Priority Climate Action Plan

The Los Angeles-Long Beach-Anaheim, CA Metropolitan Statistical Area

March 2024

Primary Coordinating Entities

Consultant Team

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Priority Climate Action Plan

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Acronyms and Other Abbreviations

Abbreviation	Definition
2020 CCAP	Los Angeles County Community Climate Action Plan 2020
2045 CAP	2045 Los Angeles County Climate Action Plan
AB	Assembly Bill
AB 32	Global Warming Solutions Act of 2006
AB 1493	California’s GHG Vehicle Emission Standards (Pavley)
ACC I/II	Advanced Clean Cars I/II
ACF	Advanced Clean Fleets
ACT	Advanced Clean Trucks
AFOLU	Agriculture, Forestry, and Other Land Use
AQMP	Air Quality Management Plan
AR5	IPCC’s Fifth Assessment Report
BAU	Business-as-usual
BOHC	Board of Harbor Commissioners
C&D	Construction and demolition
CAA	Clean Air Act
CAAP	Climate Action and Adaptation Plan
CAFÉ	Corporate Average Fuel Economy
Cal Poly	California Polytechnic State University
Cal PUC	California Public Utilities Code
CalEnviroScreen	OEHHA’s California Communities Environmental Health Screening Tool
CalEPA	California Environmental Protection Agency
CalRecycle	California Department of Resources Recycling and Recovery
CAP	Climate Action Plan
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CASP	Climate Action and Sustainability Plan
CBO	Community-based organization

Abbreviation	Definition
CCA	Community Choice Aggregation
CCAP	Comprehensive Climate Action Plan
CCI	California Climate Investments
CCS	Carbon capture and storage
CEC	California Energy Commission
CEJST	Climate and Economic Justice Screening Tool
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CH_4	Methane
CHE	Cargo-handling equipment
CNAP	California-Nevada Applications Program
CNRA	California Natural Resources Agency
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
Co-benefit	An indirect benefit that results from implementation of a GHG reduction measure
COG	Council of Governments
ConnectSoCal	2020 SCAG RTP/SCS
CPA	Clean Power Alliance
CPAP	Climate Protection Action Plan
CPRG	Climate Pollution Reduction Grant
CT	Conversion technology
CVA	Climate Vulnerability Assessment
DAC	Direct air capture
DPM	Diesel particulate matter
EAP	Energy Action Plan
ECAP	Energy and Climate Action Plan
EECAP	Energy Efficiency and Climate Action Plan
EECP	Energy Efficiency and Conservation Plan
EJScreen	EPA’s Environmental Justice Screening and Mapping Tool
EMFAC2021	CARB’s Emission Factors 2021 model
EO	Executive Order
EPA	United States Environmental Protection Agency
EPP	Environmentally Preferable Purchasing Policy
EV	Electric vehicle

Abbreviation	Definition
Full Accounting Method	The origin-destination analysis approach to estimating VMT
GDP	Gross domestic product
GHG	Greenhouse gas
GPC	Global Protocol for Community-Scale GHG Emission Inventories
GWP	Global warming potential
HAP	Hazardous air pollutant
HCD	California Department of Housing and Community Development
HFCs	Hydrofluorocarbons
ICLEI	International Council for Local Environmental Initiatives
II VMT	VMT associated with trips that begin and end within the geographic area of study
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IRA	Inflation Reduction Act
IX VMT	VMT associated with trips that begin within the geographic area of study and end outside of the geographic area of study
JPA	Joint Powers Authority
JWA	John Wayne Airport
KPI	Key performance indicator
LACTC	Los Angeles County Transportation Commission
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LFG	Landfill gas
LIDAC	Low-Income and Disadvantaged Communities
LNG	Liquefied natural gas
Metro	Los Angeles County Metropolitan Transportation Authority
MPA	Metropolitan Planning Organization
MSA	Metropolitan Statistical Area
$MTCO_2e$	Metric tons of carbon dioxide equivalent
MWD	Metropolitan Water District
N_2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NF_3	Nitrous trifluoride
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen oxides

Abbreviation	Definition
OCTA	Orange County Transportation Authority
OEHHA	California Office of Environmental Health Hazard Assessment
OGV	Ocean-going vessel
OurCounty	Los Angeles Countywide Sustainability Plan
PCAP	Priority Climate Action Plan
PFCs	Perfluorocarbons
$PM_{2.5}$	Particulate matter 2.5 microns or less in diameter
POLA	Port of Los Angeles
POLB	Port of Long Beach
Ports	San Pedro Bay Ports
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy
SB 32	California Global Warming Solutions Act of 2016: emissions limit
SB 1020	California's Renewables Portfolio Standards
SCAG	Southern California Association of Governments
SCE	Southern California Edison
Scoping Plan	CARB's program to achieve statewide GHG emissions reductions
SCRTD	Southern California Rapid Transit District
SDG&E	San Diego Gas & Electric
SDT	Same Day Taxi Program
SED	Socioeconomic data
SF_6	Sulfur hexafluoride
South Coast AQMD	South Coast Air Quality Management District
STIP	State Transportation Improvement Program
SWIMS	CalRecycle's Solid Waste Information System
SWIS	Los Angeles County Public Works' Solid Waste Information Management System
TAZ	Traffic analysis zone
TRU	Transportation refrigeration unit
US	United States
VCRMA	Ventura County Resource Management Agency
VMT	Vehicle miles traveled
VNY	Van Nuys Airport
WfH	Work from home
WISE	Waste Infrastructure System Enhancement
WTE	Waste-to-energy

Abbreviation	Definition
XI VMT	VMT associated with trips that begin outside the geographic area of study and end within the geographic area of study
XX VMT	VMT associated with trips that begin and end outside the geographic area of study
ZEV	Zero-emission vehicle

Executive Summary

This Priority Climate Action Plan (PCAP) serves as a high-level roadmap for reducing greenhouse gas (GHG) emissions across the Los Angeles-Long Beach-Anaheim, California metropolitan statistical area (MSA). This effort is born of the Biden Administration's and the United States Environmental Protection Agency's (EPA) commitment to address climate change, and is made possible through the Inflation Reduction Act (IRA) and the Climate Pollution Reduction Grant (CPRG) program. The CPRG program is providing the means for local governments and other agencies to develop climate action plans to reduce GHG emissions and collectively support United States' and California's commitments to aggressive GHG reduction targets, including those under the Paris Agreement and Justice 40 Initiative policy goals.

This PCAP is focused on the geographic areas within southern California's Los Angeles County and Orange County, encompassing 122 cities, 164 unincorporated areas, and over 13 million residents. Southern California faces significant air quality concerns; the region is in extreme nonattainment for ozone and serious non-attainment for fine particulate matter. Almost half of the Los Angeles-Long Beach-Anaheim MSA's census tracts are identified as low-income and disadvantaged communities and face historic and disproportionate impacts from climate change hazards.

To address these issues and accelerate deep emissions reductions, this PCAP addresses GHGs from the region's most critical sectors – Transportation, Energy, and Solid Waste. Emissions reductions and improvements within these sectors will yield considerable benefits for Los Angeles and Orange counties, primarily by improving the region's air quality and reducing the significant hazards associated with air pollution. These sectors represent the largest sources of GHG emissions in the MSA.

Implementation-ready measures for reducing emissions in the PCAP's key sectors will provide many co-benefits for the region, help grow the economy, improve public health, and address the needs of the most vulnerable communities. Emissions reduction measures within the PCAP are included based on their readiness for implementation, their near-term GHG reduction potential, their critical need for funding, and their co-benefits to low income and disadvantaged communities (LIDACs).

The PCAP builds from over a decade of climate action across Los Angeles and Orange counties, utilizing a multi-sector approach to cutting GHG emissions—while providing maximum benefits to vulnerable communities that have historically borne the cost of harmful environmental practices. This PCAP builds from a strong foundation of state, regional, and local policies and a multitude of existing climate action plans that have been developed by local and sub-regional government agencies throughout the region. Since 2010, more than 50 jurisdictions in the region have completed a climate action plan or equivalent or are in the process of doing so. These existing efforts and collaborations are elevated within this PCAP and provide the foundation for a strategic and comprehensive approach to addressing climate change in the Los Angeles-Long Beach-Anaheim MSA.

CHAPTER 1
Introduction

1.1 Purpose

Through the Inflation Reduction Act of 2022 (IRA), Congress provided funding to the United States Environmental Protection Agency (EPA) to reduce greenhouse gas (GHG) emissions throughout the country via the Climate Pollution Reduction Grant (CPRG) program. Through the CPRG program, EPA is supporting state, territory, tribal, and local actions to reduce GHGs and associated criteria and toxic air pollution through deployment of new technologies, operational efficiencies, and solutions that will transition America equitably to a low-carbon economy. The first phase of the CPRG program is the Priority Climate Action Plan (PCAP). The Los Angeles-Long Beach-Anaheim, CA metropolitan statistical area (MSA) PCAP covers the counties[1] of Los Angeles and Orange and includes a focused list of implementation-ready measures to reduce GHG emissions from the following high-priority sectors:

- Transportation
- Energy
- Solid Waste

These three sectors play a critical role in the regional economy and account for a substantial portion of the MSA's GHG and air quality emissions. Successful decarbonization of each of these priority sectors would substantially reduce the region's carbon footprint, lead to substantial public health improvements, and contribute to dynamic, sustainable economic growth. The measures included under each of these sectors have been identified and included in the PCAP because of their potential to achieve near-term ambitious GHG reductions and result in broader benefits to communities throughout the region, especially communities that are most vulnerable to the impacts of climate change and have disproportionately been burdened by air pollution and lack of access to opportunity. Despite their potential benefits these measures are not an exhaustive list of all the local and regional actions that can and/or should be undertaken to comprehensively reduce GHG emissions in the MSA. The PCAP, therefore, represents an early-stage framework for existing and/or new actions to reduce GHG emissions associated with community activities in Los Angeles and Orange counties for the transportation, energy, and

[1] Throughout this document, 'county' and 'counties' refer to the geographic areas of Los Angeles and Orange counties. 'County' and 'Counties' are used to denote the governing bodies of Los Angeles County and Orange County.

solid waste sectors. The subsequent Comprehensive Climate Action Plan (CCAP) effort will explore and identify a broader set of measures and strategies across all sectors that can reduce GHG emissions and benefit communities.

Many jurisdictions in Los Angeles and Orange counties (city, county, ports, airports, and other public agencies) have developed and adopted climate action plans (CAPs) that function as roadmaps to reduce GHG emissions through the deployment of measures, strategies, and programs; however, there is no MSA-wide plan to provide a roadmap for the region as a whole. This PCAP identifies measures and strategies to reduce GHG emissions for each of the three sectors for the entire MSA. To do this, it inventories GHG emissions for each sector, forecasts the emissions to 2030 and 2045, evaluates regional priority measures across these sectors, quantifies GHG emissions reductions for each measure, analyzes benefits to low-income and disadvantaged communities (LIDACs), and investigates the authority of the MSA's local jurisdictions and agencies to implement the measures.

The PCAP draws from a strong foundation of state, regional, and local policies as well as hundreds of GHG inventories and dozens of existing climate action plans that have been developed by jurisdictions throughout the region. Since 2010, approximately 42 cities in Los Angeles county have completed a climate action plan or plan equivalent (i.e., Energy Action Plan (EAP), Climate Action and Adaptation Plan (CAAP), Sustainability Plan), with other jurisdictions following suit. There are approximately 11 cities in Orange county that have posted climate change goals or are in the process of developing climate-related plans. The PCAP also draws from regional efforts, such as the Los Angeles Countywide Sustainability Plan (OurCounty) and the Los Angeles County 2045 Climate Action Plan,[2] which is the first CAP in the State of California to demonstrate how a large and diverse region can reduce GHG emissions in line with the state's 2045 GHG reduction targets. Additional detail on climate action planning in the MSA can be found in *Chapter 2, Existing Conditions: Climate Action in the MSA*.

The PCAP builds upon these existing plans by incorporating local GHG emissions inventories (e.g., the Los Angeles County 2018 GHG inventory), current GHG emissions projections (e.g., Orange County forecasts for 2030 and 2045), and planned GHG reduction initiatives (such as Southern California Edison's [SCE] carbon-free electricity goal and the Port of Los Angeles and Port of Long Beach's zero emissions commitments). The PCAP also relies on the California Air Resources Board (CARB) 2022 Scoping Plan for Achieving Carbon Neutrality, which is California's pathway to achieve assembly bill (AB) 1279's targets. It is also consistent with South Coast Air Quality Management District's 2022 Air Quality Management Plan which requires the transition to zero-emission, clean air technologies to meet National Ambient Air Quality Standards (NAAQS) to protect public health from air pollution and toxics.

1.2 MSA Background

The Los Angeles-Long Beach-Anaheim MSA is faced with daunting climate and air quality challenges due to economic activity, population density, topography and weather, as well as

2 Note that the Los Angeles County 2045 Climate Action Plan has not been finalized as of the submittal of this PCAP.

longstanding social justice issues. Our 13 million residents represent 32 percent of the state's population and would be the fifth largest state in the nation after New York. The region is also home to most of the State's low-income and disadvantaged communities with disproportionate impacts related to climate change, air pollution, and hazardous air pollutants (HAPs).

The region is part of the South Coast Air Basin which, under the Clean Air Act (CAA), is in extreme non-attainment for ozone and serious non-attainment for particulate matter that is 2.5 microns or less in diameter ($PM_{2.5}$). These pollutants, ozone and black carbon, a form of fine particulate matter, also contribute to the formation of GHG emissions.

Our residents breathe some of the worst air quality in the nation, especially in low-income disadvantaged communities that are adjacent to industrial sources and in proximity to transportation and goods movement related activity. Air pollution contributes to asthma and lung damage, respiratory and cardiac diseases, cancer, birth defects, premature death, and other health issues.

This MSA is also intrinsically linked to the Riverside-San Bernardino-Ontario and Oxnard-Thousand Oaks-Ventura MSAs which together comprise nearly the entirety of the Southern California Association of Governments (SCAG) region. The SCAG region's gross domestic product (GDP) is $1.6 trillion (about $4,900 per person in the U.S.) and would be the 15th largest economy in the world in 2021. A significant contributor to this economic engine is the San Pedro Bay Ports and Inland Empire logistics complex which is the Western gateway to the U.S. Supply Chain and international commerce. However, the goods movement system starts at the marine ports and intersects our communities through a network of highways, rail lines, warehouses, and intermodal facilities to the Inland Empire with climate and air quality impacts reaching all the way into the Coachella Valley. The heavy-duty trucks, oceangoing vessels (OGVs), locomotives, aircraft, and off-road equipment that keep our nation's supply chain moving directly impact the health of Southern Californians and contribute to climate change. Further, this expansive economic activity taxes our transportation system by contributing to congestion, increasing vehicle miles traveled, impacting safety, bifurcating communities, and wearing on infrastructure, among other issues.

Energy and waste are additional critical sectors in the region. Reducing energy use and emissions from buildings is a significant need and challenge in the region. State and local regulations and initiatives are effectively targeting delivering new buildings that are low or zero-carbon through an emphasis on energy efficiency, distributed renewable energy and storage, and a heavy focus on electrification. Existing building stock, however, represents the vast majority of the overall building stock. Successfully retrofitting existing buildings is important to reduce GHGs, improve air quality, and address energy costs, especially since low-income and disadvantaged households and businesses disproportionately occupy older buildings.

The state regulatory framework for reducing, diverting, and recycling waste is robust, and local jurisdictions throughout the region are in the midst of implementing a variety of programs to align with and achieve the associated goals. Implementing these goals is a challenge however, as it requires foundational reorienting of local policies, programs, and infrastructure. In many cases these efforts require changes or increases in waste collection rate structures that must be carefully constructed to avoid or minimize impacts to low-income households and businesses. While this is a challenge, there are also opportunities in this sector to divert edible food and textiles from ending up in landfills, improve food security, and provide economic development opportunities.

Overall, marginalized, under-resourced, or disadvantaged groups (LIDACs) disproportionately face inequities relating to environmental burden, health hazards, access to opportunities, income, housing, security, and more.

Los Angeles and Orange counties have a unique opportunity to strengthen regional collaboration through the PCAP, to deliver innovative and transformational approaches to climate change that will provide significant improvements for emissions reductions, enhance resiliency to impacts, and address equity for its residents. This is especially important for the region's preponderance of LIDACs (44 percent), and the unique environmental challenges and social structures that have caused historic and disproportionate burden (CEQ, 2023). These are challenges that the MSA is committed to address through local climate initiatives, recognizing that additional action and resources are needed for emissions reductions and for elevating those with the greatest need. This PCAP builds on this strong foundation of work underway and provides measures with co-benefits to LIDACs that will activate transformative pathways.

1.3 Policy & Regulatory Background

National

Federal and state laws can enable and inform local actions. As such, the PCAP considers applicable national and federal laws (**Table 1-1**) and recognizes that future amendments to measures may be needed to address future federal and state regulations.

Table 1-1. Relevant Federal Laws and Regulations

Legislation / Regulation	Year	Description
Clean Air Act	1970	Established a comprehensive framework for reducing harmful air pollution.
Corporate Average Fuel Economy Standards	1975	Established fuel efficiency standards for passenger cars and light trucks.
Code of Federal Regulations, Title 40, Part 89	1994	Established emissions standards for off-road compression-ignition engines.
Massachusetts v. Environmental Protection Agency	2007	The United States Supreme Court ruled that carbon dioxide is an air pollutant under the Clean Air Act and authorized the U.S. Environmental Protection Agency to regulate greenhouse gas emissions.
Phase 2 Heavy-Duty National Program*	2016	Established emissions standards for heavy-duty trucks through model year 2027.

According to the EPA, transportation emissions have accounted for the largest portion of United States (US) GHG emissions in recent years (USEPA, 2022). Federal climate change legislation has therefore focused on curbing emissions from the transportation sector by regulating fuel consumption standards for light-duty vehicles, and for medium- and heavy-duty trucks and engines. These fuel-efficiency standards are defined for new vehicle model years and are regulated under the CAA and the Corporate Average Fuel Economy (CAFE) program.

State

Over the past 30 years, the State of California has enacted legislation to address climate change (**Table 1-2**). In 2006, the Global Warming Solutions Act (AB 32) was enacted to address emissions from all sources throughout the state. AB 32 authorized CARB to implement a comprehensive program (Scoping Plan) to achieve the state's targets of reducing GHG emissions to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050. It approved the *First Update to the Climate Change Scoping Plan* (2014 Scoping Plan) in May 2014 and built upon the 2008 Scoping Plan with new strategies and recommendations. By 2016, California met the AB 32 target set for 2020. In the same year, then-Governor Jerry Brown signed SB 32, which established a new 2030 target to reduce GHG emissions by 40 percent below 1990 levels, in alignment with his Executive Order (EO) B-30-15 (2015). CARB then approved the 2017 Climate Change Scoping Plan (2017 Scoping Plan Update) in December 2017, which outlined the proposed framework of action for achieving the 2030 GHG target of 40 percent reduction in GHG emissions relative to 1990 levels. In 2018, Governor Brown issued EO B-55-18, setting a statewide goal to reach carbon neutrality by 2045, and maintain net negative emissions thereafter. In September 2022, Governor Newsom signed AB 1279, which codified EO B-55-18 by requiring that the state achieve net zero GHG emissions no later than 2045 and reduce direct anthropogenic GHG emissions 85 percent below 1990 levels by 2045. In December 2022, CARB adopted the 2022 Scoping Plan for Achieving Carbon Neutrality (2022 Scoping Plan), which lays out a path to achieve the statewide goals codified in AB 1279.

Table 1-2. Relevant State Laws, Regulations, and Policies

Legislation / Regulation	Year	Description
Statewide Emissions Reduction Targets		
EO S-3-05	2005	Established the state's first GHG emissions reductions targets: reduction to 2000 levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050.
AB 32, Global Warming Solutions Act	2006	Codified EO S-3-05's 2020 goal and authorized CARB to implement a comprehensive, multiyear program to reduce GHG emissions from all sources throughout the state.
SB 535, Greenhouse Gas Reduction Fund and Disadvantaged Communities	2012	Required that 25% of all funds allocated pursuant to an investment plan for the use of state monies collected through a Cap-and-Trade program be allocated to projects that benefit disadvantaged communities, and that at least 10% of these be spent on projects located in disadvantaged communities.
EO B-30-15	2015	Established a GHG emissions reduction target of 40% below 1990 levels by 2030.

Legislation / Regulation	Year	Description
SB 32, California Global Warming Solutions Act of 2006: Emissions limit	2016	Codified EO B-30-15's 2030 goal.
AB 398, California's Cap-and-Trade Program	2017	Extended the state's Cap-and-Trade Program through 2030, a key strategy for reducing GHGs in the state. The Cap-and-Trade Program sets total allowable emissions for facilities and creates carbon offset credits through carbon sequestration projects.
EO B-55-18	2018	Established a target to achieve carbon neutrality (net zero GHG emissions) by 2045.
AB 1279	2022	Established the policy of the state to achieve net zero GHG emissions as soon as possible, but no later than 2045; to maintain net negative GHG emissions thereafter; and to ensure that by 2045, statewide anthropogenic GHG emissions are reduced at least 85% below 1990 levels.
Transportation		
AB 1493 Clean Car Standards	2002	Established emissions reduction requirements for new passenger vehicles from 2009 to 2016.
EO S-01-07 Low Carbon Fuel Standard	2007	Established the State of California's Low Carbon Fuel Standard and an emissions reduction target of at least 10 percent of the carbon intensity of the state's transportation fuels by 2020. With the adoption of the 2022 Scoping Plan, the standard has been revised to a reduction of at least 20 percent.
SB 375	2008	Directed the California Air Resources Board to set regional targets for GHG emissions reductions from passenger vehicles.
AB 1493 Amendments	2009	Cemented the state's enforcement of the legislation starting in 2009, while providing vehicle manufacturers with new compliance flexibility.
Advanced Clean Cars Program	2012	Combined the control of smog-causing pollutants and GHG emissions into a single coordinated package of regulations to guide the development of environmentally advanced cars.
Mobile Source Strategy	2016	Described the strategy for transitioning to zero-emission vehicles, or ZEVs, with a goal of 1.5 million ZEVs by 2025 and 4.2 million ZEVs by 2030. The Mobile Source Strategy includes more stringent GHG emissions requirements for light-duty vehicles beyond 2025, and calls for increased deployment of ZEV trucks.
Advanced Clean Cars Update	2017	Affirmed that adopted GHG emissions reduction standards remain appropriate for 2022 through 2025 model years.
AB 2127	2018	Requires the CEC, working with CARB and the CPUC, to prepare and biennially update a statewide assessment of the EV charging infrastructure needed to support the levels of EV adoption required for the state to meet its goals of putting at least 5 million ZEVs on California roads by 2030 and reducing emissions of GHGs to 40% below 1990 levels by 2030.
EO B-48-15	2018	Established a statewide goal of at least 5 million ZEVs on state roads by 2030, and installation of 200 hydrogen fueling stations and 250,000 ZEV chargers.
EO N-79-20	2020	Established a target that 100 percent of in-state sales of new passenger cars and trucks be zero-emission by 2035 and that 100 percent of medium- and heavy-duty vehicles in the state be zero-emission by 2045 and by 2035 for drayage trucks.

Legislation / Regulation	Year	Description
Advanced Clean Cars I/II (ACC I/II)	2022	Requires that by 2035 all new passenger cars, trucks, and SUVs sold in California will be zero emissions. It amends the Zero-Emission Vehicle Regulation to require an increasing number of ZEVs, and relies on advanced vehicle technologies, including battery-electric, hydrogen fuel cell electric, and plug-in hybrid EVs, to meet air quality and climate change emissions standards. It also amends the Low-Emission Vehicle Regulations to include increasingly stringent standards for gasoline cars and heavier passenger trucks to continue to reduce smog-forming emissions while the sector transitions toward 100% electrification by 2035.
Advanced Clean Trucks (ACT)	2021	Establishes a manufacturer's ZEV sales requirement and a one-time reporting requirement for large entities and fleets. It is a holistic approach to accelerate a large-scale transition of zero-emission medium-and heavy-duty vehicles from Class 2b to Class 8. Manufacturers who certify Class 2b-8 chassis or complete vehicles with combustion engines would be required to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035. By 2035, zero-emission truck/chassis sales would need to be 55% of Class 2b – 3 truck sales, 75% of Class 4 – 8 straight truck sales, and 40% of truck tractor sales
Advanced Clean Fleets (ACF)	2023	Introduction of zero-emission technologies into California's truck and bus fleets requiring fleets that are well suited for electrification to transition to zero-emission vehicles (ZEV) through requirements to both phase-in the use of ZEVs for targeted fleets and requirements that manufacturers only manufacture ZEV trucks starting in the 2036 model year. Components of ACF include manufacturer sales mandate, drayage fleets, high priority and federal fleets, and State and Local agency fleets.
Energy		
SB 1078	2002	Required that 20% of electricity retail sales be served by renewable resources by 2017.
CALGreen Code (Title 24, Part 11)	2011	Established the first mandatory green building standards code in the country.
SB 350	2015	Accelerated implementation of SB 1078 and mandated a 50% Renewables Portfolio Standard, or RPS, by 2030. SB 350 includes interim annual RPS targets with three-year compliance periods and requires that 65% of RPS procurement be derived from long-term contracts of 10 or more years.
CALGreen Code Update	2016	Affirmed energy standards for newly constructed buildings, and additions and alterations to existing buildings. Added requirements for demand reductions during critical peak periods and future solar electric and thermal system installations.
SB 100 California Renewables Portfolio Standard Program	2018	Established a goal of supplying 100% of the state's electricity from clean sources by 2045.
SB 596	2021	Requires CARB, by July 1, 2023, to develop a comprehensive strategy for the state's cement sector to achieve net zero emissions of GHGs associated with cement used in California as soon as possible, but no later than December 31, 2045. The law establishes an interim target of 40% below the 2019 average GHG intensity of cement by December 31, 2035.

Legislation / Regulation	Year	Description
SB 1020	2022	Adds interim renewable energy and zero-carbon energy retail sales of electricity targets to California end-use customers set at 90% in 2035 and 95% in 2040. It accelerates the timeline required to have 100% renewable energy and zero-carbon energy procured to serve state agencies from the original target year of 2045 to 2035. This law requires each state agency to individually achieve the 100% goal by 2035, with specified requirements.
SB 905	2022	Requires CARB to create the Carbon Capture, Removal, Utilization, and Storage Program to evaluate, demonstrate, and regulate carbon capture, utilization, or storage and CO2 removal projects and technology.
SB 1137	2022	Prohibits the development of new oil and gas wells or infrastructure in health protection zones, as defined, except for purposes of public health and safety or other limited exceptions. This law requires operators of existing oil and gas wells or infrastructure within health protection zones to undertake specified monitoring, public notice, and nuisance requirements.
SB 1075	2022	Requires CARB, by June 1, 2024, to prepare an evaluation that includes policy recommendations regarding the use of hydrogen, and specifically the use of green hydrogen, in California; a description of strategies supporting hydrogen infrastructure, including identifying policies that promote the reduction of GHGs and short-lived climate pollutants; a description of other forms of hydrogen to achieve emission reductions; and other required elements.
SB 1206	2022	Mandates a stepped sales prohibition on newly produced high-GWP HFCs to transition California’s economy toward recycled and reclaimed HFCs for servicing existing HFC-based equipment. This law also requires CARB to develop regulations to increase the adoption of very low-, i.e., GWP <10, and no-GWP technologies in sectors that currently rely on higher-GWP HFCs.
Waste and Water		
AB 341	2011	Required each city, county, and regional agency to develop a source reduction and recycling element of an integrated waste management plan containing specified components, including a source reduction component, a recycling component, and a composting component. With certain exceptions, the source reduction and recycling element of that plan was required to divert 75% of all solid waste from landfill disposal or transformation by 2020, through source reduction, recycling, and composting activities.
AB 1826	2014	Required any business, defined as a commercial or public entity that generates more than 4 cubic yards of commercial solid waste per week or is a multifamily residential dwelling of 5 units or more, to arrange for recycling services.
SB 1383	2016	Established emissions reduction targets in a statewide effort to reduce emissions of short-lived climate pollutants, including methane by 40%, HFC gases by 40%, and anthropogenic black carbon by 50% below 2013 levels by 2030.
SB 606 and AB 1668	2018	Required urban and agricultural water suppliers to enact new urban efficiency standards for indoor use, outdoor use, and water lost to leaks.

Abbreviations: 2022 Scoping Plan = 2022 Scoping Plan for Achieving Carbon Neutrality; AB = Assembly Bill; CALGreen Code = California Green Building Standards Code; CARB = California Air Resources Board; CEC = California Energy Commission; CNRA = California Natural Resources Agency; CO_2 = carbon dioxide; CPUC = California Public Utilities Commission; EO = Executive Order; EV = electric vehicle; GHG = greenhouse gas; GWP = global warming potential; HFC = hydrofluorocarbon; RPS = Renewable Portfolio Standard; SB = Senate Bill; ZEV = zero-emission vehicle

1.4 Document Organization

The PCAP contains an executive summary and six chapters, as well as Appendices A through E, which provide additional detail on topics covered in the PCAP. A summary of each component of the PCAP is presented below.

- **Executive Summary** The executive summary includes a synopsis of the PCAP, including its goals, GHG inventories, emissions forecasts, GHG reduction measures, LIDAC analysis, and authority to implement discussion.
- **Chapter 1 – Introduction** This chapter outlines the purpose of the PCAP and introduces the MSA. Chapter 1 delves into the latest scientific and regulatory climate change policies, and highlights all key components of the PCAP, summarizing each chapter.
- **Chapter 2 – Existing Conditions: Climate Action in the MSA** This chapter includes an in-depth discussion of the existing conditions and statistical summary of the existing CAPs in Los Angeles and Orange counties.
- **Chapter 3 – Greenhouse Gas Emissions Inventories & Forecasts** This chapter presents the results of the 2018 GHG emissions inventories for the entire MSA, as well as for Los Angeles and Orange Counties separately, and the emissions forecasts for 2030 and 2045. A Business-as-Usual (BAU)[3] forecast and an Adjusted BAU[4] forecast for the MSA is captured for both years. The chapter includes a discussion of each emissions sector and its major sources of GHG emissions and describes how existing state standards and regulations are expected to affect emissions in the future.
- **Chapter 4 – Greenhouse Gas Reduction Measures** This chapter describes the measures and strategies the MSA could implement to achieve emissions reductions in the region, covering the energy, transportation, and solid waste sectors. GHG emissions reductions are estimated for each forecast year and provided for both the MSA as a whole and for each county. The PCAP includes 18 measures, each with 2030 and 2045 performance goals and two or more implementation strategies. The general definitions of "measure," "performance goal," and "strategy" are as follows:
  - *Measure:* An overall, sector-level initiative of the PCAP. Measures are broad and aim to achieve overarching goals within each emissions sector. For example, "Decarbonize Goods Movement" is a measure (i.e., Measure T1) and applies to all emissions associated with the goods movement industry (e.g., on-road trucks, off-road cargo handling equipment, port railyard equipment, etc.).
  - *Performance Goal:* A focused, sub-sector-specific objectives within each measure to be achieved by either 2030 or 2045. Performance goals are quantified in order to estimate GHG emissions reductions resulting from each measure. Performance goals support measures and would be achieved through implementing strategies. For example, "Reduce 50 percent of GHG emissions associated with the goods movement vehicle fleet by 2030" is a performance goal that supports Measure T1. The quantitative GHG emissions reduction analysis is provided primarily at the performance goal level.

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[3] The "business-as-usual" or BAU forecast assumes that no action is taken to reduce GHG emissions in the MSA. 2018 emissions are projected forward using growth indicators such as population, housing, and employment.

[4] The Adjusted BAU forecast accounts for future growth under BAU conditions but makes adjustments for federal, state, and County legislative regulations that were implemented before the development of the PCAP.

   - *Strategy:* A specific program or action that could be implemented for each measure to achieve the associated performance goal. For example, “Replace internal combustion vehicles and equipment with zero-emission vehicle (ZEV) equivalents” is a strategy (this strategy, Strategy T1.1, supports Measure T1 and its corresponding performance goals).

- **Chapter 5 – LIDAC Analysis** This chapter includes the LIDAC analysis, based on the EPA’s framework to define, describe, and identify the LIDACs within the MSA. This analysis employs national and state-specific tools to map LIDACs with indicators of socioeconomic, environmental, climate, or other burdens. Also captured is an assessment of direct and indirect co-benefits to LIDACs that would result from implementation of the GHG measures described in Chapter 4.
- **Chapter 6 – Stakeholder Engagement Activities** This chapter covers the engagement activities conducted throughout development of the PCAP, including community-based organization workshops, municipality and stakeholder agency outreach, and prioritization of LIDAC feedback.
- **Appendix A – MSA Climate Planning** This appendix lists all climate-related plans in the MSA and includes some key planning metrics from each (e.g., inventory years, targets). The transportation, energy, and solid waste measures, strategies, and actions from each plan are also included.
- **Appendix B – GHG Inventory and Forecast Methods** This appendix describes the GHG accounting methods for calendar year 2018 for the MSA. The methodology for the BAU and Adjusted BAU forecasts for 2030 and 2045 are also presented.
- **Appendix C – GHG Reduction Measure Quantification Methods** This appendix describes the methods and assumptions associated with quantification of the emissions reduction measures.
- **Appendix D – GHG Quantification Guidance** This appendix provides details on each of the measures and strategies presented in Chapter 4.
- **Appendix E – Potential Activities Under PCAP Measures** This appendix provides guidance and methods for calculating GHG emission reductions from specific GHG reduction measures and strategies.
- **Appendix F – LIDAC Identification** This appendix contains the lists of LIDAC Census tracts identified through the Council on Environmental Quality’s (CEQ) Climate and Economic Justice Screening Tool (CEJST).

CHAPTER 2
Existing Conditions: Climate Action in the MSA

2.1 Climate Planning Across Los Angeles County

Los Angeles county is a diverse region of 4,084 square miles and includes 88 cities and approximately 140 unincorporated areas and towns. As of the 2020 census, there are just over 10 million people living in Los Angeles county. The region has a strong history of leadership and collaboration for improving environmental conditions for the local and regional community, through current and recent climate action and sustainability planning initiatives that prioritize greenhouse gas emissions reductions, climate adaptation, and equity. These existing efforts, summarized below, were reviewed to help inform the summary of emissions in the MSA as well as identify the GHG reduction measures that are included within Chapters 3 and 4 of the PCAP.

Table 2-1 below lists local city climate-related plans in the region. Over half of the cities in Los Angeles county, plus the County itself, have engaged in climate-related planning – 49 cities (56 percent). This includes completed or in progress climate-related plans, such as CAPs, CAAPs, EAPs, Energy and Climate Action Plan (ECAP) or Energy Efficiency and Climate Action Plan (EECAP), and sustainability plans.

Since 2010, 42 cities (48 percent of cities countywide) plus the County have completed a climate-related plan and seven currently have one drafted and/or are in progress. Of the 50 jurisdictions with climate-related plans, 33 are CAPs or CAAPs (66 percent). Of the jurisdictions without a CAP or CAAP, this is the breakdown by plan type:

- Eight EAPs (16 percent),
- Six ECAPs or EECAPs (12 percent), and
- Three Sustainability Plans (six percent).

Of the published climate-related plans, 12 have been completed within the last five years (28 percent) and 32 have been completed within the last 10 years (74 percent). Refer to *Appendix A, MSA Climate Planning* for a library of climate action planning activity in the MSA.

Table 2-1. Climate Action Planning Activity by Los Angeles County Jurisdictions

Jurisdiction	Plan	Status
Agoura Hills	Climate Action and Adaptation Plan	Complete (2022)
Alhambra	Comprehensive Environmental Sustainability Plan	In Progress
Bellflower	Climate Action Plan	Complete (2012)
Beverly Hills	Climate Action and Adaptation Plan	Draft (2022)
Bradbury	General Plan 2012-2030 Update Climate Action Plan	Complete (2014)
Burbank	Greenhouse Gas Reduction Plan Update	Complete (2022)
Carson	Climate Action Plan	Complete (2017)
Covina	Energy Action Plan	Complete (2012)
Culver City	Energy Action Plan	Complete (2016)
Diamond Bar	Climate Action Plan 2040	Complete (2019)
Duarte	Energy Action Plan	Complete (2012)
El Segundo	Climate Action Plan	Complete (2017)
Gardena	Climate Action Plan City of Gardena	Complete (2017)
Glendale	Greener Glendale Plan	Complete (2012)
Hawthorne	Climate Action Plan City of Hawthorne	Complete (2017)
Hermosa Beach	Energy Efficiency Climate Action Plan (EECAP)	Complete (2015)
Inglewood	Energy and Climate Action Plan (ECAP)	Complete (2013)
La Cañada Flintridge	Climate Action Plan	Complete (2016)
La Puente	Energy Action Plan	Complete (2013)
Lancaster	City of Lancaster Climate Action Plan	Complete (2016)
Lawndale	Energy Efficiency Climate Action Plan (EECAP)	Complete (2015)
Lomita	Energy Efficiency Climate Action Plan (EECAP)	Complete (2015)
Long Beach	Long Beach Sustainable City Action Plan	Complete (2010)
Long Beach	Long Beach Climate Action Plan	Complete (2022)
Los Angeles	L.A.'s Green New Deal: Sustainable City pLAn	Complete (2019)
Los Angeles County	Draft 2045 Climate Action Plan	In Progress
Los Angeles County	OurCounty, Countywide Sustainability Plan	Complete (2019)
Lynwood	Energy Action Plan	Complete (2018)
Malibu	Community Resilience and Adaptation Plan	In Progress
Manhattan Beach	Manhattan Beach: Working Towards a Sustainable Community (Climate Action Plan)	Complete (2010)
Maywood	Climate Action, Adaptation, and Resilience Plan	In Progress
Monterey Park	Climate Action Plan	Complete (2012)
Norwalk	Energy Action Plan	Complete (2015)
Palmdale	Climate Action Plan	Complete (2022)

Jurisdiction	Plan	Status
Palos Verdes Estates	Climate Action Plan	Complete (2018)
Paramount	Climate Action Plan	Complete (2021)
Pasadena	Climate Action Plan	Complete (2018)
Pomona	Energy Action Plan	Complete (2012)
Rancho Palos Verdes	Emissions Reduction Action Plan (ERAP)	Complete (2017)
Redondo Beach	Energy Efficiency Climate Action Plan (EECAP)	Complete (2015)
Rolling Hills	Climate Action Plan	Complete (2018)
Rolling Hills Estates	Energy Efficiency Climate Action Plan	Complete (2015)
San Fernando	Climate Action and Resilience Plan	In Progress
San Gabriel	Energy Action Plan	Complete (2012)
Santa Clarita	Climate Action Plan	Complete (2012)
South Gate	Climate Action Plan	In Progress
Santa Monica	Climate Action & Adaptation Plan	Complete (2019)
South Pasadena	Climate Action Plan	Complete (2020)
Torrance	Climate Action Plan	Complete (2017)
Walnut	Climate Action Plan	In Progress
Vernon	Environmental Sustainability Action Plan	Complete (2023)
West Hollywood	WEHO Climate Action	Complete (2021)

Source: Cal Poly, 2023.

Los Angeles County Climate Action

The County of Los Angeles continues to build on climate action planning efforts for the unincorporated areas of Los Angeles county. Recent efforts led by the Department of Regional Planning and the Chief Sustainability Office include the unincorporated Los Angeles County Community Climate Action Plan 2020 (2020 CCAP) published in 2015, the 2019 OurCounty Sustainability Plan (OurCounty), the 2021 Climate Vulnerability Assessment (CVA), and the 2045 Los Angeles County Climate Action Plan (2045 CAP) published in 2023.

Draft 2045 Los Angeles County Climate Action Plan, 2023

The Draft 2045 CAP (2045 CAP) builds on previous work established in the 2020 CCAP and defines new reduction targets beyond the year 2020 that are consistent with California-state goals for 2030, 2035, and 2045. The 2045 CAP identifies a long-term aspirational target for carbon neutrality by 2045 and meeting the goals of the Paris Agreement. It provides strategies, measures, and actions to mitigate GHG emissions from community activities across major sectors. The actions described in the 2045 CAP are organized around 5 major strategies of Energy Supply; Transportation; Building Energy and Water; Waste; and Agriculture, Forestry, and Other Land Uses.

Los Angeles County Community Climate Action Plan, 2020

The 2020 CCAP was adopted as a component of the Air Quality Element of the General Plan in 2015 and aligned with General Plan goals, policies, and programs and several other existing programs in Los Angeles county. It identified emissions related to community activities, established a 2020 GHG emissions reduction target consistent with state targets (AB 32), and established 26 local actions for GHG emissions reduction. The 2020 CCAP was the first attempt to set countywide GHG emissions reduction goals, providing a road map for implementing the County GHG emissions reduction measures. It addresses emissions from land use, transportation, building energy, water consumption, and waste generation.

Los Angeles Countywide Sustainability Plan, 2019

OurCounty is a regional sustainability plan that outlines a long-term vision for implementing sustainable actions that improve equity, the environment, and the economy across Los Angeles county, including unincorporated areas and all 88 cities. While not directly focused on emissions reductions or climate action planning, OurCounty provides cross-sector goals and strategies that align with Los Angeles County’s 2045 CAP strategies focused on equitable and sustainable land use and development, thriving ecosystems and biodiversity, and a transition to zero-emission energy and transportation systems.

Metro Climate Action and Adaptation Plan, 2019

In 2019, Metro released a Climate Action and Adaptation Plan with goals and strategies aimed at combating climate change impacts on the Los Angeles region’s transportation infrastructure and population. The plan sets ambitious goals to reduce greenhouse gas emissions, including transitioning to an electric bus fleet by 2030, and reducing energy and water usage while continuing to provide high quality transportation service to the region. The plan places a strong emphasis on fortifying transportation infrastructure to withstand climate change hazards such as extreme weather events, flooding, and rising sea levels. It also highlights sustainable practices in construction and maintenance, alongside active collaboration with local communities and stakeholders. The plan, guided by principles of climate leadership, ongoing metric evaluation, and proactive community involvement, commits Metro to ensuring that the regional transportation system both adapts to and actively combats the effects of climate change. Beyond their CAAP, Metro partners with municipal transit agencies, many of which have their own sustainability plans, such as Long Beach Transit.

2.2 Climate Planning Across Orange County

Orange county comprises 793 square miles of dense, coastal, and inland communities, and includes 34 cities and 24 unincorporated areas and towns. As of the 2020 census, there are just over 3 million people living in Orange county. Orange County, Orange County Transportation Authority (OCTA), and local jurisdictions are in the early stages of building climate action initiatives to address climate change and GHG emissions. These existing efforts and future goals for climate action planning helped to inform the emissions summary and identification of greenhouse gas reduction measures that are included within Chapters 3 and 4 of the PCAP.

As Orange County and other regional agencies build on climate planning efforts, local jurisdictions are also increasingly working to address climate action and GHG emissions in their communities. **Table 2-2** below lists local city climate-related plans in the region.

TABLE 2-2. CLIMATE ACTION PLANNING ACTIVITY BY ORANGE COUNTY JURISDICTIONS

Jurisdiction	Plan	Status
Aliso Viejo	Green City Initiative	Complete (2013)
Brea	City of Brea Sustainability Plan: Leadership in Energy Efficiency	Complete (2012)
Dana Point	Energy Efficiency and Conservation Plan (EECP)	Complete (2011)
Fullerton	Climate Action Plan	Complete (2012)
Huntington Beach	Sustainability Master Plan	In Progress
Irvine	Climate Action & Adaptation Plan	In Progress
La Habra	Climate Action Plan	Complete (2014)
Laguna Beach	Climate Protection Action Plan (CPAP)	Complete (2009)
Mission Viejo	Sustainability Action Plan	Complete (2013)
San Clemente	Climate Action Plan	Complete (2012)
Santa Ana	Climate Adaptation Plan	Complete (2015)

Source: Cal Poly, 2023.

Approximately a third of Orange County's jurisdictions have engaged in climate action planning – 11 cities (32 percent). This includes completed or in progress climate-related plans. Nine cities within Orange county (26 percent) have completed a climate-related plan and two currently have one in progress. Of the 11 completed plans, seven are CAPs or CAAPs (64 percent). By individual plan types, CAPs and Sustainability plans make up the majority:

- Five cities have CAPs (46 percent),
- Three cities have a sustainability plan (27 percent),
- Two cities have a CAAP (18 percent), and
- One city has an EAP (nine percent).

All climate-related plans were completed prior to 2016 with the oldest dating back to 2009. Only two CAPs were completed within the last 10 years, one in 2014 and one in 2015. Refer to Appendix A for a library of climate action planning activity in the MSA.

Orange County Climate Action

Over the past several decades Orange County has taken steps to address climate change and promote sustainability through various initiatives. Notably, in 2008 the County adopted the OC Environmentally Preferable Purchasing (EPP) Policy, ensuring that Orange County agencies and departments prioritize purchasing products and services that minimize harmful effects on human health and the environment. Building on this commitment, in June 2023, the Orange

County Board of Supervisors unanimously approved the establishment of the Office of Environmental Sustainability, housed within the Orange County Waste and Recycling Department (OC Waste and Recycling). This office, led by the Deputy Director of Environmental Sustainability starting in February 2024, is spearheading the development of Orange County's Climate Action Plan.

Additionally, Orange County has implemented various agency-led initiatives focused on environmental sustainability and green technologies to diminish its carbon footprint. To address the lack of infrastructure available to adequately implement the passage of SB1383 Short Lived Climate Pollutants and Edible Food Recovery, OC Waste and Recycling established the "Orange is the New Green" initiative which will build out local organics recycling infrastructure and expand efforts in renewable natural gas and energy. Using a phased approach this program will:

- Leverage the existing landfill structure by creating a Smart Landfill System and continue to transition into a resource recovery model for organics and renewable energy while collaborating and partnering with key stakeholders and the jurisdictions it serves;
- Work with local wastewater treatment plants to convert source-separated organics, food waste from commercial and industrial sources, into a suitable feed stock for anaerobic digestion;
- Build out a centralized anaerobic digester to help serve the regions needs by creating renewable natural gas and energy and final solids composted locally to back into the local communities; and
- Build out and expand efforts on additional recycling infrastructure for self-haul, construction and demolition materials to further support the need for local recycling infrastructure co-located within the active landfill system.

The Smart Landfill will improve the overall efficiency through automation and recovery of Landfill Gas with the use of best available technology to enhance well field management and improve landfill gas collection. OC Waste and Recycling is working on the conversion of landfill gas to renewable natural gas and energy, to further expand its current electrical production portfolio. OC Waste and Recycling efforts in a Smart Landfill System, increases the efforts for renewable energy by expanding into solar and energy storage. With three large active landfills and 20 closed landfills, Orange County is looking at the potential for co-location of solar farms and battery storage in key locations. The feasibility study will incorporate the potential for other county owned properties to be considered, relative to current infrastructure assessment and California Environmental Quality Act (CEQA) findings.

With a collaborative regional approach, Orange County will transition from the current waste disposal agreement to the Waste Infrastructure System Enhancement Agreement (WISE Agreement). Under the WISE Agreement, regional programs and collaboration will establish standards for every stakeholder and jurisdiction to ensure long term success in organics diversion, edible food recovery, and sustainable systems by creating a circular economy with the build out of local infrastructure.

To enhance walking and biking connections in unincorporated areas and along OC Flood Control District channel maintenance roads, Orange County adopted "OC On the Move", a critical Active Transportation Plan. The plan expands the active transportation network, promoting transportation equality and interconnectivity across various areas, destinations, and public transit. Drawing from previous planning efforts and stakeholder input, the plan focuses on 28 unincorporated areas and 16 flood control channels. Its goals include enhancing safety, connectivity, social equity and sustainability and aims to provide safe and convenient facilities for historically disadvantaged communities.

The Central Utility Facility serves as the microgrid utility for the Santa Ana Civic Center, which acts as a central hub for County operations, providing electricity, cooling, heating, and chilled water to 20 buildings. Operating through cogeneration, it concurrently produces electricity and heat. Monthly, it generates 31 million pounds of steam and 770 million BTU of chilled water, effectively cooling 6,400,000 square feet. By 2021, it had produced 36,725 megawatt hours of electricity and 363,258 metric million British Thermal Units (MMBtu) of thermal energy. Following the completion of its infrastructure upgrade project in 2018, the facility achieved a 20 to 30 percent efficiency boost, alongside improved resiliency and reduced emissions.

Orange County Climate Action Plan (2024)

The Orange County CAP, being drafted in coordination with key stakeholders, will incorporate initiatives, projects, and plans from the 22 departments comprising Orange County's operations and support services. This inclusive approach aims to lay the groundwork for reducing GHG emissions and pollutants, while fostering a sustainable circular economy that benefits low-income and disadvantaged communities.

To kickstart the planning process, Orange County Supervisors Katrina Foley (Fifth District) and Vicente Sarmiento (Second District) hosted an investigative hearing on climate resiliency and the needs of community members related to climate change and sustainability. Specific recommendations from the hearing included addressing coastal erosion, expanding resilient infrastructure to protect community members from wildfire threats, and investing in electric vehicle charging infrastructure. To specifically address the concerns raised by the community and stakeholders, the CAP will assess any and all opportunities to address climate change including the following:

- Developing a Countywide Electric Vehicle Infrastructure Master Plan to address site-specific infrastructure needs driven by demand. Surveys of existing electrical services will inform infrastructure additions, which will either serve the county-owned fleet or be made publicly accessible. While the local electrical utility is the default provider of EV charging power, certain facilities may offer opportunities to integrate photovoltaic technologies.
- The CAP will also encompass an evaluation of Orange County's LIDACs to ensure equitable wildfire and flood prevention measures such as testing and assessment of technologies like heat sensing, hardening utility infrastructure in fire-vulnerable zones, and opportunities to establish fire breaks using grass or gravel. These fire breaks double as emergency access roads and may expand hiking and biking opportunities. Additionally, the plan will explore the feasibility of implementing fire-resistant building materials in County-led construction.

John Wayne Airport Climate Action Plan, 2018

The County of Orange-operated John Wayne Airport (JWA) implemented a CAP in 2018 that outlines comprehensive measures aimed at combating climate change through GHG mitigation from the airport's operations. This plan reflects the County of Orange's ongoing efforts to provide cleaner and more sustainable services to residents. A central feature of the CAP is the GHG Emissions Inventory, established to assist airport operators in understanding the sources of existing emissions and future emission trends at JWA. The plan also includes resiliency efforts related to preparing for increasing temperatures, drought conditions, and changes in air travel demand. Additionally, it emphasizes GHG Emission Reduction Measures such as improving energy efficiency, transitioning to renewable energy sources, and electrifying ground support equipment. These measures are designed to reduce GHG emissions on a per-passenger basis, reflecting a sustainable approach to airport operations. The CAP also features a structured implementation and monitoring strategy with key performance indicators (KPIs) to assess the effectiveness of these initiatives, ensuring a proactive and adaptive response to environmental challenges.

Orange County Transportation Authority Climate Adaptation and Sustainability Plan

OCTA is developing a Climate Adaptation and Sustainability Plan (CASP) that focuses on proactively responding and adapting to changing environmental conditions. With an inventory of OCTA's greenhouse gas emissions and accompanying strategies to reduce GHGs, the CASP aims to identify how the transportation authority can minimize its contributions to climate change. The CASP also identifies recommended strategies and measures for OCTA's consideration to better adapt and build resilience to anticipated climate hazards. Other initiatives at OCTA include efforts to offset the environmental impacts of freeway projects. Namely, the Environmental Mitigation Program allocates funds to acquire land and restore native habitats. To date OCTA has acquired over 1,300 acres dedicated to preservation and restoration and will restore approximately 350 acres of native habitat. Furthermore, in 2021, OCTA completed its Natural Hazard Mitigation Plan to support current OCTA emergency and crisis management plans, as well as strengthen the agency's preparedness in the face of natural hazards, including climate change.

2.3 Additional Climate Plans in the MSA

In the realm of climate action and sustainability, additional plans have been developed within the MSA to address the unique environmental challenges and opportunities in the region. These are presented by different areas and agencies outside of traditional local governments. While these plans, summarized below, are not specific to Los Angeles county and Orange county jurisdictions, they offer valuable insights into regional efforts to combat climate change across sectors, reduce GHG emissions, and enhance resilience. Each plan reflects a commitment to climate action, environmental stewardship, and sustainable development, tailored to the specific needs and conditions of their respective areas and entities.

Southern California Association of Governments' 2020-2045 Regional Transportation Plan/Sustainable Communities Strategy, 2020

Adopted in 2020, SCAG's latest Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS or Connect SoCal), presents a long-range visioning plan that balances future mobility and housing needs with economic, environmental, and public health goals for the SCAG region. This encompasses six counties in Southern California, including Los Angeles and Orange counties, and their jurisdictions, which are active members in the development and implementation of the RTP/SCS. Building on the established land use and transportation strategies from previous plans, Connect SoCal aims to enhance mobility options and foster sustainable growth. The plan delineates a trajectory towards a region that is more mobile and sustainable while also prosperous, by fostering connections among transportation networks, planning strategies, and the collaborative efforts of people aimed at elevating life quality in the SCAG region (SCAG, 2020). While the RTP/SCS does not impose local land use policies, it serves as a foundational regional policy framework for local governments to develop further within their jurisdictions.

South Coast Air Quality Management District's Air Quality Management Plan, 2022

The 2022 South Coast Air Quality Management District's Air Quality Management Plan (AQMP) identifies strategies to be implemented to improve air quality in the Los Angeles Basin, which includes all of Orange county and major sections of Los Angeles, Riverside and San Bernadino counties. The plan, adopted December in 2022, includes a comprehensive analysis of GHG emissions, climate and air quality modeling, and growth projections. It aims to address the requirements for meeting the NAAQS for ozone, set at 70 parts per billion by the EPA (South Coast AQMD, 2022). The AQMP includes specific measures for different sources of pollution, emphasizing the importance of zero-emission and low-emission technologies. The plan also involves public participation and considers environmental justice, ensuring that disadvantaged communities benefit from improved air quality and access to advanced technologies.

San Pedro Bay Ports Clean Air Action Plan, 2017

The San Pedro Bay Ports Clean Air Action Plan (Ports' CAAP) is an aggressive plan to reduce pollution from the nation's busiest port complex. It includes strategies for mitigating air pollution and greenhouse gas emissions from port activities and associated health risks. As a joint effort by the Port of Los Angeles and the Port of Long Beach (the "Ports"), the plan outlines a series of measures and strategies to reduce emissions from various sources such as trucks, ships, and other port-related equipment. Key features of the plan include programs for cleaner truck fleets, reduction of vessel emissions, and the adoption of new, more environmentally friendly technologies. Originally developed in 2006, the most recent update from 2017 adjusts the Ports' CAAP and its associated strategies to conform with evolving environmental standards and the dynamic nature of air quality challenges, as well as supporting job creation for planned port expansions. The 2017 CAAP also set aggressive targets to reduce GHG emissions from Port-related sources to 40 percent below 1990 levels by 2030 and 90 percent below 1990 levels by 2050.

Metropolitan Water District Climate Action Plan, 2022

The Metropolitan Water District of Southern California (MWD) released their latest Climate Action Plan (MWD CAP) in May 2022, presenting a comprehensive framework for addressing climate change impacts on the region's water resources and infrastructure, and helping advance the MWD's mission of providing clean reliable water to Southern California. The plan is structured with an overarching goal of achieving carbon neutrality by 2045. Central to the plan are measures to enhance operational resilience against changing environmental conditions, and a commitment to robust water conservation in response to climate change and population growth. The plan also incorporates waste management initiatives, targeting zero landfilled waste by 2045, and explores innovative approaches in water conservation and carbon capture. In particular, the MWD CAP emphasizes the significant co-benefits from climate strategies, including cost savings, enhanced operational resilience, and water conservation.

Los Angeles World Airports Sustainability Report, 2022

The 2022 Sustainability Report from Los Angeles World Airports (LAWA) summarizes achievements in sustainable transportation and infrastructure of the Los Angeles International Airport (LAX) and Van Nuys Airport (VNY). Key achievements include the expansion of the EV charging network at LAX, with a notable increase in charging stations and a commitment to transition LAWA's vehicle fleets to zero-emission vehicles. Other efforts include The Good Traveler program, allowing travelers to purchase carbon emission offsets for flights, which offset over 100 metric tons of CO2 in 2022. LAWA's dedication to environmental stewardship has been recognized through various awards in areas such as energy management, sustainable construction, and design, underscoring its commitment to eco-friendly initiatives.

CHAPTER 3
Greenhouse Gas Emissions Inventories & Forecasts

3.1 Greenhouse Gas Emissions Inventory

The 2018 GHG emissions inventory for the MSA forms the baseline inventory for the PCAP. The year 2018 was selected because it was the most recent year for which data was readily available and because a complete GHG inventory was available for all of Los Angeles county. The 2018 GHG emissions inventory is compliant with the *Global Protocol for Community-Scale Greenhouse Gas Inventories* (GPC Protocol), which accounts for communitywide GHG emissions in line with 2006 Intergovernmental Panel on Climate Change guidelines for national GHG inventories (World Resources Institute, 2014; IPCC, 2006). The inventory accounts for the carbon dioxide (CO_2) equivalent of three gases: CO_2, methane (CH_4), and nitrous oxide (N_2O).[1] These emissions are organized into the three priority sectors, based on the activity type or source:

- **Transportation:** The transportation sector accounts for emissions from fuel combustion and electricity consumption associated with on-road vehicles (passenger vehicles, trucks, and buses), passenger rail, and off-road goods movement equipment (ports, airports, cargo-handling equipment for rail, and transportation refrigeration units).
- **Energy:** The energy sector includes direct emissions from the consumption of natural gas and indirect emissions from grid-supplied electricity used in buildings and facilities.
- **Solid Waste:** The waste sector accounts for fugitive CH_4 emissions generated at landfills.

The community-scale GHG emissions inventory for the MSA was developed using the GPC Protocol and includes the following emissions:

- Emissions produced from activities and sources within the boundaries of Los Angeles and Orange counties (Scope 1).
- Emissions generated from the use of grid-supplied electricity, heat, steam, and/or cooling within the boundaries of Los Angeles and Orange counties (Scope 2).
- Emissions occurring outside the boundaries of Los Angeles and Orange counties as a result of activities taking place within the boundaries of Los Angeles and Orange counties (Scope 3).

[1] Hydrofluorocarbons (HFCs), perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are not included in the inventory due to data limitations.

The GHG inventory comprises emissions from activities occurring within the MSA, including emissions that occur elsewhere because of those activities. A good example is solid waste, which is generated within the MSA but may be disposed of at a landfill outside the MSA where it decomposes and generates GHGs. Solid waste is a Scope 3 emissions source.

Additional detail on the inventory and its data sources and methods can be found in Appendix B.

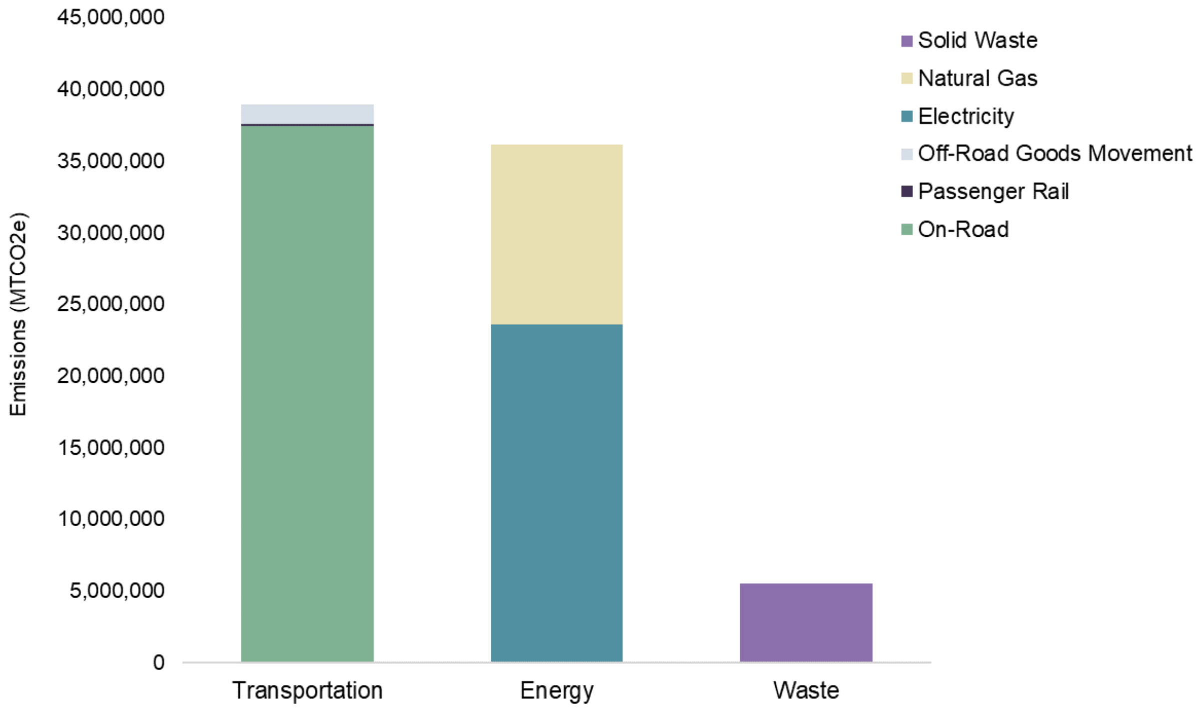
MSA GHG Emissions

In 2018, emissions generated by community activities occurring in the MSA for the transportation, energy, and solid waste sectors amounted to 80,640,445 metric tons CO_2 equivalent ($MTCO_2e$). The transportation sector accounts for approximately 38,932,159 $MTCO_2e$ (48 percent) of total GHG emissions, while the energy sector accounts for approximately 36,142,674 $MTCO_2e$ (45 percent) of total GHG emissions. The transportation sector includes emissions from on-road vehicles, passenger rail, and off-road goods movement, which includes ports, airports, cargo-handling equipment for rail, and transportation refrigeration units (TRUs). On-road goods movement activities, such as drayage trucks, are captured in the on-road subsector; total emissions associated with goods movement represent about six percent of total MSA emissions. The energy sector includes emissions from residential, commercial, and industrial buildings. Solid waste comprises seven percent of emissions, or 5,565,612 $MTCO_2e$.**Table 3-1** and **Figure 3-1** show the 2018 emissions by sector and sub-sector.

TABLE 3-1. 2018 MSA GHG EMISSIONS

Sector / Sub-sector	Emissions (MTCO2e)
Transportation	38,932,159
On-Road	37,469,333
Passenger Rail	135,020
Off-Road Goods Movement	1,327,805
Energy	36,142,674
Electricity	23,585,492
Natural Gas	12,557,182
Solid Waste	5,565,612
Total	80,640,445

Source: ESA, 2024
Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent



Source: ESA, 2024.

Figure 3-1.
2018 MSA GHG Emissions by Sector and Sub-sector

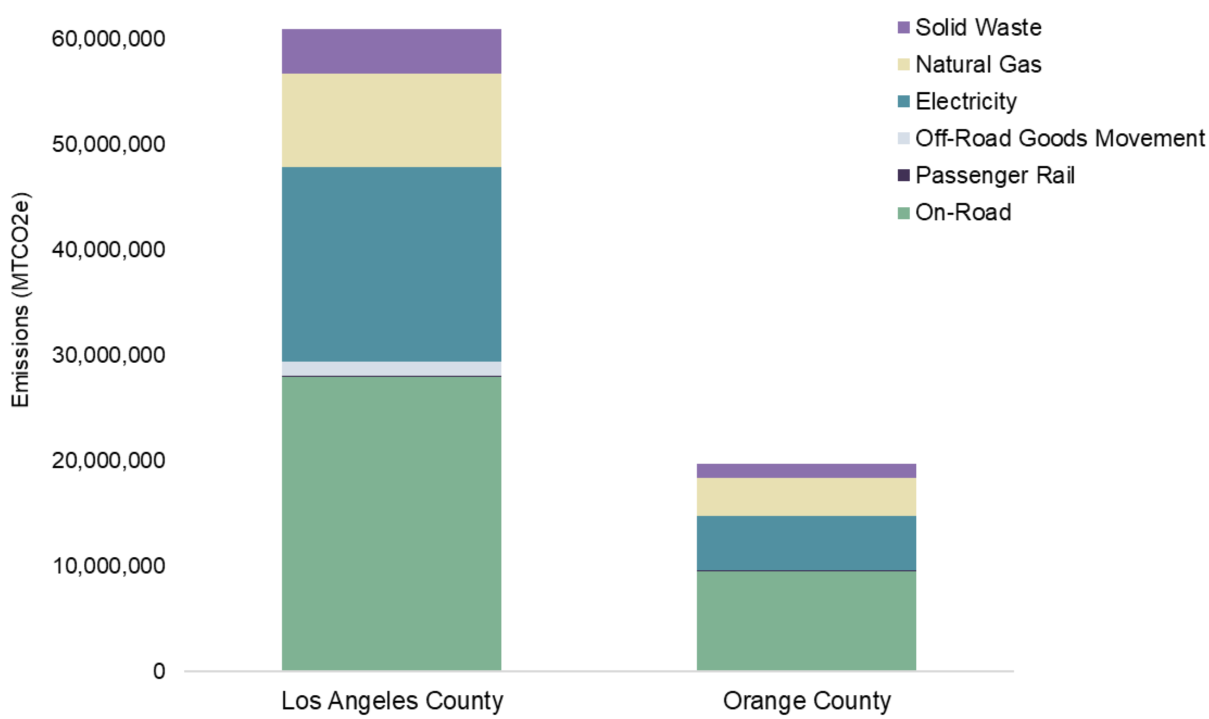
County-Level GHG Emissions

Table 3-2 shows the GHG emissions breakdown of the MSA by Los Angeles and Orange counties. Los Angeles county comprises 76 percent of total MSA emissions. Orange county comprises the remaining 24 percent of emissions within the MSA. Los Angeles and Orange counties exhibit a similar breakdown in emissions as compared to the MSA. The transportation sector accounts for approximately 48 percent of Los Angeles county emissions and 49 percent of Orange county emissions. The energy sector accounts for approximately 45 percent and 44 percent of Los Angeles and Orange county emissions, respectively, and solid waste comprised seven percent of emissions for both counties. Due to the presence of the Port of Los Angeles and Port of Long Beach within Los Angeles county, Los Angeles county accounts for a much larger share of goods movement emissions relative to Orange county.

Table 3-2. 2018 GHG Emissions by County

Sector / Sub-sector	Emissions (MTCO2e)	
	Los Angeles County	Orange County
Transportation	29,352,846	9,579,313
On-Road	27,968,741	9,500,592
Passenger Rail	82,136	52,884
Off-Road Goods Movement	1,301,969	25,836
Energy	27,364,704	8,777,970
Electricity	18,456,672	5,128,821
Natural Gas	8,908,032	3,649,149
Solid Waste	4,205,841	1,359,771
Total	60,923,391	19,717,054

Source: ESA, 2024.
Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent.



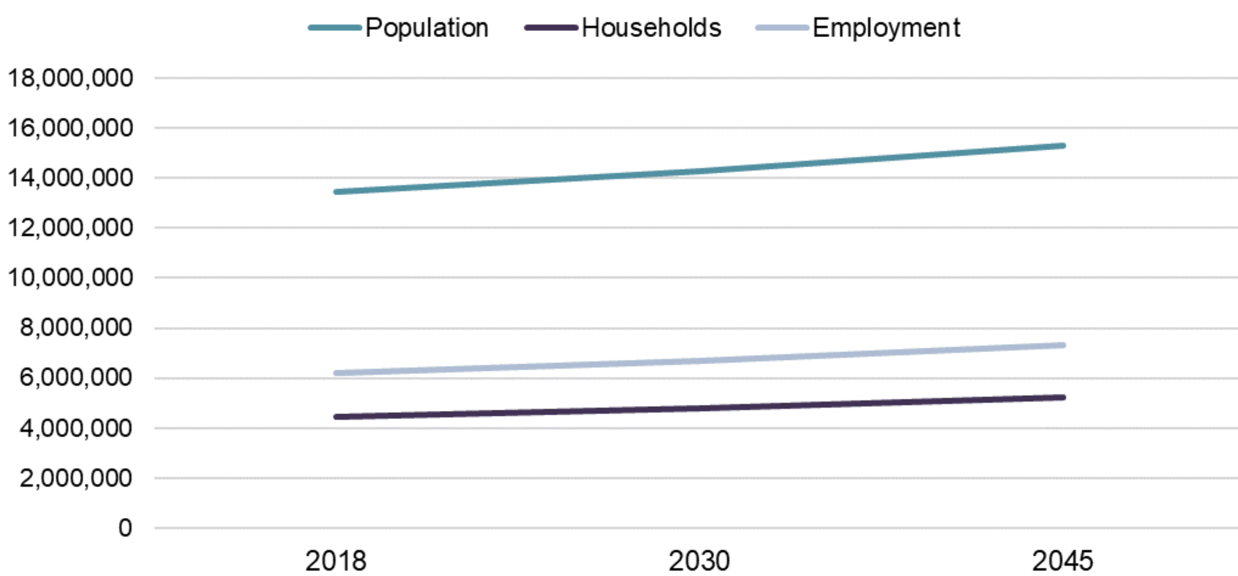
Source: ESA, 2024.

Figure 3-2.
2018 MSA GHG Emissions by County and Sub-sector

3.2 Greenhouse Gas Emissions Forecasts

Although the EPA does not require PCAPs to include GHG emissions forecasts, this PCAP includes forecasts for 2030 and 2045 as a foundation for estimating GHG emission reduction potentials in future years for reduction measures (see Chapter 4).

The emissions forecasts used in the PCAP account for socioeconomic trends, population growth, historic emissions patterns, and existing policies and legislation that affect GHG emissions. **Figure 3-3** shows population, household, and employment growth projections from 2018 to 2045 for the MSA. The 2018 GHG emissions inventory serves as the year from which future emissions are forecasted.



Source: ESA, 2024.

Figure 3-3.
Population, Household, and Employment Growth in the MSA

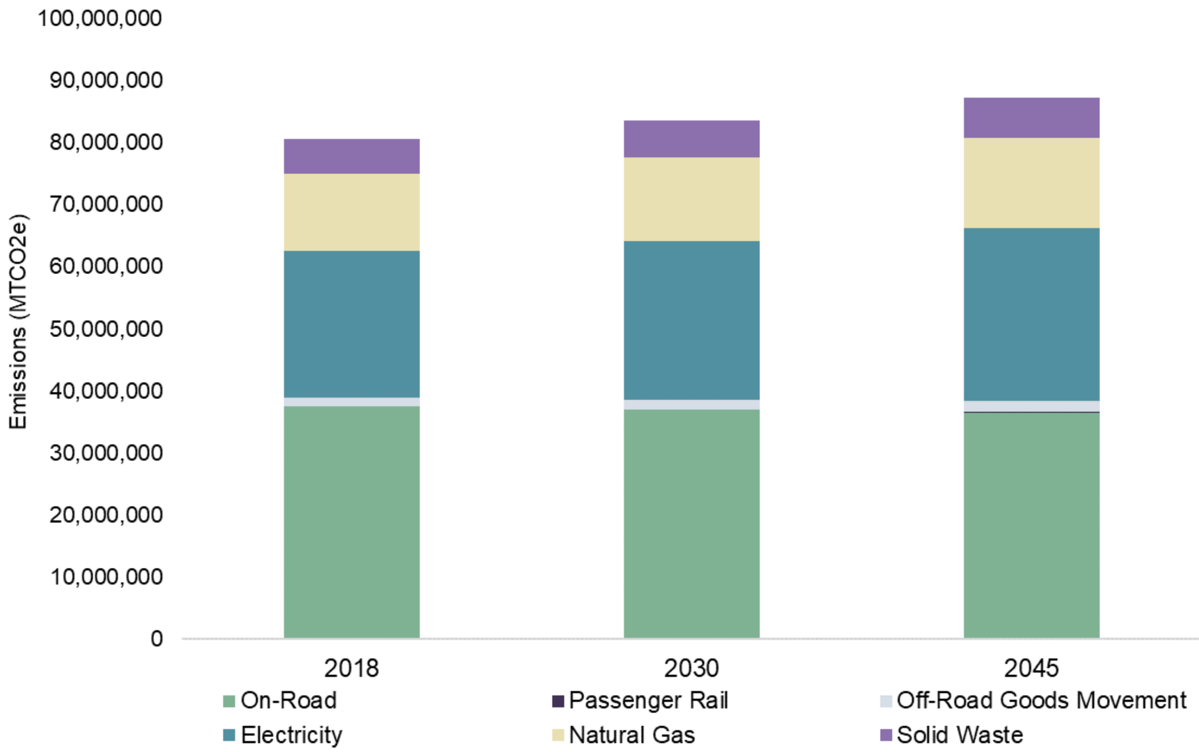
Business-as-Usual Forecast

MSA emissions forecasts were developed by sector under a business-as-usual (BAU) scenario for the years 2019 through 2045 (**Figure 3-4**). **Table 3-3** shows the projected total emissions for each forecast year under the BAU forecast. The BAU forecast assumes that no further government action is taken to reduce GHG emissions and is consistent with the following:

- Population, housing, and employment data were available for 2016 and 2040, which were interpolated and extrapolated upon to obtain 2018, 2030, and 2045 socioeconomic data (SED) for each jurisdiction within the MSA. The SED was obtained from SCAG's 2016 Regional Travel Demand Model, which has a base year of 2016 and a horizon year of

2040.[2] The SED was used to forecast emissions by sector and is detailed in *Appendix B, GHG Inventory and Forecast Methods*.

- Passenger vehicle and truck vehicle miles traveled (VMT) and emissions estimated using the SCAG's 2016 Regional Travel Demand Model and CARB's EMissions FACtors 2021 (EMFAC2021) model.
- Changes were made to the 2016 SCAG model inputs to reflect more recent Work from Home (WfH) assumptions. The WfH assumptions, provided by SCAG, were used to develop an estimate of WfH conditions in 2040 for each household income range included in the 2016 SCAG model. The 2040 SCAG model was then updated to reflect these WfH assumptions for use in the VMT inventory estimates.



Source: ESA, 2024.

Figure 3-4.
2045 Business-as-Usual GHG Emissions Forecast

2 Due to the constrained timeline associated with the Priority Climate Action Plan, the technical analysis done to establish the emissions forecast and quantify estimated GHG reduction measures and strategies incorporated socioeconomic data from SCAG's 2016 Regional Travel Demand Model. SCAG is expected to finalize the Connect SoCal 2024 RTP/SCS and its associated SED, which projects slower growth rates in LA and Orange counties. The MSA Steering Committee will consider updating and integrating the socioeconomic data into the technical analysis for the subsequent Comprehensive Climate Action Plan (CCAP) to reflect these changing growth patterns and refine the estimated GHG forecasts and reduction potential.

Table 3-3. MSA Business-as-Usual Forecasts

Sector	Emissions (MTCO2e)		
	2018	2030	2045
Transportation	38,932,159	38,519,494	38,205,990
On-Road	37,469,333	36,938,149	36,451,363
Passenger Rail	135,020	143,955	155,123
Goods Movement	1,327,805	1,437,391	1,599,504
Energy	36,142,674	38,997,310	42,460,779
Electricity	23,585,492	25,523,646	27,893,595
Natural Gas	12,557,182	13,473,664	14,567,184
Solid Waste	5,565,612	5,940,397	6,408,877
Total	80,640,445	83,457,200	87,075,646

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

Adjusted Business-as-Usual Forecast

The Adjusted BAU forecast accounts for future growth under BAU conditions but adjusts for federal, state, and county regulations that were implemented before development of the PCAP. The Adjusted BAU forecast assumes that population, housing, employment, and transportation activities would continue to grow over time, consistent with the projections shown in Figure 3-5.

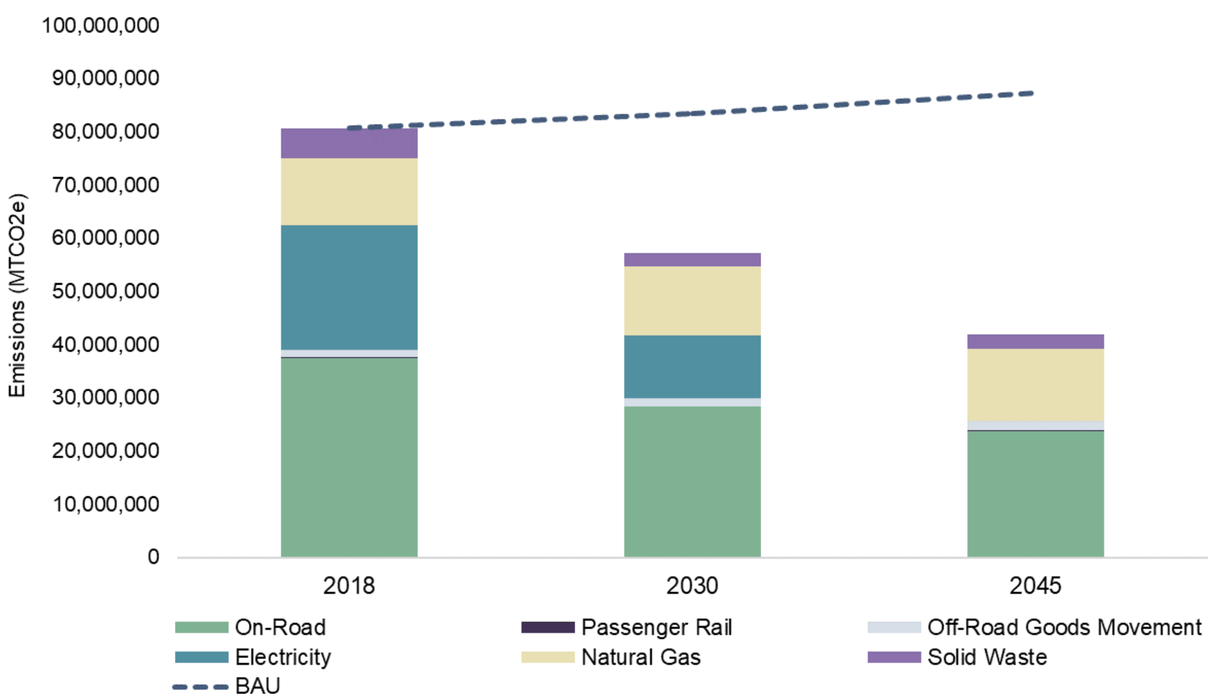
The Adjusted BAU forecast also accounts for existing standards and regulations, such as the California Energy Commission (CEC) 2019 and 2022 Title 24 building energy efficiency requirements, Renewables Portfolio Standards (SB 1020), the California Department of Resources Recycling and Recovery (CalRecycle) 75 percent waste diversion initiative (AB 341 and SB 1383), Pavley and Advanced Clean Car I Standards (AB 1493), and CARB's Advanced Clean Trucks regulation. The Adjusted BAU scenario does not include newer regulations that haven't been incorporated into CARB's standard modeling tools, such as the Advanced Clean Car II Standards and the Advanced Clean Fleets Standards.

Table 3-4 shows the projected total emissions for each forecast year under the Adjusted BAU forecast. Total emissions for the MSA are forecasted to decline from 80,640,437 $MTCO_2e$ in 2018 to 57,266,321 $MTCO_2e$ by 2030, a 29 percent reduction, and further decline to 41,921,589 $MTCO_2e$ by 2045, a 48 percent reduction. The table also shows the forecasts by each sector and subsector. **Figure 3-5** compares the Adjusted BAU forecast to the BAU forecast.

Table 3-4. MSA Adjusted Business-as-Usual Forecasts

Sector	Emissions (MTCO2e)		
	2018	2030	2045
Transportation	38,932,159	29,907,973	25,511,615
On-Road	37,469,333	28,338,294	23,775,532
Passenger Rail	135,020	143,955	155,123
Goods Movement	1,327,805	1,425,724	1,580,959
Energy	36,142,674	24,857,368	13,629,188
Electricity	23,585,492	11,764,550	0
Natural Gas	12,557,182	13,092,817	13,629,188
Solid Waste	5,565,612	2,475,165	2,670,366
Total	80,640,445	57,240,506	41,811,168

Source: ESA, 2024
Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent
Note: By 2045, California's Renewable Portfolio Standard requires electricity providers to procure 100 percent carbon-free electricity; therefore, electricity emissions are forecasted to be zero.



Source: ESA, 2024.

Figure 3-5.
2045 MSA BAU and Adjusted Business-as-Usual GHG Emissions Forecasts

CHAPTER 4
Greenhouse Gas Reduction Measures

4.1 GHG Emission Reduction Framework

The MSA's extensive foundation of existing inventories and climate action plans, combined with a strong state and regional policy and funding framework for reducing emissions across all sectors, allows the PCAP to focus on strategies that can be implemented with a high degree of confidence. The main goal of the PCAP is to facilitate emissions reductions and promote regional collaboration for implementing GHG measures that will benefit LIDACs and all MSA residents. This PCAP leverages the massive volume of data that this vast and diverse metropolitan region represents to ensure that participating municipalities have the tools they need to successfully apply for implementation grants and reduce GHG emissions and co-pollutants in their communities.

Although statewide policies and regulations offer compelling contributions to reducing GHG emissions, achieving aggressive emissions reduction targets and the long-term goal of carbon neutrality requires local measures. Emission reduction measures include a selection of feasible, effective strategies for reducing emissions in the key sectors of energy, transportation/goods movement, and solid waste. The measures described herein are purposefully aligned with the state's goals in order to maximize efficiency of GHG reduction efforts and further the progress of existing investments. This effort draws on tools, ideas, and experience from many sources, including the International Council for Local Environmental Initiatives (ICLEI), the U.S. Conference of Mayors Best Practices for Climate Protection, Urban Sustainability Directors Network, CoolCalifornia.org, California Air Pollution Control Officers Association (CAPCOA), CARB guidance, recent peer-reviewed literature, and the coordinating entities' wide experience developing CAPs for local governments in California (ICLEI, 2024; U.S. Conference of Mayors, 2023; USDN, 2024; CoolCalifornia, 2024; CARB, 2024; CAPCOA, 2022). The analysis folds in reduction measures from current city and county CAPs and the San Pedro Bay Ports CAAP (The Port of Los Angeles, 2017). Additionally, zero-emission control strategies from South Coast AQMD's 2022 AQMP were incorporated (South Coast AQMD, 2022).

The GHG reduction measures and strategies in this PCAP were also developed using the EPA's Quantified Climate Action Measures Directory for Local Climate Action Plans and a collection of current CAPs and sustainability plans in the MSA (refer to Appendix A for a list of existing CAPs) (USEPA, 2023). This chapter describes the priority GHG emission reduction measures within the MSA for the transportation, energy, and solid waste sectors.

Throughout this chapter, measures, performance goals, and strategies are defined as follows:

- **Measures** are overall, sector-level initiatives of the PCAP. Measures are broad and aim to achieve overarching goals within each emissions sector. For example, “Decarbonize Goods Movement” is a measure (i.e., Measure T1) and applies to all emissions associated with the goods movement industry (on-road trucks, off-road cargo handling equipment, port railyard equipment, etc.).
- **Performance Goals** are focused, sub-sector-specific objectives within each measure to be achieved by either 2030 or 2045. Performance goals are quantified in order to estimate GHG emissions reductions resulting from each measure. Performance goals support measures and would be achieved through implementing strategies. For example, “Reduce 40 percent of GHG emissions associated with the goods movement vehicle fleet by 2030" is a performance goal that supports Measure T1. The quantitative GHG emissions reduction analysis is provided primarily at the performance goal level.
- **Strategies** are specific programs or actions that could be implemented for each measure to achieve the associated performance goal. For example, “Replace fossil fuel-powered vehicles, rail, and equipment with zero-emission vehicles” is a strategy (this strategy, Strategy T1.1, supports Measure T1 and its corresponding performance goals).

4.2 GHG Emission Reduction Potential

This PCAP includes 18 separate GHG reduction measures in the transportation, energy, and solid waste emissions sectors. These priority measures meet the following criteria.

- Effective in reducing both community and municipal emissions by the PCAP’s forecast years, while building in flexibility to accommodate future technological advances.
- Actionable in the near-term, realistic, and include specific implementing strategies for successful implementation.
- Incorporate quantitative, objective GHG reduction performance standards and implementation metrics that can be monitored.

GHG emissions reductions associated with all 18 measures were estimated using various methods and data sources, which are detailed in Appendix C. This analysis quantifies the *maximum* annual GHG emissions reductions that would occur if the 2030 and 2045 performance goals were achieved. For example, Measure E1 would reduce GHG emissions by 410,637 MTCO$_2$e annually by 2030 if the MSA achieved the performance goal of decarbonizing 25 percent and 15 percent of existing residential and commercial building stock, respectively.

To show the maximum reduction potential of each measure’s performance goals, adjustments were not made to account for the dampening effects that can occur when multiple measures are implemented together. For example, lowering the carbon intensity of purchased electricity means that fewer emissions reductions will be achieved through the reduction of electricity use. Additionally, there is overlap between the emissions sources that fall under each measure. For example, both Measure T1 (Decarbonize Goods Movement) and Measure T3 (Transition

Medium- and Heavy-Duty Vehicles to ZEVs) aim to reduce emissions associated with heavy-duty vehicles. Each reduction measure was quantified independently of other measures and double counting between measures was not considered. Therefore, emission reductions from one measure cannot be summed with the emission reductions of another for measures within the same sector.[1]

Table 4-1 shows the maximum annual emissions reductions that would occur in the region if the reduction measures' 2030 and 2045 performance goals were achieved. GHG reductions are shown separately for state and local contributions for each year.[2] The state contribution represents the reductions associated with the Adjusted BAU scenario compared to the BAU scenario, which includes implementation of State of California regulations and policies described in Chapter 3. The local contribution represents the reductions associated with implementation of each measure and achievement of its performance goals beyond the Adjusted BAU scenario. Many local measures are needed to realize the full potential of State policies. These locally implemented measures are described in more detail in the following sections. In addition to MSA-level emissions reductions, reductions are presented by County. **Table 4-2** presents measure-level emission reductions for Los Angeles County by state and local contributions. **Table 4-3** presents measure-level emission reductions for Orange County by state and local contributions.

Table 4-1. Regional GHG Emission Reductions

Sector and Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
Transportation						
T1: Decarbonize Goods Movement	850,918	1,699,656	**2,550,574**	1,988,777	3,144,434	**5,133,211**
T2: Decarbonize Passenger Transport	7,596,586	4,560,391	**12,156,977**	10,437,556	16,885,810	**27,323,366**
T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs	1,003,269	1,312,222	**2,315,490**	2,238,275	1,555,747	**3,794,022**

1 To avoid underestimating the maximum potential GHG emission reductions from individual measures, potential overlaps and double counting were not considered when quantifying the reductions from individual measures. Therefore, the sum of reductions presented does not represent the total reduction achieved when implementing multiple measures simultaneously. For example, Measure T1 includes GHG reductions from on-road goods movement vehicles (mostly trucks), while Measure T3 includes GHG reductions from on-road medium- and heavy-duty vehicles (some of which are goods movement vehicles); there is some overlap in reductions between these measures. As another example, Measure E1 includes GHG reductions from removing natural gas combustion in existing buildings through fuel switching (e.g., electrification), while Measure E6 includes GHG reductions from reducing natural gas in existing buildings through efficiency upgrades; there is some overlap in reductions between these measures.

2 State contributions represent GHG emission reductions achieved through State of California regulations and policy. Local contributions represent GHG emission reductions achieved by the priority measures beyond state policy. For example, for Measure W1, the state contribution includes GHG reductions anticipated to occur through implementation of CalRecycle's SB 1383 regulation, and the local contribution includes GHG reductions anticipated to occur beyond the SB 1383 regulation to achieve the measure's performance goals.

Sector and Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
T4: Reduce VMT Through Sustainable Land Use	0	1,902,737	**1,902,737**	0	4,906,652	**4,906,652**
T5: Expand the Active Transportation Network	0	1,376,328	**1,376,328**	0	2,544,588	**2,544,588**
T6: Expand the Transit Network and Increase Ridership	0	149,866	**149,866**	0	271,119	**271,119**
T7: Optimize Traffic Flow to Reduce Idle Time	0	19,939	**19,939**	0	41,629	**41,629**
Energy						
E1: Decarbonize Existing Buildings	187,068	410,402	**597,470**	187,068	8,084,868	**8,271,936**
E2: Decarbonize New Buildings	133,620	31,148	**164,768**	600,045	685,354	**1,285,399**
E3: Decarbonize Industrial Processes	2,378,383	34,244	**2,412,628**	5,152,044	1,670,994	**6,823,037**
E4: Increase Renewable Energy Generation and Storage	13,759,096	8,823,413	**22,582,508**	27,893,595	0	**27,893,595**
E5: Improve Grid Efficiency and Resiliency Through Grid Modernization	13,759,096	1,119,736	**14,878,832**	27,893,595	0	**27,893,595**
E6: Improve Energy Efficiency Through Building Upgrades	8,248,299	5,032,672	**13,280,972**	8,248,299	6,434,191	**14,682,490**
E7: Improve Energy Efficiency Through Urban Greening	0	5,240	**5,240**	0	10,480	**10,480**
E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations	2,378,383	1,716,633	**4,095,016**	5,152,044	1,667,653	**6,819,697**
Solid Waste						
SW1: Increase Organics Diversion	3,465,231	2,103,890	**5,569,122**	3,738,512	2,536,847	**6,275,359**
SW2: Recover and Reuse Materials	Not Quantified					
SW3: Increase Waste-to-Energy and Conversion Technology Potential	0	244,169	**244,169**	0	0	**0**

Source: ESA, 2024
Abbreviations: $MTCO_2e$ = metric tons of carbon dioxide equivalent

TABLE 4-2. LOS ANGELES COUNTY REDUCTIONS BY STATE AND LOCAL CONTRIBUTION

Sector / Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
Transportation						
T1: Decarbonize Goods Movement	674,411	1,397,816	**2,072,227**	1,522,584	2,578,404	**4,100,988**
T2: Decarbonize Passenger Transport	5,629,908	3,469,770	**9,099,679**	7,802,695	12,772,564	**20,575,259**
T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs	793,917	1,002,768	**1,796,685**	1,683,156	1,238,110	**2,921,265**
T4: Reduce VMT Through Sustainable Land Use	0	1,388,779	**1,388,779**	0	3,779,209	**3,779,209**
T5: Expand the Active Transportation Network	0	1,048,766	**1,048,766**	0	1,898,018	**1,898,018**
T6: Expand the Transit Network and Increase Ridership	0	132,246	**132,246**	0	239,333	**239,333**
T7: Optimize Traffic Flow to Reduce Idle Time	0	16,802	**16,802**	0	35,589	**35,589**
Energy						
E1: Decarbonize Existing Buildings	145,277	310,503	**455,780**	145,277	5,978,139	**6,123,416**
E2: Decarbonize New Buildings	103,769	25,716	**129,485**	485,906	573,370	**1,059,277**
E3: Decarbonize Industrial Processes	1,695,731	20,819	**1,716,550**	3,446,257	991,518	**4,437,775**
E4: Increase Renewable Energy Generation and Storage	11,284,370	6,520,748	**17,805,118**	21,881,237	0	**21,881,237**
E5: Improve Grid Efficiency and Resiliency Through Grid Modernization	11,284,370	826,512	**12,110,883**	21,881,237	0	**21,881,237**
E6: Improve Energy Efficiency Through Building Upgrades	6,750,070	3,659,992	**10,410,062**	6,750,070	4,575,512	**11,325,582**
E7: Improve Energy Efficiency Through Urban Greening	Regional Measure					
E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations	1,695,731	1,053,264	**2,748,995**	3,446,257	989,536	**4,435,793**
Solid Waste						
SW1: Increase Organics Diversion	2,628,966	1,596,158	**4,225,123**	2,848,414	1,932,852	**4,781,266**
SW2: Recover and Reuse Materials	Not Quantified					
SW3: Increase Waste-to-Energy and Conversion Technology Potential	Regional Measure					

Source: ESA, 2024
Abbreviations: $MTCO_2e$ = metric tons of carbon dioxide equivalent
Note: State = GHG emission reductions based on adopted State of California regulations. Local = GHG emission reductions based on the identified measures in this PCAP.

Table 4-3. Orange County Reductions by State and Local Contribution

Sector / Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
Transportation						
T1: Decarbonize Goods Movement	176,507	301,840	**478,347**	466,193	566,030	**1,032,223**
T2: Decarbonize Passenger Transport	1,966,677	1,090,621	**3,057,298**	2,634,861	4,113,246	**6,748,107**
T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs	209,352	309,453	**518,805**	555,119	317,638	**872,756**
T4: Reduce VMT Through Sustainable Land Use	0	513,958	**513,958**	0	1,127,443	**1,127,443**
T5: Expand the Active Transportation Network	0	327,562	**327,562**	0	646,570	**646,570**
T6: Expand the Transit Network and Increase Ridership	0	17,621	**17,621**	0	31,785	**31,785**
T7: Optimize Traffic Flow to Reduce Idle Time	0	3,137	**3,137**	0	6,041	**6,041**
Energy						
E1: Decarbonize Existing Buildings	41,791	99,898	**141,689**	41,791	2,106,729	**2,148,520**
E2: Decarbonize New Buildings	29,851	5,432	**35,283**	114,139	111,983	**226,122**
E3: Decarbonize Industrial Processes	682,652	13,425	**696,077**	1,705,786	679,476	**2,385,262**
E4: Increase Renewable Energy Generation and Storage	2,474,725	2,302,665	**4,777,390**	6,012,357	0	**6,012,357**
E5: Improve Grid Efficiency and Resiliency Through Grid Modernization	2,474,725	293,224	**2,767,949**	6,012,357	0	**6,012,357**
E6: Improve Energy Efficiency Through Building Upgrades	1,498,230	1,372,681	**2,870,910**	1,498,230	1,858,679	**3,356,908**
E7: Improve Energy Efficiency Through Urban Greening	Regional Measure					
E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations	682,652	663,369	**1,346,021**	1,705,786	678,117	**2,383,904**
Solid Waste						
SW1: Increase Organics Diversion	836,266	507,733	**1,343,998**	890,098	603,995	**1,494,093**
SW2: Recover and Reuse Materials	Not Quantified					
SW3: Increase Waste-to-Energy and Conversion Technology Potential	Regional Measure					

Source: ESA, 2024
Abbreviations: $MTCO_2e$ = metric tons of carbon dioxide equivalent
Note: State = GHG emission reductions based on adopted State of California regulations. Local = GHG emission reductions based on the identified measures in this PCAP.

4.3 Reduction Measures and Strategies

This section presents the GHG reduction measures captured in the PCAP, describing anticipated GHG emissions reductions, performance goals, specific reduction strategies to achieve these performance goals, and co-benefits.

In addition to reducing GHG emissions, measures in this PCAP can provide social, economic, and environmental advantages to many communities, especially for communities facing climate change vulnerabilities and disadvantages. This PCAP includes a co-benefits assessment to identify indirect benefits (co-benefits) which serve as an additional benefit that can offer positive outcomes in public health, economic development, resource allocation, and more (refer to Chapter 5 for a complete list of benefits per measure and an in-depth co-benefit analysis).

Each measure is presented as follows:

Measure S1: Sample Measure Name

Annual GHG Emissions Reductions

By 2030: XXX
By 2045: XXX

(units = $MTCO_2e$)

Performance Goals

Sample performance goal by:

- X percent by 2030
- X percent by 2045

Description

Sample description.

Reduction Strategies

Sample1.1— Sample strategy.

Sample1.2— Sample strategy.

Co-Benefits

Icons representing applicable co-benefits.

Annual GHG Emissions Reductions equal the local contribution of the maximum potential $MTCO_2e$ that could be reduced by the target years 2030 and 2045 across the MSA. The state contribution, associated with implementation of California regulations and policies, is not captured in these values but can be found in Tables 4-1, 4-2, and 4-3 above.

Performance Goals are the specific objectives within each measure to be achieved by 2030 or 2045.

Description is a summary explanation of a specific measure and its purpose.

Reduction Strategies are examples of specific programs or actions that could be implemented for each measure to achieve the associated performance goals.[3] Appendix D, *Quantification Guidance* provides guidance and methods for calculating GHG emission reductions from

[3] The list of reduction strategies associated with each measure is not comprehensive or exclusionary; it is intended to provide useful examples. There are many ways in which the 18 reduction measures can be carried out beyond what is described below.

specific GHG reduction measures and strategies. It includes relevant background information, recommended calculation methods, and a list of guidance documents, resources, and emission calculation tools.

Tracking metrics are intended to identify potential data that may be used to analyze GHG emission reduction strategies and track implementation over time.

Co-Benefits are identified benefits based on the measure's co-benefits assessment. The following icons are used (more detail is provided in Chapter 5, *LIDAC Analysis*):

Air Pollution: GHG reduction measures can yield co-benefits for air quality by curbing emissions of pollutants, thus enhancing community health outcomes alongside a range of additional improvements to quality of life.

Other Pollution: Decreasing dependence on fossil fuels and their extraction and transportation can reduce the occurrence of soil and groundwater contamination caused by leaks, spills, and other discharges throughout the supply chain.

Public Health: Reducing GHG emissions can generate co-benefits for public health beyond those stemming from improved air quality, such as promoting physical activity through active transportation options like walking and cycling, which can reduce the risk of chronic diseases like obesity and cardiovascular ailments.

Resource Conservation: GHG reduction measures can lead to co-benefits related to resource conservation by encouraging the adoption of sustainable practices like energy efficiency and waste reduction, thereby conserving valuable resources such as water, land, and raw materials for future generations.

Economic Development: Measures that will be employed to reduce GHG emissions can yield co-benefits by creating economic opportunities through the establishment of new "green" jobs and businesses, fostering innovation and growth in sectors like renewable energy, energy efficiency, and sustainable transportation.

Community Awareness & Capacity Building: Implementing GHG reduction measures increases community awareness and capacity for climate action, fostering informed participation in planning processes and garnering local support and investment for sustainability initiatives.

Parks and Urban Greening: Beyond contributing to reductions in GHG emissions, urban greening provides aesthetic improvements to the environment and promotes physical activity, improved physical and mental health, placemaking and community gathering, and outdoor recreation.

Community Resilience: Measures that promote community resilience can be particularly beneficial to LIDACs, which due to historic disinvestment are particularly vulnerable to climate change hazards.

Socioeconomic Equity and Environmental Justice: GHG reduction measures that promote environmental justice include those which will reduce the disproportionate burden of environmental harm experienced by low income and disadvantaged communities.

Transportation

Activities within the transportation sector are responsible for the majority of GHG emissions within the MSA, as the dominant mode of transportation is vehicles that run on fossil fuels. The land use patterns that have developed over time—along with the associated highway networks, streetscapes, and parking infrastructure—prioritize and promote the usage of cars and trucks. The PCAP identifies measures and strategies to address transportation emissions and to prioritize public transportation, walking, biking, and rolling, and other alternatives to single-occupancy trips, as well as land use that reduces the distance between key destinations. For trips requiring vehicles, the PCAP includes measures and strategies to advance zero-emission and near-zero-emission technologies through deployment of vehicles and supportive infrastructure such as electric vehicle (EV) charging.

Efforts to decarbonize transportation provide many co-benefits for residents, employees, and employers; however, many of these benefits do not always reach low-income and disadvantaged communities. For example, residents of affordable housing and multifamily housing have not been well served by EV charging infrastructure and low-cost charging opportunities. This can lead to cycles of disinvestment and more expensive gas and electricity bills. The lack of housing affordability and overall high cost of living in the MSA requires a comprehensive approach that provides residents with affordable and high-quality transportation choices that reduce reliance on vehicles and new and innovative approaches to ensure EV charging infrastructure and ZEVs are affordable and accessible to all residents, especially low-income and disadvantaged households and communities.

In addition to moving people, our transportation also moves goods and raw materials across and within MSA boundaries. As noted in the background description, the MSA is the backbone of the largest international trade gateway in the United States and is critical to the regional and national economy. Due to its size and importance, the movement of goods constitutes a substantial portion of emissions from the transportation sector and, due to its reliance on diesel fuel, accounts for a disproportionately large amount of the region's health impacts from air pollution. The footprint of the goods movement sector, and its associated benefits and impacts, extends into neighboring MSAs and states, and throughout the nation. As such, transitioning the MSA's goods movement sector to clean, zero-emissions technologies has the potential to dramatically reduce GHG and air pollution emissions regionally and scale these technologies and infrastructure to catalyze a national transformation of the goods movement system. This can effectively mirror the effect that the EV passenger vehicle transition (both single-occupancy and transit vehicles) regionally, and in California as a whole, is having on scaling national EV adoption.

Measure T1: Decarbonize Goods Movement

Annual GHG Emissions Reductions

By 2030: 1,699,656
By 2045: 3,144,434

(units = $MTCO_2e$)

Performance Goals

Reduce GHG emissions associated with the goods movement vehicle fleet by:

- 40 percent by 2030
- 100 percent by 2045

Reduce GHG emissions associated with port cargo-handling equipment by:

- 100 percent by 2030

Reduce GHG emissions associated with non-port goods movement equipment by:

- 70 percent by 2030
- 100 percent by 2045

Description

Implement and incentivize the decarbonization of goods movement activities by increasing the zero-emission vehicle (ZEV) market share of heavy-duty, on-road vehicles and off-road equipment fleets.

Measure T1 addresses GHG emissions from on-road goods movement vehicles (medium- and heavy-duty trucks) port vessels and equipment (ocean-going vessels, harbor craft, cargo-handling equipment, and locomotives), and non-port cargo-handling equipment (rail cargo-handling equipment and transportation refrigeration units).

Reduction Strategies [Tracking Metrics]

T1.1—Replace fossil fuel-powered vehicles, rail, and equipment with zero emission vehicles (ZEV). [ZEV registrations]

T1.2—Install electric vehicle (EV) charging stations/infrastructure, including for offroad equipment and harbor craft. [EVCS installed]

T1.3—Install hydrogen fueling infrastructure, including for off-road equipment and harbor craft. [hydrogen fueling stations installed]

T1.4—Install ship to shore power infrastructure. [terminals retrofitted with shore power]

T1.5—Upgrade electric grid to support ZEV charging infrastructure. [EV-ready parking spaces]

T1.6—Expand rail infrastructure and low- and zero-emissions locomotives to support the decarbonization of goods movement. [low-emission locomotives; zero-emission locomotives]

Co-Benefits

Measure T2: Decarbonize Passenger Transport

Annual GHG Emissions Reductions

By 2030: 4,560,391
By 2045: 16,885,810

(units = $MTCO_2e$)

Description

Increase the ZEV market share for on-road passenger vehicles and passenger buses, including school buses.

Measure T2 addresses GHG emissions from on-road light-duty vehicles and buses.

Performance Goals

Reduce GHG emissions associated with buses by:

- 50 percent by 2030
- 100 percent by 2045

Electrify passenger vehicles by:

- 30 percent by 2030
- 90 percent by 2045

Reduction Strategies [Tracking Metrics]

T2.1—Replace fossil fuel-powered passenger vehicles with ZEVs and install necessary EV infrastructure. [ZEV registrations]

T2.2—Replace fossil fuel-powered buses with ZEVs and install necessary EV infrastructure. [ZEV registrations]

T2.3—Install publicly accessible EV chargers. [public and shared private EVCS installed]

T2.4—Install publicly accessible hydrogen fueling infrastructure. [hydrogen fueling stations installed]

Co-Benefits

Measure T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs

Annual GHG Emissions Reductions

By 2030: 1,312,222
By 2045: 1,555,747

(units = MTCO$_2$e)

Performance Goals

Transition medium- and heavy-duty vehicles to ZEVs by:

- 50 percent by 2030
- 90 percent by 2045

Description

Increase the ZEV market share for on-road medium- and heavy-duty vehicles.

Measure T3 addresses GHG emissions from all medium- and heavy-duty on-road trucks in the MSA (including on-road goods movement vehicles addressed via Measure T1).

Reduction Strategies [Tracking Metrics]

T3.1—Replace fossil fuel-powered medium- and heavy-duty vehicles with ZEVs. [ZEV registrations]

T3.2—Install EV charging stations. [EVCS installed]

T3.3—Install hydrogen fueling infrastructure. [hydrogen fueling stations installed]

Co-Benefits

Measure T4: Reduce VMT Through Sustainable Land Use

Annual GHG Emissions Reductions

By 2030: 1,902,737
By 2045: 4,906,652

Description

Reduce VMT by constructing transit-oriented, mixed-use, and infill development and increasing housing and high-quality transit near high job density areas.

(units = $MTCO_2e$)

Performance Goals

Reduce per capita passenger vehicle VMT from 2018 levels by:

- 10 percent by 2030
- 20 percent by 2045

Measure T4 addresses GHG emissions from on-road, light-duty vehicles.

Reduction Strategies [Tracking Metrics]

T4.1—Increase housing and job density along transit corridors, such as high-quality transit areas (HQTA). [jobs per acre; dwelling units or population per acre]

T4.2—Construct infill and mixed-use development. [jobs per acre; dwelling units or population per acre]

T4.3—Establish flexible parking requirements through zoning changes or new development regulations that can result in reduced parking. [parking spaces per land use type]

Co-Benefits

Measure T5: Expand the Active Transportation Network

Annual GHG Emissions Reductions

By 2030: 1,376,328
By 2045: 2,544,588

(units = $MTCO_2e$)

Performance Goals

Increase active transportation mode share by:

- 5 percent by 2030
- 10 percent by 2045

Description

Expand active transportation infrastructure and vehicles, including bicycle and pedestrian networks and micro-mobility options (e.g., e-bikes, scooters, electric golf carts, etc.), to encourage and support zero-carbon transportation options.

Measure T5 addresses GHG emissions from on-road, light-duty vehicles.

Reduction Strategies [Tracking Metrics]

T5.1—Enhance pedestrian infrastructure in areas of development that support active transportation by expanding sidewalks and protected multi-use trails. [miles of sidewalks; miles of multi-use trails]

T5.2—Improve the connectivity of the bicycle network by expanding bicycle facilities and infrastructure. [miles of bike lanes and bikeways]

T5.3—Support the integration of micro-mobility and first-mile/last-mile travel options, such as e-bikes and scooters, through subsidies and community awareness. [e-bikes and scooters in operation]

Co-Benefits

Measure T6: Expand the Transit Network and Increase Ridership

Annual GHG Emissions Reductions

By 2030: 149,866
By 2045: 271,119

(units = $MTCO_2e$)

Performance Goals

Increase transit ridership by:

- 10 percent by 2030
- 20 percent by 2045

Description

Expand transit services, infrastructure, and accessibility to reach the majority of residents and workers.

Measure T6 addresses GHG emissions from on-road, light-duty vehicles.

Reduction Strategies [Tracking Metrics]

T6.1—Expand transit coverage by incorporating new ZEV buses and increasing the service and frequency of bus and rail systems. [ZEVs in transit fleet; transit service hours; transit service miles; miles of transit-only lanes]

T6.2—Provide information, outreach, and incentives to community members to encourage transit use. [ridership]

T6.3—Improve connectivity and transit efficiency through development of bus rapid transit (BRT) systems. [BRT service hours; BRT service miles]

T6.4—Expand rail infrastructure and low- and zero-emissions locomotives to support the decarbonization of passenger rail. [low-emission locomotives; zero-emission locomotives]

Co-Benefits

Measure T7: Optimize Traffic Flow to Reduce Idle Time

Annual GHG Emissions Reductions

By 2030: 16,802
By 2045: 35,589

(units = $MTCO_2e$)

Performance Goals

Reduce GHG emissions associated with idle time on major arterials below 2018 levels by:

- 10 percent by 2030
- 20 percent by 2045

Description

Retrofit and enhance traffic infrastructure to improve traffic flows and reduce idle times.

Measure T7 addresses GHG emissions from all on-road transportation occurring on major arterials.

Reduction Strategies [Tracking Metrics]

T7.1—Implement traffic signal synchronization on arterial roads. [roadway miles with traffic signal synchronization; intersections with traffic signal synchronization]

T7.2—Replace lanes and roadway adjacent infrastructure with high-occupancy vehicle (HOV) / express lanes and active transportation lanes. [miles of HOV / express lanes; miles of active transportation lanes]

Co-Benefits

Energy

Buildings are central in the MSA's approach to reducing GHG emissions associated with energy supply and consumption. This category includes a range of strategies aimed at decarbonizing the energy and materials used in buildings and reducing energy use in buildings. The approach combines increasing energy efficiency, electrifying buildings, replacing fossil fuels with carbon-free and renewable fuel sources, and decarbonizing building materials.

These actions must apply to both new and existing buildings. A foundational first step for existing buildings is to track building energy and water use to raise awareness and highlight opportunities for savings, followed by retrofit programs for efficiency and decarbonization. Green building standards and net zero energy incentives for new developments will significantly reduce GHG emissions. Scaling up energy efficiency programs and developing energy and emissions performance standards for existing and new buildings will reduce overall energy demand and associated GHG emissions, avoiding costly new infrastructure and enabling an easier transition to renewable energy sources and low-/zero-GHG buildings.

Improving the environmental performance of buildings provides multiple co-benefits for occupants. These benefits have not always reached frontline communities. Residents of affordable housing and multifamily housing, in particular, have not been well-served by traditional energy retrofit programs, leading to ongoing cycles of disinvestment, higher energy bills, and less healthy indoor air quality. At the same time, many of these same residents are already extremely rent and utility burdened, and COVID-19 has exacerbated these problems.

The lack of housing and high cost of living in the region mean that increased costs in household expenses could trigger displacement. New and innovative approaches are needed to bring the benefits of healthy, decarbonized, and resilient buildings to all residents while protecting and increasing affordable housing.

Measure E1: Decarbonize Existing Buildings

Annual GHG Emissions Reductions

By 2030: 410,402
By 2045: 8,084,868

(units = $MTCO_2e$)

Performance Goals

Decarbonize existing residential and commercial building stock by:

- 25 percent and 15 percent, respectively, by 2030
- 80 percent and 60 percent, respectively, by 2045

Description

Implement building performance standards and fuel switching to decarbonize existing buildings and reduce the GHG intensity of existing building operations.

Measure E1 addresses GHG emissions from natural gas use in existing residential and commercial buildings.[4]

Reduction Strategies [Tracking Metrics]

E1.1—Adopt Building Performance Standards and reach code requirements in existing buildings. [adoption of reach codes; buildings retrofitted]

E1.2—Replace natural gas equipment and appliances with electric and zero-GHG alternatives. [appliances replaced]

E1.3—Establish financial incentives for private and public building owners to invest in energy-efficient retrofitting. [buildings retrofitted]

E1.4—Decommission and replace outdated refrigeration equipment and properly dispose of high-GWP refrigerants. [equipment retrofitted]

Co-Benefits

Measure E2: Decarbonize New Buildings

Annual GHG Emissions Reductions

By 2030: 31,148
By 2045: 685,354

(units = $MTCO_2e$)

Description

Require new buildings to achieve zero GHG emissions in building operations.

Measure E2 addresses GHG emissions from natural gas use in new residential and commercial buildings.

4 For the purposes of this plan, existing buildings are defined as those constructed in or before 2025. New buildings are defined as those constructed in 2026 or later.

Performance Goals

Decarbonize all-applicable new residential and commercial buildings by:

- 90 percent by 2030
- 100 percent by 2045

Reduction Strategies [Tracking Metrics]

E2.1—Adopt an ordinance requiring all applicable new buildings to be zero-GHG emission. [adoption of reach codes; buildings constructed]

E2.2—Adopt a zero net energy (ZNE) ordinance for all new buildings. [adoption of reach codes; buildings constructed]

Co-Benefits

Measure E3: Decarbonize Industrial Processes

Annual GHG Emissions Reductions

By 2030: 34,244
By 2045: 1,670,994

(units = $MTCO_2e$)

Performance Goals

Decarbonize industrial energy use by:

- 10 percent by 2030
- 80 percent by 2045

Description

Decarbonize and retrofit industrial processes by adopting zero GHG emission technologies, improving energy efficiency, and transitioning to carbon-free and renewable energy sources.

Measure E3 addresses GHG emissions from natural gas use in industrial buildings.

Reduction Strategies [Tracking Metrics]

E3.1—Retrofit industrial processes and equipment with electric- or hybrid-powered equipment. [number of retrofits]

E3.2—Encourage and support on-site installation and use of zero-GHG and renewable energy generation systems. [kW of solar capacity installed]

Co-Benefits

Measure E4: Increase Renewable Electricity Generation and Storage

Annual GHG Emissions Reductions

By 2030: 8,823,413
By 2045: 0

(units = $MTCO_2e$)

Description

Accelerate use of renewable energy by expanding renewable electricity generation, participating in renewable electricity services, and maximizing electricity storage.

Measure E4 addresses GHG emissions from all regional electricity use.

Performance Goals

Increase energy use provided by carbon-free and renewable electricity generation by:

- 75 percent by 2030
- 100 percent by 2045

Reduction Strategies [Tracking Metrics]

E4.1—Install onsite zero-GHG and renewable electricity generation and storage systems throughout the MSA. [kW of solar capacity installed]

E4.2—Establish financial incentives for residents and businesses to install renewable electricity generation and storage equipment. [value of financial incentives awarded; kW of solar capacity installed]

E4.3—Streamline permitting processes for installation of onsite zero-GHG and renewable electricity generation and storage systems. [kW of renewable energy capacity installed]

E4.4—Establish incentives for municipalities to streamline permitting processes for installation of onsite zero-GHG and renewable electricity generation and storage systems. [kW of renewable energy capacity installed]

E4.5—Encourage residents and businesses to participate in renewable offerings through utilities and community choice aggregates (CCA). [CCA participation rate; utility renewable participation rate]

E4.6—Leverage funding for public schools to retrofit buildings with electricity storage and renewable electricity generation. [building retrofits; kW of renewable electricity capacity installed]

Co-Benefits

Measure E5: Improve Grid Efficiency and Resiliency Through Grid Modernization

Annual GHG Emissions Reductions

By 2030: 1,119,736
By 2045: 0

(units = MTCO$_2$e)

Performance Goals

Reduce electricity consumption compared to 2018 levels by:

- 10 percent by 2030
- 20 percent by 2045

Description

Improve energy efficiency and grid resiliency by expanding regional energy storage, developing microgrids, and using other grid modernization technologies, such as peak shaving, demand management, and net energy metering.

Measure E5 addresses GHG emissions from all regional electricity use.

Reduction Strategies [Tracking Metrics]

E5.1—Identify and prioritize solar and microgrid backup power projects at critical facilities. [kW of solar capacity installed; number and capacity of microgrid systems installed; estimated energy savings]

E5.2—Conduct feasibility studies to identify priority areas for building- and community-scale microgrids and alternative technologies such as fuel cells and grid paralleling, to support demand management, peak shaving, and load shifting to increase grid resilience. [priority areas identified; facilities upgraded]

E5.3—Leverage funding for public facilities to address grid modernization and improved resiliency. [facilities upgraded]

Co-Benefits

Measure E6: Improve Energy Efficiency Through Building Upgrades

Annual GHG Emissions Reductions

By 2030: 5,032,672
By 2045: 6,434,191

(units = $MTCO_2e$)

Performance Goals

Reduce energy use compared to 2025 levels by:

- 20 percent for residential buildings, 15 percent for industrial buildings, and 25 percent for commercial buildings by 2030
- 50 percent for residential, industrial, and commercial buildings by 2045

Description

Retrofit existing building stock to improve energy efficiency.

Measure E6 addresses GHG emissions from electricity and natural gas use in new residential, commercial, and industrial buildings.

Reduction Strategies [Tracking Metrics]

E6.1—Incentivize retrofits for energy-efficient appliances and building envelope improvements. [buildings retrofitted; estimated energy savings]

E6.2—Incentivize installation of smart meters. [smart meters installed]

E6.3—Establish financial incentives for private and public building owners to invest in energy-efficient retrofitting. [buildings retrofitted]

Co-Benefits

Measure E7: Improve Energy Efficiency Through Urban Greening

Annual GHG Emissions Reductions

By 2030: 5,240
By 2045: 10,480

(units = $MTCO_2e$)

Description

Reduce energy consumption in urban environments through the strategic planting of shade trees and vegetation and the use of cooling surfaces.

Measure E7 addresses GHG emissions from all regional electricity use and natural gas use.

Performance Goals

Reduce energy consumption by planting:

- 200,000 new shade trees by 2030
- 400,000 new shade trees by 2045

Reduction Strategies [Tracking Metrics]

E7.1—Expand shade tree planting on private, City, School District, and County property and in the public right-of-way. [trees planted]

E7.2—Create and implement equitable Urban Forest Management Plans that prioritize: (1) tree- and parks-poor communities; (2) climate- and watershed-appropriate and drought/pest-resistant vegetation; (3) appropriate watering, maintenance, and disposal practices; (4) provision of shade; and (5) biodiversity. [trees planted; drought-tolerant vegetation planted]

E7.3—Promote cool roofs and pavement, green roofs, vertical gardens, reflective materials, and other materials that help reduce the urban heat island effect. [area of cool materials installed; buildings with cool roofs; buildings with vertical gardens]

Co-Benefits

Measure E8: Reduce Fugitive Emission and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations

Annual GHG Emissions Reductions

By 2030: 1,716,633
By 2045: 1,667,653

(units = $MTCO_2e$)

Performance Goals

Reduce gas and oil operations by:

- 40 percent by 2030
- 80 percent by 2045

Description

Develop strategies and policies to decommission oil and gas operations and increase carbon removal.

Successful implementation of this measure must address multiple complex issues including safely managing the environmental risk of subsidence, reserving funds for the municipal and state underfunded abandonment liability, transitioning and training workforce to the clean energy sector, and filling in revenue gaps which impact critical equity, youth, public health and safety programs and local infrastructure projects. Sunsetting oil and gas operation and moving to a zero emissions future is of utmost importance for the MSA and its overburdened communities, and this measure is best accompanied by a meticulous approach and intentional solutions to address these issues.

Measure E8 addresses GHG emissions from industrial electricity and natural gas use.

Reduction Strategies [Tracking Metrics]

E8.1—Develop sunset strategies for all oil and gas operations that prioritize disproportionately affected communities. [oil wells decommissioned; gas operations ended]

E8.2—Develop a policy that requires the examination of all active, idle, and abandoned oil wells for fugitive emissions of GHG. [number of oil wells examined; amount of GHGs emitted (estimated or measured)]

E8.3—Develop a carbon removal strategy that considers direct air capture (DAC) and carbon capture and sequestration (CCS). [capacity of DAC systems installed; capacity of CCS systems installed]

E8.4—Create training opportunities to help the fossil fuel workforce transition to clean energy jobs. [clean energy jobs created]

Co-Benefits

Solid Waste

The MSA aims to reduce GHG emissions from waste in a manner that prioritizes overall environmental benefit. This starts with expanded efforts to reduce and reuse waste at the source. Incentives and educational programs will be used to increase awareness and bolster participation in recycling programs. Organic waste, which is responsible for the vast majority of GHG emissions in the waste sector,[5] will be addressed through source reduction, donation of edible food, and composting. Organic waste will also be addressed through waste conversion technologies such as anaerobic digestion and biomass conversion, which produce biogas that can be used to produce heat and electricity, pipeline gas, and other beneficial products such as compost and fertilizer. At wastewater treatment plants, biogas will be captured and converted into electricity.

A circular economy focused on material recovery and reuse not only reduces waste and conserves resources, but also offers significant benefits by lowering GHG emissions from waste management. This will be addressed by educational programs on sorting practices, ensuring materials reach their proper recycling streams and mandatory construction and demolition (C&D) diversion mandates to significantly increase the reuse and recycling of materials like concrete and steel. Recovery and reuse of materials will also be addressed through waste diversion such as increasing frequency of recycling pickups and a textile recovery program, which can provide a closed-loop solutions for unwanted clothing and diverting textiles from landfills for conversion into new products.

5 Note that emissions associated with the movement of solid waste are captured under the transportation sector, and solid waste collection vehicles are included in Measure T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs.

Measure SW1: Increase Organics Diversion

Annual GHG Emissions Reductions

By 2030: 2,103,890
By 2045: 2,536,847

(units = $MTCO_2e$)

Performance Goals

Divert organic waste from landfills generated by residential, industrial, and commercial sources by:

- 85 percent by 2030
- 95 percent by 2045

Recover edible food that would have otherwise been sent to landfill by:

- 50 percent by 2030
- 75 percent by 2045

Description

Increase diversion of organic waste from landfills that is generated from residential, industrial, and commercial sources.

Measure SW1 addresses GHG emissions from organic waste sent to landfills.

Reduction Strategies [Tracking Metrics]

SW1.1—Add new or expand existing regional composting facilities. [composting facilities constructed; organics processing capacity]

SW1.2—Increase availability of public organics bins. [organic bins in use]

SW1.3—Increase frequency of organic waste pickups. [organic waste pickups; quantify of organic waste collected]

SW1.4—Implement food recovery programs. [tons of food recovered]

SW1.5—Implement composting programs. [tons of organics composted]

SW1.6—Divert tree trimming debris to local mulch recycling programs. [tons of material diverted]

Co-Benefits

Measure SW2: Recover and Reuse Materials

Annual GHG Emissions Reductions

By 2030: Not Quantified
By 2045: Not Quantified

(units = $MTCO_2e$)

Performance Goals

Increase diversion of recoverable, reusable, and recyclable materials from landfill by:

- 80 percent by 2030
- 95 percent by 2045

Description

Reduce waste generation, conserve resources, and promote circular economy practices by expanding the recovery, recycling, and reuse of materials.

Measure SW2 addresses lifecycle GHG emissions, which are not captured in the scope of the PCAP's GHG emissions inventory. Therefore, this measure was not quantified.

Reduction Strategies [Tracking Metrics]

SW2.1—Educate the public on proper disposal sorting. [waste generation rates; waste disposal rates]

SW2.2—Establish construction and demolition (C&D) diversion requirements beyond state requirements. [C&D waste disposal rates]

SW2.3—Increase frequency of recycling pickups and/or increase cost of waste bins. [recycling pickups; quantify recycling material collected]

SW2.4—Implement a textile recovery program. [textiles recovered]

SW2.5—Replace single use items with multi-use recyclable materials. [recycling rate; diversion rate]

SW2.6—Invest in local reuse and repurposing companies. [waste disposal rate; diversion rate]

Co-Benefits

Measure SW3: Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential

Annual GHG Emissions Reductions

By 2030: 244,169
By 2045: 0

(units = $MTCO_2e$)

Performance Goals

Install waste-to-energy generation capacity by:

- 200 MW by 2030
- 400 MW by 2045

Description

Expand waste management practices and implement waste-to-energy and energy conversion technologies.

Measure SW3 addresses GHG emissions from organic waste sent to landfills.

Reduction Strategies [Tracking Metrics]

SW3.1—Increase landfill gas capture and build waste-to-energy systems in local solid waste and landfill facilities. [quantity of landfill gas captured; capacity of WTE facilities constructed; energy generated at WTE facilities]

SW3.2—Explore the feasibility of regional anaerobic digestion and conversion technology facilities. [anaerobic digestion facilities; biogas generated; digestate generated]

Co-Benefits

4.4 Review of Authority to Implement

The PCAP is designed to advance regional climate action planning by identifying key GHG reduction measures across the primary sectors of transportation, energy, and solid waste. The PCAP leverages the existing statutory and regulatory authority of local and regional governmental entities and organizations in the MSA. The PCAP underscores a collaborative effort across local and regional entities, and a network of supporting organizations, to promote a comprehensive approach to climate action.

This section summarizes the statutory and/or regulatory authority of jurisdictions in the MSA, which allows them to implement the measures identified in this PCAP. In certain cases, statutory and/or regulatory authority may not be required to implement priority measures (e.g., community engagement, education programs, etc.).

Jurisdictions geographically captured under this PCAP – and who have statutory and/or regulatory authority needed to implement PCAP measures – include, but are not limited to, the County of Los Angeles, the County of Orange, the cities of Los Angeles and Long Beach, the Los Angeles County Metropolitan Transportation Authority (Metro), the Orange County Transportation Authority (OCTA), the Port of Long Beach, the Port of Los Angeles, SCAG, and the South Coast AQMD. These entities may work in concert with other local or regional organizations to implement PCAP GHG measures, drawing upon their existing legal and regulatory frameworks.

With this expansive body of combined local and regional government jurisdictions which is authorized by local ordinance and state and federal regulations and laws, it would be unlikely to encounter obstacles in exercising authority needed to implement any GHG reduction measure included in this PCAP. It also would be infeasible both timewise and fiscally to detail all pathways to “gain authority” for the diverse governmental entities in the MSA. There are 122 cities and 140 unincorporated areas spanning two counties and overlaid by regional agencies such as the metropolitan planning organization and air quality management district.

County of Los Angeles

Established in 1850, Los Angeles County is one of California’s original 27 counties and one of the nation’s largest, with 4,084 square miles and nearly 10 million residents who account for approximately 27 percent of California’s population – the largest population of any County in the nation. The county consists of 88 incorporated cities and approximately 140 unincorporated areas.

Los Angeles County, under its foundational charter, has a five-member elected Los Angeles County Board of Supervisors (Board) that acts as the county legislature. As a subdivision of the state, the County is charged with providing numerous services that affect the lives of all residents, including law enforcement, tax collection, public health protection, public social services, elections, and flood control.

Additionally, the County comprises 38 departments and 13 County-related agencies. The Board directs County departments and offices to pursue and implement policies that will promote sustainability, benefit the environment, and improve public health. Examples of these efforts include the establishment of a “Clean Fuel – Sustainable Fleet” policy, a motion to limit the use of single use plastics in the county’s unincorporated areas to reduce waste, and a measure that changes the default energy offering in unincorporated homes throughout the county to be 100 percent renewable.

Los Angeles County is governed by various sections of the California Government Code, including but not limited to Title 3 (Counties) and Title 5 (Local Agencies), as well as the Charter of the County of Los Angeles County and the Los Angeles County Code of Ordinances (Cal. Gov't Code; LA County, 2024).

County of Orange

Established in 1889, the County of Orange is the third-most-populous county in California and the sixth-most-populous in the United States, with 793 square miles and home to a population of over 3 million residents. Through its 22 departments (and respective divisions) the County of Orange functions as a regional service provider and planning agency whose core businesses include public safety, public health, environmental protection, regional planning, public assistance, social services and aviation.

The County of Orange derives its authority from the California Government Code, primarily within Title 3, Divisions 1-5. Key articles within this framework, such as those found in Article 1 and Article 2, define the creation of counties, establish them as legal subdivisions, and enumerate their powers as a body corporate and politic. These legal provisions form the basis for counties in California to organize themselves, plan, and implement various programs, encompassing areas like public safety, public health, environmental protection, regional planning, public assistance, social services, and aviation.

Orange County is governed by the California Government Code, including but not limited to Title 3, which includes the following articles that are relevant to county organization and powers: Article 1, § 23000-23001 and Article 2, § 23002-23004 (Cal. Gov't Code).

General Law and Charter Cities

Article XI, § 3 of the Constitution of California provides for the creation of city governments. There are two types of cities within the Los Angeles-Long Beach-Anaheim Metropolitan Statistical Area: general law and charter. Cities have a wide range of planning and implementation authority and a wide range of activities relevant to climate action. These include key activities such as creating and implementing general plans and climate action plans among others, to passing ordinances, to providing services, to building, operating, and maintaining infrastructure, to providing incentives, to levying fees and taxes.

General law and charter cities are governed by the California Government Code, particularly Title 4, Divisions 1-5 (Cal. Gov't Code).

Los Angeles County Metropolitan Transportation Authority

Metro was formed in 1993 by the California State Legislature to oversee funding and coordination of all public transportation services within Los Angeles County. It merged two rival agencies: the Southern California Rapid Transit District (SCRTD or more often, RTD) and the Los Angeles County Transportation Commission (LACTC). Metro has assumed the functions of both agencies and now develops and oversees transportation plans, policies, funding programs, and both short-term and long-range solutions to mobility, accessibility, and environmental needs in the County of Los Angeles. Metro is also the primary transit provider for the City of Los Angeles, providing the bulk of such services. Metro has a total of 89 member agencies, which include the County of

Los Angeles and 88 incorporated cities. More than 10 million people –more than 25 percent of California's residents – live, work, and play within its 1,433-square-mile service area.

Metro serves as the County Transportation Commission and has the following responsibilities: 1) Operates Transit, 2) Service Authority for Freeway Emergencies, and 3) Sales Tax Authority. Metro's primary funding sources include locally raised transportation tax funds, state funding for transportation, and federal funding for transportation. Metro serves as transportation planner and coordinator, designer, builder, and operator for one of the country's largest, most populous counties.

Metro is the single largest transit agency within the County of Los Angeles and operates the third-largest public transportation system in the United States by ridership, with 2,000 peak hour buses on the street any given business day. Metro also operates 109 miles (175 kilometers) of urban rail service. The authority has 11,600 employees, making it one of the region's largest employers. Metro directly operates a large transit system that includes bus, light rail, heavy rail (subway), and bus rapid transit services. Metro also provides funding for transit it does not operate, including Metrolink commuter rail, municipal bus operators and paratransit services. Additionally, Metro provides funding and directs planning for railroad and highway projects within Los Angeles county.

Metro recommends projects that will be federally funded under the RTP/SCS. The RTP/SCS identifies strategies to meet mobility of all modes, legislative, financial, and air quality requirements in the six-county area of SCAG. Metro identifies long range transportation improvement projects beyond those already programmed in the six-year federal funding plan. Metro coordinates the input provided to SCAG with local agencies to ensure consistency with city and county transportation plans and projects.

Metro also serves as the tax authority and implementation agency for voter-approved sales tax measures, currently a total of four. Additionally, Metro programs projects for State Transportation Improvement Program (STIP) funds, including special funds created by the state for programs like bicycle and pedestrian facilities and specialized transit for seniors and persons with disabilities; develops evaluation criteria based on federal or state guidance and selects or recommends the most competitive projects based on this criteria; and distributes funds to public transit operators for planning, program administration, bicycle and pedestrian facilities projects, public bus transit, and rail transit.

Metro draws its authority from state legislation, particularly the Metropolitan Transportation Authority Act (Public Utilities Code, Division 12, Part 5, Chapter 8) (Cal. PUC).

Orange County Transportation Authority

OCTA was formed in 1991 through the consolidation of various transportation agencies in Orange County, to promote collaborative multimodal transportation planning of highways, roads, transit, and rail services, and to unify decision making. As such, OCTA is responsible for funding and implementing transit and capital projects that support a balanced and sustainable transportation system for Orange county's nearly 3.2 million residents that live within the 34 cities and unincorporated County of Orange. OCTA also administers local transportation sales tax measures, such as Measure M, in 1990, that funded the successful delivery of a package of transportation improvements promised to Orange county voters. Renewed by the voters in 2006, Measure M2 (M2) provides funding for freeway, roadway, and transit improvements through 2041.

OCTA is Orange county's primary provider of public transportation and includes operations for bus service, light-rail, microtransit, freeway express lanes, and ridesharing support, among others. Fixed-route bus service includes local fixed-route, community fixed-route, and Stationlink (rail feeder). OCTA also operates the iShuttle service on behalf of the City of Irvine, OC ACCESS paratransit service, Same Day Taxi (SDT) program, and programs providing service to seniors and people with disabilities. OCTA also operates OC Flex, an on-demand, app-based microtransit service. As part of its plan to convert to a zero-emission fleet by 2040, OCTA has built a hydrogen fuel facility, added 10 hydrogen buses and 10 battery-electric buses. OCTA is also currently implementing the OC Streetcar, a light-rail line that broke ground in late 2018.

OCTA is responsible for representing Orange County within SCAG's metropolitan transportation planning process. OCTA also oversees planning studies to focus on transportation solutions that respond to changes in population, employment, and housing, proposes innovative strategies to enhance the transportation system, and develops integrated long-range investment plans in keeping with federal planning best practices. In addition, OCTA is tasked with prioritizing the use of state and federal funds to support long-range and short-range regional plans.

OCTA is a member of a Joint Powers Authority (JPA) that oversees implementation and operation of the Metrolink System in the SCAG region. OCTA funds and oversees OCTA's investments in the three Metrolink lines serving Orange county – the Orange County (OC) Line, the Inland Empire-Orange County (IEOC) Line, and the 91/Perris Valley Line (Perris/Riverside – Fullerton - Los Angeles) Line. One of the centerpieces of M2 is the expansion of Metrolink service which includes added trains, track capacity, station improvements, and connecting transit services.

OCTA opened the 405 Express Lanes in late 2023, consisting of a four-lane facility along 16 miles of the I-405 freeway median. OCTA also owns and operates the 91 Express Lanes which is a four-lane facility located in the median of SR-91 that stretches for 10 miles within Orange county and was extended by the Riverside County Transportation Commission another eight miles into Riverside county. OCTA's Express Lanes help to reduce harmful emissions by managing congestion and incentivizing ridesharing. To further support ridesharing, OCTA provides transportation options to commuters as alternatives to driving alone. Services include carpool matching, vanpooling, and employer assistance to meet air-quality mandates.

OCTA administers a variety of funding programs for local jurisdictions to implement roadway projects that improve intersections, coordinate signals, build over or under crossings where streets intersect rail lines, and prevent roadway pollution from impacting waterways. OCTA also coordinates with local jurisdictions on active transportation programs that provide residents and commuters in Orange county with options to reach their destinations by walking or bicycling.

OCTA is governed by state legislation, including the Orange County Transportation Authority Act (Cal. PUC).

Port of Long Beach

The Port of Long Beach (POLB) was founded in 1911, following the state's granting of the sovereign tide and submerged lands in trust to the City of Long Beach for port operations. A portion of the City of Long Beach's grant includes the Long Beach Harbor District. The City of Long Beach, acting by and through the Board of Harbor Commissioners, is trustee of the sovereign tide and submerged lands located within the Long Beach Harbor District. The POLB is managed through an independent city department, the Long Beach Harbor Department, and is governed by a five-member Board of Harbor Commissioners. The Harbor Commissioners are appointed by the Mayor and confirmed by the Long Beach City Council.

The POLB serves as a premier gateway for trans-Pacific trade, with goods movement crossing every congressional district in the United States. POLB comprises over 3,500 acres of land, 4,600 acres of water, 10 piers, and 80 berths, and supports over 575,000 jobs in Southern California. It includes 22 shipping terminals, including container, break bulk, dry bulk, and liquid bulk. The POLB leases its facilities to private companies, including shipping lines and cargo-handling firms, to support maintenance and infrastructure improvements.

The POLB is governed by Article XII of the Long Beach City Charter, particularly Sections 1200, 1201, 1202, and 1203, which detail the establishment, commission, power and duties, and other powers of the Harbor Department, including those to promote and develop the POLB (City of Long Beach, 2023).

Port of Los Angeles

The Port of Los Angeles (POLA) was founded in 1907 with the creation of the City of Los Angeles' Harbor Department's Board of Harbor Commissioners (BOHC), which is authorized to control the operation, maintenance, and management of the POLA in accordance with the state tidelands grants and Los Angeles City Charter. This includes POLA activities to promote and accommodate maritime commerce, navigation and fishery, water-dependent recreation and visitor-serving facilities.

POLA provides a major trade gateway for international goods and services, and includes 23 major cargo terminals, including dry and liquid bulk, container, breakbulk, and automobile facilities. In addition to cargo business operations, the POLA is home to cruise and ferry passenger facilities, commercial fishing vessels, shipyards, boat repair facilities, and recreational, community, and educational facilities. POLA leases properties to more than 300 tenants, including private terminal operators, who may develop the terminal facilities and participate in implementing POLA projects, programs, and services.

The POLA was established by state grants in the Tidelands Trust Act of 1911 as amended. It is governed by state statutes in California Public Resources Code Section 6306–Granted Public

Trust Lands, various sections of the California Harbors and Navigation Code, including Division 8, and the Los Angeles City Charter (Cal. PRC; Cal. HNC; City of LA, 2024).

Southern California Association of Governments

Founded in 1965, SCAG is a JPA under California state law, established as an association of local governments and agencies that voluntarily convene as a forum to address regional issues. Under federal law, SCAG is designated as a Metropolitan Planning Organization (MPO) and under state law as a Regional Transportation Planning Agency and a Council of Governments.

The SCAG region encompasses six counties (Los Angeles, Orange, Imperial, Riverside, San Bernardino, and Ventura) and 191 cities in an area covering more than 38,000 square miles. The agency develops long-range regional transportation plans including sustainable communities strategy and growth forecast components, regional transportation improvement programs, regional housing needs allocations, and a portion of the South Coast AQMD's AQMPs. In 1992, SCAG expanded its governing body, the Executive Committee, to a 70-member Regional Council to help accommodate new responsibilities mandated by the federal and state governments, as well as to provide more broad-based representation of Southern California's cities and counties. With its expanded membership structure, SCAG created regional districts to provide for more diverse representation. The districts were formed with the intent to serve equal populations and communities of interest. Currently, the Regional Council consists of 86 members.

In addition to the six counties and 191 cities that make up SCAG's region, there are six County Transportation Commissions that hold the primary responsibility for programming and implementing transportation projects, programs and services in their respective counties. Additionally, SCAG Bylaws provide for representation of Native American tribes and Air Districts in the region on the Regional Council and Policy Committees.

SCAG is responsible for key regional planning processes such as the Regional Transportation Plan and Sustainable Communities Strategy, leads a range of planning initiatives focused on sectors such as transit and goods movement, and provides grants and incentives to support local planning and infrastructure projects.

SCAG is governed by the California Government Code, particularly Title 5, Division 1, Chapter 6, Section 6500 et seq. (Cal. Gov't Code).

South Coast Air Quality Management District

The South Coast AQMD is the regulatory agency responsible for improving air quality for large areas of Los Angeles, Orange, Riverside and San Bernardino counties, including the Coachella Valley. The region is home to more than 17 million people, including nearly two-thirds of the state's overburdened environmental justice communities. This region has some of the worst air quality in the nation and is in extreme non-attainment for ozone and severe non-attainment for $PM_{2.5}$.

South Coast AQMD operates within a regulatory framework established by state and federal mandates aimed at addressing air quality concerns. The primary federal mandates that guide the South Coast AQMD's actions include the CAA and associated amendments. These mandates empower the district to regulate and enforce air quality standards, reduce emissions, and protect public health and the environment.

The CAA requires South Coast AQMD to develop AQMPs which are the essential blueprints to meet the NAAQS. The 2022 AQMP includes new regulations and the development of incentive programs to support early deployment of advanced clean technologies.

In the South Coast Air Basin, mobile sources – heavy-duty trucks, ships, airplanes, locomotives, and off-road equipment – account for 80 percent of NO_x emissions. Stationary sources – such as power plants, refineries, and factories – are responsible for the remaining 20 percent. The majority of South Coast AQMD’s regulatory authority is for stationary sources with authority for fleets and indirect source measures to control mobile sources. The 2022 AQMP requires wide-spread adoption of zero-emission technologies across all mobile and stationary sources.

State law, SB 2297 (Rosenthal) Chapter 1546, established South Coast AQMD’s Clean Fuels Program. The Clean Fuels Program supports the development and demonstration of clean technologies across the mobile source sectors to reduce air pollution and protect public health, especially in disproportionately impacted, low-income disadvantaged communities. South Coast AQMD also implements incentive programs to spur the transition to the cleanest available technologies, while supporting large-scale commercialization.

South Coast AQMD also has the authority to regulate stationary sources such as, but not limited to, residential, commercial, and large industrial facilities. Building on existing rules and regulations, the 2022 AQMP includes control measures for residential combustion sources to reduce emissions from residential water and space heating, cooking devices, and other combustion sources. Similar control measures are proposed to reduce emissions from commercial buildings as well as small combustion engines and other equipment. Additionally, South Coast AQMD has large combustion source measures for industrial facilities and equipment such as boilers and process heaters, refineries, emergency standby engines, turbines, electricity generating facilities, landfills, incinerators, and other permitted equipment. In addition to rules and regulations, South Coast AQMD has incentivized the transition to cleaner stationary source technologies such as residential heat pumps, commercial boilers, and other equipment.

South Coast AQMD is the regional agency responsible for local, state, and federal air quality mandates. South Coast AQMD has both the authority and mandate to reduce air pollution by all means feasible including regulations, rules, and clean technology development, demonstration, and deployment.

South Coast AQMD is governed by the California Health and Safety Code, particularly Division 26, Part 3, Sections 40400 et seq (Cal. HSC).

CHAPTER 5
LIDAC Analysis

5.1 Vulnerability Assessment

Low-income and disadvantaged communities (LIDACs) face a higher risk of bearing unequal impacts from climate change hazards. Specific impacts include air pollution, wildfires, extreme heat, drought conditions, and other factors that can worsen existing inequities and hinder the ability of LIDACs to prepare for and respond to climate change. Studies on climate change impacts have revealed that communities and census tracts with large concentrations of people of color, encompassing Black, Latinx, Native American, Asian, and Pacific Islander populations, bear a disproportionate burden of exposure to climate risks. This exacerbates their vulnerability and leads to worsened community health and socioeconomic outcomes. Identifying the region's specific vulnerabilities can reduce the future impact on these LIDACs (Berberian et al., 2022). This section evaluates the heightened vulnerability of LIDACs to these impacts, and draws insights from a thorough literature review, existing regional plans addressing climate change and GHG emissions, as well as data from national and state-specific resources. These include CEQ's CEJST, EPA's Environmental Justice Screening and Mapping Tool (EJScreen), and the California Environmental Protection Agency's (CalEPA) Priority Population Investments tool, which are described in greater detail in *Section 5.2 LIDAC Identification*.

Air Pollution

The Los Angeles-Long Beach-Anaheim MSA is in the South Coast Air Basin, which has some of the worst air quality in the nation. The South Coast Air Basin does not meet multiple National Ambient Air Quality Standards. Under the Clean Air Act, the region is classified as extreme nonattainment for ozone and serious for $PM_{2.5}$ (South Coast AQMD, 2022). Combustion of fossil fuels is a source of both GHG emissions and air pollution as well as HAPs. Additionally, CO_2 and methane emissions from waste facilities contribute to climate change and poor air quality for nearby communities. Addressing GHG emissions from the transportation, energy, and waste sectors will provide co-benefits to reduce NO_x and the formation of ozone, air toxics from combustion of diesel, and methane from landfills and waste-related facilities. Primary pollutants within the region include ground-level ozone, $PM_{2.5}$, and diesel particulate matter (DPM). Regional wildfires are expected to increase in frequency and severity in the coming decades and cause worsening air pollution throughout the region due to far-ranging smoke impacts (CNRA, 2018). The likelihood of escalating air pollution is contingent on various factors, including local and regional emission rates, temperature, wind patterns, and the occurrence of wildfires.

Air Pollutants

Ozone

Rising global temperatures are a direct consequence of climate change. These elevated temperatures can have several adverse effects, including the exacerbation of ground-level ozone formation and the intensification of the 'heat island' effect in urban areas. The Los Angeles area has the highest levels of ozone in the nation (South Coast AQMD, 2022). Ground-level ozone is formed when pollutants undergo chemical reactions in sunlight. The urban heat island effectively traps pollutants and escalates the occurrence of smog comprised mainly of ozone (Hall et al., 2018). The main contributors to ozone pollution include trucks, cars, planes, trains, industrial facilities, agricultural operations, construction sites, and dry cleaning (OEHHA, 2021). Ozone levels tend to peak in the afternoon and on hot days. Exposure to ozone, even at low levels, can lead to lung irritation, inflammation, and the worsening of chronic illnesses. Certain groups, such as children, older adults, outdoor workers, and individuals who spend extended periods outdoors, are particularly vulnerable to the adverse effects of ozone (OEHHA, 2021).

Fine Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ consists of tiny airborne particles, each 2.5 micrometers or less in diameter, which is smaller than the width of a human hair. $PM_{2.5}$ tends to be a complex mixture of particles, including organic chemicals, dust, soot, and metals. These particles can originate from various sources, such as vehicles, factories, wood burning, and other human activities. Due to their small size, such particles can penetrate deep into the lungs, leading to a range of health issues, particularly heart and lung diseases. Individuals most susceptible to the adverse effects of $PM_{2.5}$ exposure include children, older adults, and those with pre-existing heart or lung conditions, asthma, or pre-existing conditions (OEHHA, 2021).

$PM_{2.5}$ is a significant indicator of burden within Los Angeles and Orange counties; approximately 33 percent of census tracts in Los Angeles county and 13 percent of census tracts in Orange county have a percentile greater than or equal to 90 for $PM_{2.5}$ exposure and are low income (CEQ, 2023).

Diesel Particulate Matter

The exhaust emissions from various sources, such as trucks, buses, trains, ships, and other equipment powered by diesel engines, comprise a mixture of gases and solid particles. These solid particles are commonly referred to as diesel particulate matter (DPM), and they encompass a wide array of different chemicals, many of which can contribute to negative health outcomes. The highest concentrations of DPM are typically found near ports, rail yards, and highways. The particles in DPM can travel deep into the lungs and cause health problems including eye, throat, and nose irritation, heart and lung disease, and lung cancer. Among affected populations, children and older adults are particularly sensitive to the adverse effects of DPM exposure (OEHHA, 2021).

Approximately 16 percent of census tracts in Los Angeles county have a percentile greater than or equal to 90 for DPM and are low income (CEQ, 2023). Within Orange county, there are zero census tracts (0 percent) that are greater than or equal to the 90^{th} percentile (CEQ, 2023).

Vulnerabilities

Climate change, including extreme heat, drought, and wildfire, combined with local polluting sources, can further affect air quality in the South Coast Air Basin, making it harder to attain clean air standards which intensifies the risks for vulnerable groups such as older adults, children, and those with preexisting conditions. These climate and air pollution risks also disproportionately impact our low-income and disadvantaged communities throughout the region. The pollutants described above contribute to respiratory issues like asthma, pulmonary disease, pneumonia, and bronchitis, while also impacting cardiovascular health with links to heart disease, heart failure, and cardiac arrest.

Extreme Heat

Globally, the ten warmest years on record have all occurred since 2010, indicating a rapid increase in global temperatures (NOAA, 2022). This trend is attributed to record levels of heat-trapping emissions in the atmosphere (Lindsey and Dahlman, 2023). Climate change will continue to increase average and maximum temperatures and create a new “normal” for all communities, bringing more intense and frequent extreme heat days and nights that last for longer periods of time. The urban heat island effect, illustrated in **Figure 5-1**, exacerbates these conditions. The urban heat island effect is influenced by land uses, where more developed areas with buildings, paved roads, and other low albedo and impermeable surfaces absorb and re-emit the sun’s heat with greater intensity, resulting in higher daytime and nighttime temperatures. Built-out communities in metropolitan areas can experience daytime temperatures that are up to 20°F hotter than outlying areas that are less developed and/or have greater vegetation and forestry (Climate Central, 2021). Relatedly, the urban heat island effect typically results in higher nighttime temperatures as well, depriving communities of needed periods of relief from extreme heat and supporting accelerated daytime heating.

Increasing temperatures and greater intensity, frequency, and duration of extreme heat events are likely to impact public health, energy consumption and costs, air pollution, water resources, vegetation and wildlife, and critical infrastructure such as roads and rail lines. Regarding public health, higher temperatures can cause heat-related illnesses, such as heat exhaustion and heat stroke, which can worsen existing health conditions including cardiovascular and respiratory illnesses. In severe cases, such as heat stroke, heat events can impact mental health and lead to missed school and workdays, cause stress, aggression, fatigue, confusion, coma, and even death. Among children, extreme heat temperatures inhibit learning outcomes and can reduce student achievement (Park et al., 2020). In the United States, extreme heat is the cause of more deaths per year on average than other weather-related hazards combined (Bedsworth, 2018). From 2004 to 2018, there were over 10,000 heat-related deaths recorded in the nation (USEPA, 2022). In California, a 2006 prolonged heat wave contributed to over 600 deaths and resulted in 1,200 hospitalizations and 16,000 emergency department visits (CNAP, 2015). As previously noted, extreme heat can also increase the amount of ozone pollution and particulate pollution threatening decades of hard-won air quality gains in the region. Additionally, extreme heat is a major contributor to the frequency, intensity, and duration of wildfires that compound and multiply air pollution and its public health impacts.

Source: Climate Central, 2021.

Figure 5-1.
Urban Heat Island Effect

Vulnerabilities

Exacerbated by rising global temperatures and the urban heat island effect, extreme heat increases the risk of illnesses and mortality for vulnerable populations in Los Angeles and Orange counties. These groups include individuals without health insurance, children, those with disabilities, linguistically isolated individuals, people experiencing unsheltered homelessness, individuals with pre-existing conditions, older adults, those with reduced mobility, outdoor workers, and low-income households, including those dependent on agricultural income.

Furthermore, communities with fewer trees and limited access to green space face an elevated risk of extreme heat hazards, especially for those who regularly commute (walking, biking, transit), work outdoors, or have preexisting health conditions. Lack of green space and prevalence of impervious surfaces is a significant burden for communities in Los Angeles and Orange counties. For LIDACs in particular, approximately 21 percent of census tracts in Los Angeles county and 6 percent of census tracts in Orange county have impervious surfaces (lack of green space) equal to or exceeding the 90^{th} percentile of land area coverage (CEQ, 2023).

The energy sector is also involved, as extreme heat affects consumption, production, cost, and health. Increased energy demand during extreme heat events can strain the electrical grid, leading to power outages that disproportionately affect vulnerable individuals, leaving them without functioning critical resources such as medical devices, air conditioning, and refrigeration. Additionally, data from the Department of Energy shows that average energy costs for low-income households are three times higher than households that are not low income (CEQ, 2022). Low-income households are more likely to lack access to air conditioning and, if they do have access, are less able to pay for it during extreme heat events due to higher energy costs. Some public facilities, such as schools, are more likely to lack air conditioning, especially those located in low-income and disadvantaged communities.

As noted above, infrastructure is also vulnerable to the impacts of extreme heat. This includes critical transportation facilities such as rail lines and roads that can buckle, break, or degrade under extreme heat conditions and affect the ability to move people and goods safely and efficiently.

Flooding

While precipitation levels in the coming decades are expected to decrease overall in Southern California, the Los Angeles and Orange counties are expected to experience a rise in both the frequency and severity of atmospheric river events. Projections for the late 21st century suggest a potential surge of 25-30 percent in total rainfall on the wettest day of the year (CNRA 2018). This increase in the frequency, intensity, and duration of extreme precipitation events, will lead to heightened urban and riverine flooding in inland and coastal areas. Stormwater flooding will be further exacerbated by rising sea levels, resulting in a permanent shift in ocean water levels that narrows beaches, intensifies beach erosion, and increases the occurrence of coastal flooding.

The Los Angeles-Long-Beach-Anaheim MSA has historically been a floodplain and legacy stormwater infrastructure is increasingly unable to handle more frequent and intense precipitation events. Risk from increased storm intensity and precipitation coupled with sea level rise in Los Angeles and Orange County may lead to effects on the transportation infrastructure, with street, road, and low-lying area flooding, and impacts to the stormwater drainage system. This, in turn, can affect vital roadways and evacuation routes, hindering emergency response times and creating hazardous driving conditions. There is also potential for long-term disruptions, such as to the local and regional economy, delays in goods movement, and decreased job and school attendance. Rail facilities and infrastructure are also vulnerable to flooding and extreme weather. Temporary or longer-term rail closures due to extreme weather disruptions, such as the coastal rail corridor in southern Orange county that carries both passenger and goods, have cascading negative impacts on the regional economy, mobility, and ability to reduce GHG emissions. In general, frequent and severe flooding can result in property damage, population displacement, injuries and deaths, and economic impacts.

Moreover, prolonged flooding may lead to increased mold, contributing to respiratory health issues. The anticipated rise in vector-borne diseases, facilitated by stagnant water, poses an additional concern, particularly for diseases like West Nile virus. Furthermore, extreme weather events have the potential to disrupt power supplies, impacting essential services for residences and critical infrastructure, such as hospitals and emergency response centers.

Vulnerabilities

Vulnerable populations, including those without a car or access to transit, children, older adults, and low-income communities face heightened challenges during and after floods and extreme precipitation events. During floods that necessitate evacuation, linguistically isolated populations are particularly vulnerable, as these households may encounter obstacles accessing crucial information. Communities within and adjacent to flooding zones will also have an increased exposure to vector-borne diseases. Additionally, individuals experiencing homelessness are vulnerable because of mobility limitations and difficulties related to relocation after flood events. The economic burden of flood-related property damage disproportionately affects low-income communities as these households often lack financial resources essential for repairs after a flood or rain event (VCRMA, 2018) and are frequently located in areas that are most vulnerable to flooding. Moreover, agricultural workers are at risk of displacement and economic loss due to the potential damage to crops and agricultural infrastructure caused by flooding. Populations vulnerable to coastal flooding hazards include individuals or families who live or work in the coastal zone or in areas inundated by sea level rise. Flooding impacts are not limited to coastal areas, however. Many additional communities face inland, riverine, and/or urban flooding due to being located within or adjacent to floodplains, low lying areas, and/or areas with infrastructure that is not designed to handle extreme weather precipitation events.

Drought

Climate change is expected to exacerbate drought conditions, bringing more frequent and longer periods of dry conditions that could impact water supplies and lead to shortages. Prolonged periods of drought can impact water prices, food costs, security, vegetation, and wildlife, and contribute to wildfires and bad air quality. Stress on plant communities and trees can increase susceptibility to pests, diseases, and plant mortality, which creates more suitable conditions for wildfires. In urban areas this stress can also manifest as a loss of trees and green space that can counteract efforts to address the urban heat island effect. Moreover, communities reliant on agriculture may face significant economic challenges as crops are threatened by these adverse conditions. While agricultural lands are relatively limited in Los Angeles and Orange counties, they are directly affected by drought conditions and water conservation measures, and may directly or indirectly affect costs, revenues, and outdoor workers, and are, therefore, an important consideration within this PCAP and other climate plans in the region. During drought periods, agricultural communities face an increased risk of dust storms that will release particulate matter in the air, which can irritate the lungs and worsen respiratory illnesses and symptoms (Bayleyegn & Jeddy, 2019). Additionally, outside the boundaries of the MSA, drought impacts on the Salton Sea and increased exposure of the playa could have far reaching impacts affecting regional air quality.

Vulnerabilities

Vulnerable populations include low-income households who will be disproportionately affected by increases in water prices. Additionally, individuals who are sensitive to air pollution including outdoor workers and those with pre-existing conditions, are indirectly impacted by drought when it contributes to an increase in the frequency and severity of regional wildfires, causing more smoke and bad air quality days. Individuals and families that depend on income from the agricultural sector will be disproportionately affected by impacts to agriculture due to stress on water supply, especially low-income households, immigrant communities, and seasonal workers.

Wildfires

Climate change has been associated with more frequent wildfire occurrences and prolonged fire seasons throughout California. Elevated temperatures, early snowmelt, extended mega-droughts, and irregular precipitation patterns all contribute to this trend (SCAG, 2020). Within the MSA, less than 2 percent of census tracts in both Los Angeles county and Orange county are greater than or equal to the 90^{th} percentile for share of properties at risk of fire in 30 years and are low income (CEQ, 2023). However, regional wildfires significantly impact air quality as large amounts of carbon dioxide, black carbon, brown carbon, and ozone precursors are released into the atmosphere (NOAA, 2018). The smoke from wildfires can travel long distances, impacting individuals far removed from the actual fire site. Mid-century projections indicate a substantial rise in Los Angeles County's frequency, average potency, and duration of smoke waves due to wildfires. Furthermore, wildfires can lead to an increased risk of mudslides and debris flows, creating additional hazards. Therefore, in addition to physical injury and property loss, wildfires can result in several impacts, including respiratory impacts due to poor air quality (SCAG, 2020).

Vulnerabilities

Intensified by rising temperatures and local environmental factors, wildfires pose a heightened risk to vulnerable populations in Southern California. The increasing frequency and severity of these fires disproportionately impacts low-income residents, individuals without health insurance, children, those with disabilities, linguistically isolated individuals, and people experiencing homelessness.

Evacuations during wildfires pose a significant challenge for individuals with limited financial resources, people with unreliable transportation, individuals experiencing homelessness, or those residing in linguistically isolated households. Wildfires also contribute to heightened air pollution, posing increased health risks for vulnerable communities, particularly individuals with pre-existing conditions, older adults, and children. Additionally, prolonged periods of sheltering in place due to wildfire-related smoke may impact mental health. In the aftermath of wildfires there is an increased risk of mudslides and debris flows that can create mobility issues and safety concerns for affected communities. Agricultural workers face heightened economic loss risks resulting from potential crop damage and reduced work opportunities due to wildfire smoke affecting outdoor working conditions. Low-income communities may face additional challenges in recovering from property losses caused by wildfires, including potential limitations in accessing financial resources and support services.

Summary of Vulnerabilities

The compounding impacts of climate change, including elevated levels of air pollutants, extreme heat, flooding and sea level rise, drought, and wildfires, pose significant challenges for vulnerable populations. The convergence of these climate-related hazards creates a complex web of environmental stressors that disproportionately affect communities already facing socio-economic disparities. Air pollution, exacerbated by climate change, contributes to respiratory issues and other health impacts especially for children, older adults, and those with existing conditions. Extreme heat and temperature fluctuations amplify the risk of heat-related illnesses and strain energy demands for cooling. Flooding and sea level rise heighten the threat of displacement and exacerbate challenges for communities with limited resources for adaptation and response. Prolonged drought conditions intensify water scarcity issues, disproportionately affecting low-income households, immigrant communities, and seasonal workers. Wildfires, exacerbated by drier conditions, not only directly threaten communities but also contribute to air quality degradation. Low income and disadvantaged communities in Los Angeles and Orange counties are frequently exposed to multiple stressors, intensifying their vulnerability and straining community resilience.

5.2 LIDAC Identification

LIDACs in Los Angeles and Orange counties have been identified in the analysis below using both national and state-specific tools. This analysis was conducted to provide a greater understanding of the LIDACs present in the region and the indicators that are used to identify LIDACs, as well as support the preliminary assessment of direct and indirect impacts of climate action to LIDACs. The CEJST is used as the primary method for identifying LIDACs; this is supplemented with LIDAC identification through EJScreen and the Priority Population Investments 4.0 map.

This analysis adds to the vulnerability assessment to climate change, presented above, and provides a preliminary analysis of anticipated benefits for LIDACs as a result of implementing the GHG reduction measures in the PCAP.

National: CEQ and EPA

CEQ Climate and Economic Justice Screening Tool

The EPA recommends the use of the CEQ's CEJST to identify LIDACs. The CEJST identifies LIDACs through various datasets using indicators of burden across eight categories, which are summarized in **Table 5-1** below. Available data at the census tract level helps to identify communities as disadvantaged if they:

- Are at or above the threshold for one or more environmental, climate or other burdens, and
- Are at or above the threshold for an associated socioeconomic burden.

Additionally, census tracts that are surrounded by disadvantaged communities and are at or above the 50th percentile for low income are also considered disadvantaged.

Table 5-1. CEJST Categories of Burden

Category of Burden	Disadvantaged Community Identification Communities are identified as disadvantaged if they are in census tracts that:
Climate Change	Are at or above the 90th percentile for expected agriculture loss rate OR expected building loss rate OR expected population loss rate OR projected flood risk OR projected wildfire risk AND are at or above the 65th percentile for low income
Energy	Are at or above the 90th percentile for energy cost OR PM 2.5 in the air AND are at or above the 65th percentile for low income
Health	Are at or above the 90th percentile for asthma OR diabetes OR heart disease OR low life expectancy AND are at or above the 65th percentile for low income
Housing	Experienced historic underinvestment OR are at or above the 90th percentile for housing cost OR lack of green space OR lack of indoor plumbing OR lead paint AND are at or above the 65th percentile for low income
Legacy Pollution	Have at least one abandoned mine land OR Formerly Used Defense Sites OR are at or above the 90th percentile for proximity to hazardous waste facilities OR proximity to Superfund sites (National Priorities List (NPL)) OR proximity to Risk Management Plan (RMP) facilities AND are at or above the 65th percentile for low income
Transportation	Are at or above the 90th percentile for diesel particulate matter (DPM) exposure OR transportation barriers OR traffic proximity and volume AND are at or above the 65th percentile for low income
Water and Wastewater	Are at or above the 90th percentile for underground storage tanks and releases OR wastewater discharge AND are at or above the 65th percentile for low income
Workforce Development	Are at or above the 90th percentile for linguistic isolation OR low median income OR poverty OR unemployment AND more than 10 percent of people ages 25 years or older whose high school education is less than a high school diploma

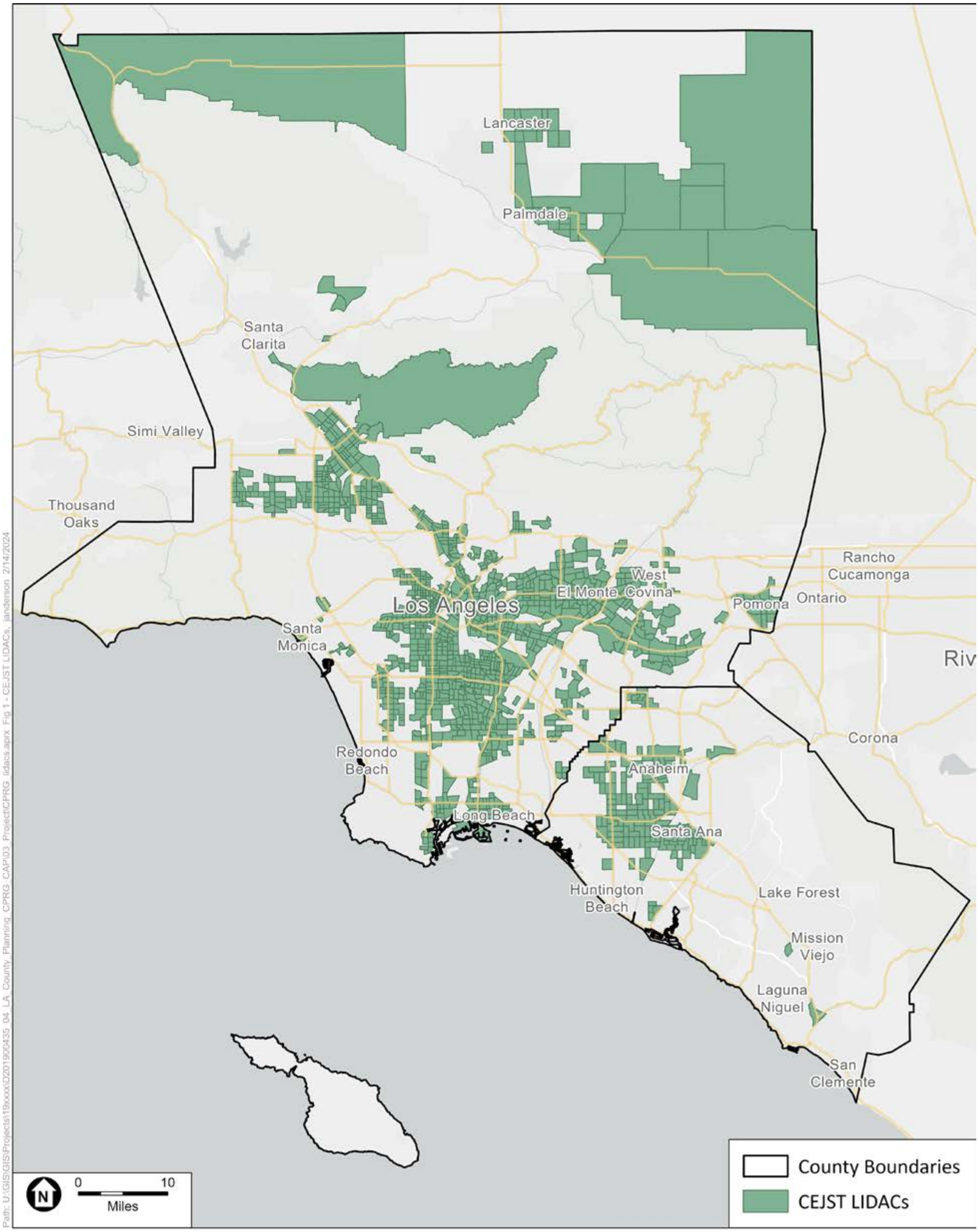
Source: CEQ, 2022.
Note: Census tracts are considered low income if the percentage of the population's household income is at or below 200 percent of the Federal poverty level.

CEJST LIDACs in Los Angeles and Orange Counties

CEJST identifies a total of 2,929 census tracts in Los Angeles and Orange counties combined.[1] Of these, 1,285 tracts or 44 percent are identified as LIDACs using the CEJST criteria. These locations are shown as the areas in blue in **Figure 5-2** below. Within Los Angeles county, 1,146 of a total 2,346 tracts are LIDACs (49 percent); within Orange county, 139 of a total 583 tracts are LIDACs (24 percent).

The count and percentage of CEJST indicators of burden for Los Angeles and Orange counties is shown in **Table 5-2** below. The full list of CEJST LIDAC census tracts is provided in *Appendix F, LIDAC Identification*.

1 CEJST uses 2010 census data for census tract numbers (CEQ, 2022).



Source: CEQ, 2023; ESA, 2024

Figure 5-2.
CEJST LIDACs in Los Angeles and Orange Counties

Table 5-2. CEJST LIDACs in Los Angeles and Orange Counties

CEJST Indicators of Burden, by Category	Los Angeles County		Orange County	
	Count	Percent	Count	Percent
Climate Change				
Greater than or equal to the 90th percentile for expected agriculture loss rate and is low income	0	0.0%	0	0.0%
Greater than or equal to the 90th percentile for expected building loss rate and is low income	4	0.2%	0	0.0%
Greater than or equal to the 90th percentile for expected population loss rate and is low income	6	0.3%	0	0.0%
Greater than or equal to the 90th percentile for share of properties at risk of flood in 30 years and is low income	151	6.4%	4	0.7%
Greater than or equal to the 90th percentile for share of properties at risk of fire in 30 years and is low income	36	1.5%	1	0.2%
Energy				
Greater than or equal to the 90th percentile for energy burden and is low income	5	0.2%	0	0.0%
Greater than or equal to the 90th percentile for PM2.5 exposure and is low income	781	33.3%	76	13.0%
Health				
Greater than or equal to the 90th percentile for asthma and is low income	4	0.2%	0	0.0%
Greater than or equal to the 90th percentile for diabetes and is low income	52	2.2%	2	0.3%
Greater than or equal to the 90th percentile for heart disease and is low income	18	0.8%	0	0.0%
Greater than or equal to the 90th percentile for low life expectancy and is low income	17	0.7%	0	0.0%
Housing				
Tract experienced historic underinvestment and remains low income	214	9.1%	0	0.0%
Greater than or equal to the 90th percentile for housing burden and is low income	692	29.5%	56	9.6%
Greater than or equal to the 90th percentile for share of the tract's land area that is covered by impervious surface or cropland as a percent and is low income	487	20.8%	37	6.3%
Share of homes with no kitchen or indoor plumbing (percentile)	253	10.8%	31	5.3%
Greater than or equal to the 90th percentile for lead paint, the median house value is less than 90th percentile and is low income	100	4.3%	2	0.3%
Legacy Pollution				
There is at least one abandoned mine in this census tract and the tract is low income.	0	0.0%	0	0.0%
There is at least one Formerly Used Defense Site (FUDS) in the tract and the tract is low income.	12	0.5%	0	0.0%

CEJST Indicators of Burden, by Category	Los Angeles County		Orange County	
	Count	Percent	Count	Percent
Greater than or equal to the 90th percentile for proximity to hazardous waste facilities and is low income	698	29.8%	70	12.0%
Greater than or equal to the 90th percentile for proximity to superfund sites and is low income	159	6.8%	8	1.4%
Greater than or equal to the 90th percentile for proximity to RMP sites and is low income	268	11.4%	22	3.8%
Transportation				
Greater than or equal to the 90th percentile for diesel particulate matter (DPM) and is low income	376	16.0%	0	0.0%
Greater than or equal to the 90th percentile for DOT transit barriers and is low income	113	4.8%	1	0.2%
Greater than or equal to the 90th percentile for traffic proximity and is low income	323	13.8%	32	5.5%
Water and Wastewater				
Greater than or equal to the 90th percentile for leaky underground storage tanks and is low income?	146	6.2%	19	3.3%
Greater than or equal to the 90th percentile for wastewater discharge and is low income	269	11.5%	22	3.8%
Workforce Development				
Greater than or equal to the 90th percentile for households in linguistic isolation and has low high school attainment	906	38.6%	124	21.3%
Greater than or equal to the 90th percentile for low median household income as a percent of area median income and has low HS attainment	0	0.0%	0	0.0%
Greater than or equal to the 90th percentile for households at or below 100% federal poverty level and has low HS attainment	156	6.6%	3	0.5%
Greater than or equal to the 90th percentile for unemployment and has low HS attainment	127	5.4%	3	0.5%

Source: CEQ, 2022.

For census tracts in both Los Angeles and Orange counties, **linguistic isolation** is the top CEJST indicator (workforce development category of burden) with the greatest percentage (39 percent in Los Angeles county and 21 percent in Orange county). Linguistic isolation refers to the share of households with individuals over age 14 who do not speak English very well. The second highest is **fine particulate matter (PM 2.5) exposure** (33 percent in Los Angeles county and 13 percent in Orange county), a CEJST indicator in the energy category that refers to the level of inhalable particles in the air, 2.5 micrometers or smaller. This is followed by **hazardous waste facilities proximity** (30 percent in Los Angeles county and 12 percent in Orange county), a CEJST indicator in the legacy pollution category, and **housing burden** (30 percent in Los Angeles county and 10 percent in Orange county), a CEJST indicator in the housing category). Other CEJST indicators with high percentages in Los Angeles and Orange counties include lack of green space, exposure to diesel particulate matter (DPM), and traffic proximity.

EPA EJScreen: Environmental Justice Screening and Mapping Tool

The EPA recommends the use of EPA's EJScreen as a supplement to CEJST for identifying LIDACs. Within EJScreen, LIDACs are identified as any census block group that is at or above the 90th percentile for any of EJScreen's 13 Supplemental Indexes when compared to the nation or state. The Supplemental Indexes used within EJScreen are summarized in **Table 5-3**.

Table 5-3. EJScreen Supplemental Indexes

Supplemental Index Name	Supplemental Index Description Block groups are identified as LIDAC if they are at or above the 90th percentile for any of EJScreen's Supplemental Indexes:
Particulate Matter 2.5 ($PM_{2.5}$)	Annual average concentration (µg/m3) of PM 2.5 in the air, combined with average of supplemental demographic factors
Ozone	Summer seasonal average of daily maximum 8-hour concentration in air (parts per billion or ppb), combined with average of supplemental demographic factors
Diesel Particulate Matter (DPM)	Concentration of DPM (µg/m3), combined with average of supplemental demographic factors
Air Toxics Cancer Risk	Lifetime cancer risk from inhalation of air toxics, combined with average of supplemental demographic factors
Air Toxics Respiratory Hazard Index	Ratio of exposure concentration to a reference concentration set by U.S. EPA, combined with average of supplemental demographic factors
Toxic Releases to Air	Modeled, toxicity-weighted concentrations of pollutants in air from U.S. EPA's Toxics Release Inventory (TRI) chemicals, combined with average of supplemental demographic factors
Traffic Proximity	Vehicle counts of average annual daily traffic at major roads (proximate), combined with average of supplemental demographic factors
Lead Paint	Percent of housing units built before 1960 as an indicator of potential lead paint exposure, combined with average of supplemental demographic factors
Risk Management Plan (RMP) Facility Proximity	Proximate count of RMP (potential chemical accident management plan) facilities, combined with average of supplemental demographic factors
Hazardous Waste Proximity	Proximate count of hazardous waste facilities, combined with average of supplemental demographic factors
Superfund Proximity	Proximate count of superfund sites, combined with average of supplemental demographic factors
Underground Storage Tanks	Proximate count of underground storage tanks and leaking underground storage tanks, combined with average of supplemental demographic factors
Wastewater Discharge	Toxicity-weighted concentrations of pollutants in downstream water bodies (proximate), combined with average of supplemental demographic factors

Source: USEPA, 2023.
Note: The Supplemental Indexes combine individual environmental indicators with an average of 5 supplemental socioeconomic factors: Percent Low Income, Percent Unemployed, Percent Limited English Speaking, Percent Less than High School Education, and Low Life Expectancy.

The supplemental indexes combine individual environmental indicators with an average of five socioeconomic indicators:

- Percentage of low income,
- Percentage of unemployed,
- Percentage of limited English speakers,
- Percentage of less than high school education, and
- Low life expectancy.

The Supplemental Indexes reveal the block group areas that have the highest intersection between the environmental and socioeconomic indicators (USEPA, 2023).

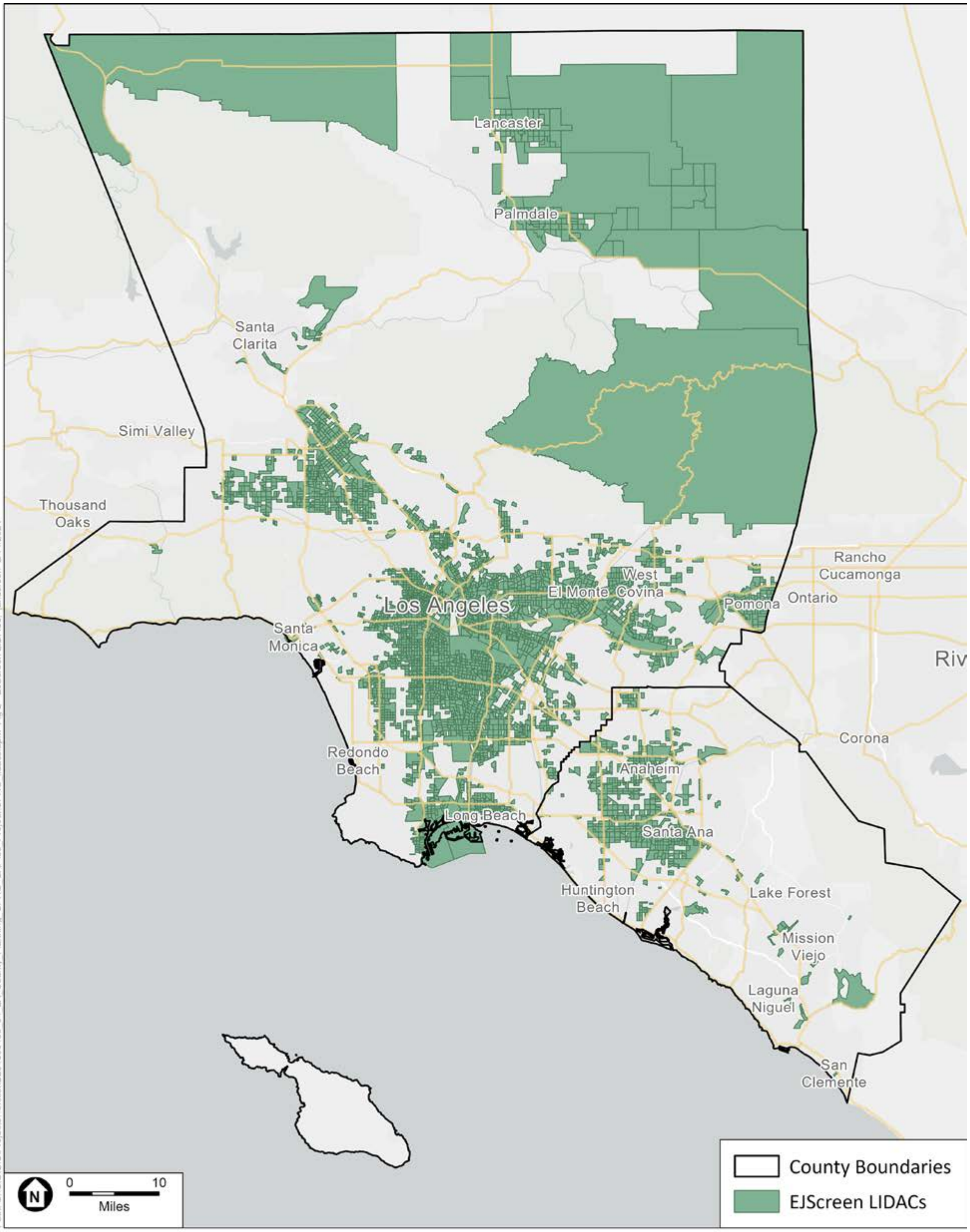
EJScreen LIDACs in Los Angeles and Orange Counties

Data from EJScreen shows there are a total of 8,640 block groups in Los Angeles and Orange counties combined. Of these, 3,726 or 43 percent are identified as LIDACs using EJScreen's criteria. These LIDAC block groups are shown in **Figure 5-3** below. Within Los Angeles county, there are a total of 3,225 LIDAC block groups (49 percent); within Orange county, there are a total of 501 LIDAC block groups (25 percent). The count and percentage of EJScreen Supplemental Indexes for Los Angeles and Orange counties are shown in **Table 5-4** below.

TABLE 5-4. EJSCREEN LIDACS (BLOCK GROUPS) IN LOS ANGELES COUNTY AND ORANGE COUNTY

	Los Angeles County		Orange County	
EJScreen Supplemental Indexes	Count	Percent	Count	Percent
$PM_{2.5}$	2,599	39.4%	469	22.9%
Ozone	2,118	32.1%	351	17.1%
Diesel Particulate Matter	1,998	30.3%	298	14.5%
Air Toxics Cancer Risk	1,871	28.4%	197	9.6%
Air Toxics Respiratory Hazard Index	2,302	34.9%	207	10.1%
Toxic Releases to Air	1,400	21.2%	228	11.1%
Traffic Proximity	1,932	29.3%	355	17.3%
Lead Paint	1,636	24.8%	133	6.5%
Superfund Proximity	1,921	29.1%	240	11.7%
RMP Facility Proximity	1,576	23.9%	244	11.9%
Hazardous Waste Proximity	2,615	39.7%	446	21.8%
Underground Storage Tanks	678	10.3%	110	5.4%
Wastewater Discharge	1,779	27.0%	246	12.0%

Source: USEPA, 2023.



Source: USEPA, 2023; ESA, 2024

Figure 5-3.
EJScreen LIDACs in Los Angeles Orange Counties

For both Los Angeles and Orange counties, **hazardous waste proximity** and **concentration of PM 2.5** represent the top EJScreen Supplemental Index indicators with the greatest percentages for block groups. For hazardous waste proximity, 40 percent of block groups in Los Angeles county and 22 percent in Orange county are at or above the 90th percentile; for PM 2.5, 39 percent of block groups in Los Angeles county and 23 percent of block groups in Orange county are at or above the 90th percentile. The hazardous waste indicator considers the number of nearby facilities (within 5 kilometers) divided by distance. PM 2.5 considers the annual average concentration of fine particulate matter in the air (similar to CEJST, this refers to inhalable particles that are 2.5 micrometers or smaller). Other EJScreen Supplemental Indexes with high percentages in Los Angeles County and Orange County block groups include Air Toxic Respiratory Hazard Index, Ozone, Traffic Proximity, and DPM concentration.

State: CalEPA and OEHHA

CalEPA Priority Population Investments 4.0

The EPA allows data from other sources to be included within the LIDAC analysis to provide a more comprehensive understanding of impacted communities and comparison of census tracts to the CEJST. Therefore, this analysis includes California's identification of LIDACs or "Priority Populations" that refer to disadvantaged and low-income communities, as designated by California Senate Bill 535 and Assembly Bill 1550, respectively. Priority Populations are identified for purposes of targeting state climate investments (California Climate Investments from the Cap-and-Trade Program) for public health, quality of life, and economic opportunity to the most burdened communities.

Priority Populations are identified through the Priority Population Investments 4.0 mapping tool that considers a combination of environmental hazards, socioeconomics, public health, and geographic criteria. Specifically, Priority Populations are identified based on the following:

- **Disadvantaged Communities:** Census tracts that are in the top 25 percent (75th – 100th percentile) for combined pollution burden and population indicators through California's Office of Environmental Health Hazard Assessment's (OEHHA) California Communities Environmental Health Screening Tool: CalEnviroScreen 4.0, and;
- **Low-income:** Census tracts that are at or below 80 percent of the state's median income, or at or below the threshold designated as low-income by the California Department of Housing and Community Development (HCD).

The indicators used for CalEPA's Priority Populations are summarized in **Table 5-5**.

CalEPA LIDACs in Los Angeles and Orange Counties

CalEPA identifies a total of 2,965 census tracts in Los Angeles and Orange counties combined.[2] Of these, 1,219 tracts or 41 percent are identified as Priority Populations. These locations are shown as the areas in blue in **Figure 5-4** below. Within Los Angeles county, 1,127 of a total 2,372 tracts are Priority Populations (48 percent); within Orange county, 92 of a total 593 tracts are Priority Populations (16 percent).

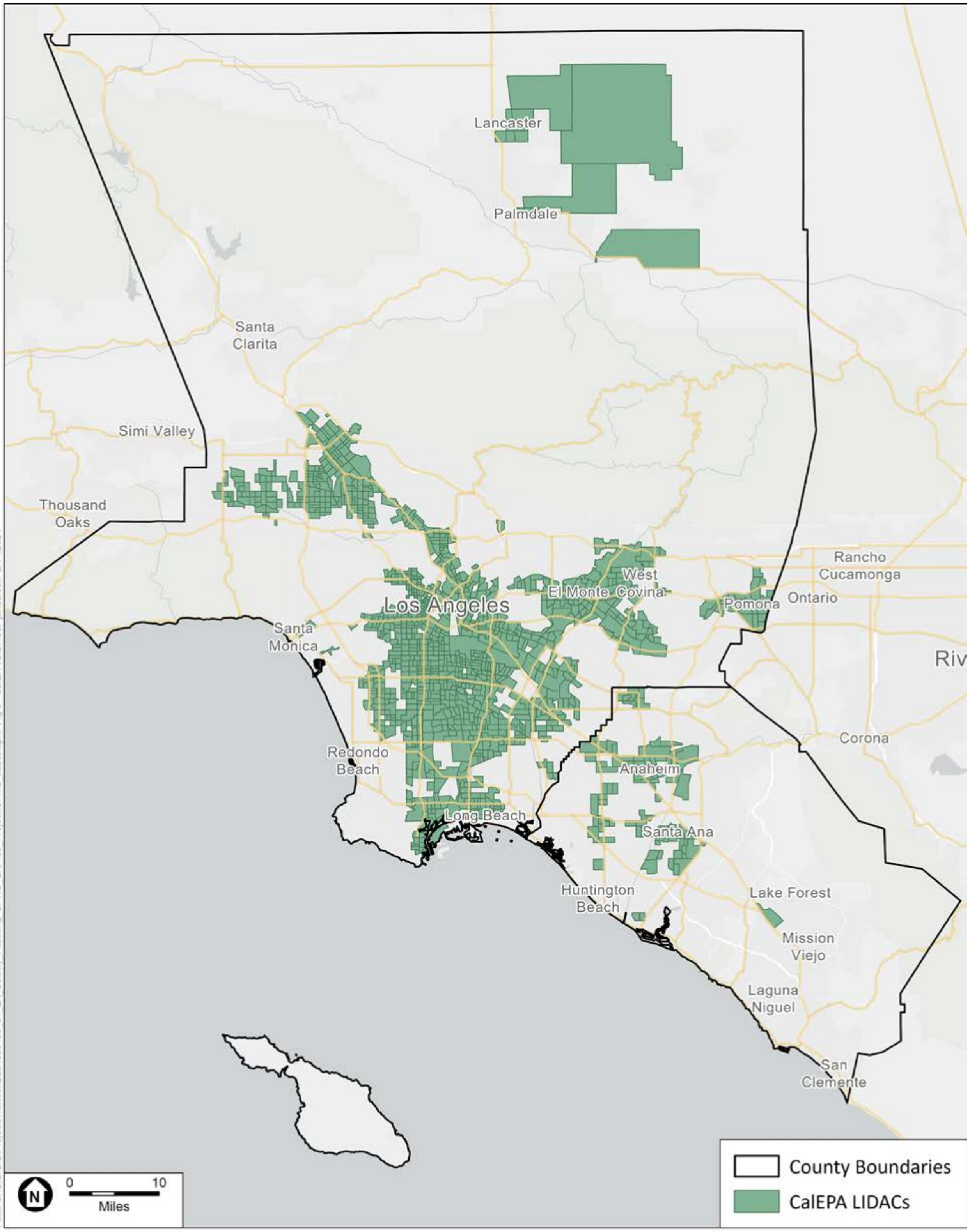
2 CalEPA uses 2016 census data for census tract numbers (CCI, 2023).

Table 5-5. CalEPA Priority Populations – Disadvantaged Community Indicators

Priority Populations Indicators	Indicator Description Priority Populations are identified as census tracts that meet HCD's low-income criteria AND are designated as disadvantaged through OEHHA's CalEnviroScreen 4.0, representing a cumulative score across Pollution Burden and Population Characteristics:
Pollution Burden	
Ozone	Summer mean of the daily maximum 8-hour ozone concentration in the air (in parts per million or ppm)
PM 2.5	Average concentration of PM 2.5 in the air (in micrograms per cubic meter or $\mu g/m^3$)
DPM	Proximate emissions (tons per year) of DPM in the air
Drinking Water Contaminants	Index of relevant drinking water contaminants, considering average concentrations of contaminants and average violations
Children's Lead Risk from Housing	Weighted sum for percent of homes with likelihood of lead-based paint hazards and percent of low-income households with children, as an indicator for potential risk for lead exposure
Pesticide Use	Average reported use of hazardous and volatile pesticides on agricultural commodities
Toxic Releases from Facilities	Modeled, toxicity-weighted concentrations of chemical releases in the air from large facility emissions (proximate)
Traffic Impacts	Average traffic volumes by amount of roadways
Cleanup Sites	Proximate count and weight of cleanup and superfund sites
Groundwater Threats	Proximate count and weight of groundwater cleanup sites
Hazardous Waste	Proximate count and weight of permitted Treatment, Storage, and Disposal facilities (TSDFs), hazardous waste generators, and chrome plating facilities,
Impaired Waters	Proximate count of pollutants in water bodies listed as impaired
Solid Waste Sites	Proximate count and weight of solid waste facilities
Population Characteristics	
Asthma	Asthma rate (estimate of emergency department visits for asthma per 10,000 people)
Cardiovascular Disease	Rate of heart attacks (estimate of emergency department visits for heart attacks per 10,000 people)
Low Birth Weight	Percent of low birth weight (<2,500 grams or approximately 5.5 pounds) infants from the total of live births
Education	Percent of adults over age 25 with less than a high school education
Housing Burden	Percent of households that are both low income and severely burdened by housing costs (paying greater than 50 percent of their household income to housing costs)
Linguistic Isolation	Percent of households where no one over age 14 speaks English well
Poverty	Percent of people living twice below the federal poverty level [b]
Unemployment	Percent of people over age 16 that are unemployed and eligible for the workforce

Source: CCI, 2023; OEHHA, 2021.
Notes:

a. *Census tracts are considered low income if the percentage of the population's household income is at or below 200 percent of the Federal poverty level.*
b. *For Poverty, twice the federal poverty level is used in California due to the high cost of living.*
c. *CalEPA further identifies lands under the control of federally recognized Tribes as disadvantaged, however, there are none within Los Angeles or Orange counties.*



Source: CCI, 2023; ESA, 2024

Figure 5-4.
CalEPA LIDACs in Los Angeles Orange Counties

5.3 Co-Benefits to PCAP Measures

Identifying LIDACs and understanding their climate change vulnerabilities allows for targeted and equitable planning to ensure adopted measures are tailored to address specific challenges. Many of the measures identified in this PCAP provide additional social, economic, or environmental advantages to LIDACs in addition to reducing GHG emissions. The primary goal of the co-benefits assessment is to qualitatively identify the indirect benefits (co-benefits) that the PCAP measures could provide in areas such as public health, economic development, resource allocation, and others. This information is crucial in empowering communities to assess the advantages specific to their jurisdictions when evaluating and prioritizing measures to reduce GHG emissions. These co-benefits directly impact the well-being, awareness, and resilience of communities. Co-benefits evaluated for this PCAP are described below.

Air Pollution

Many of the GHG reduction measures in the PCAP will lead to air quality improvements and bring positive changes to low-income and disadvantaged communities. As described in *Section 5.1, Vulnerability Assessment*, Los Angeles and Orange counties have some of the poorest air quality in the nation. Currently, LIDACs are exposed to air pollution at higher rates and have fewer resources to protect themselves from impacts.

Implementing GHG reduction measures that reduce air pollution in the region will help alleviate existing burdens on LIDACs. Communities that experience a disproportionate burden of $PM_{2.5}$, DPM, ozone, and fugitive emissions will benefit from reduced exposure to these harmful pollutants, improving health outcomes and reducing the occurrence of respiratory, cardiovascular, and other illnesses.

Other Pollution

Many of the activities required to extract, refine, transport and store fossil fuels carry the potential for soil and groundwater contamination, which can result from leaks, spills and other discharges that occur throughout the supply chain. LIDACs can face unique challenges linked to legacy pollution as result of the high concentration of orphaned and idle oil and gas wells in the region (United States Department of the Interior, n.d.). The strategies outlined in this plan to reduce GHG emissions indirectly contribute to lowering this risk.

Public Health

As discussed above, the GHG reduction measures in this plan will contribute to better health outcomes as result of air quality improvements, however there are many other public health co-benefits that can be realized in LIDACs. For example, measures that reduce vehicle-miles traveled by offering an improved and accessible bicycling network can increase physical activity and help improve life expectancy. Measures that reduce VMT can also reduce injury collisions by removing cars from the road and promoting safety for all types of travel. Public health can be promoted through increased resilience, enabling LIDACs to better prepare for and withstand climate-related hazards, ultimately contributing to enhanced public safety within these communities. Such outcomes have cascading impacts for public health by reducing risk and levels of chronic disease, respiratory disease, and affecting physical and mental health and well-being.

Measures that have the potential to improve public health should be prioritized for implementation in LIDAC communities where health vulnerabilities are more severe. In Los Angeles county, 52 census tracts (two percent) are greater than or equal to the 90th percentile for diabetes and are low income (CEQ, 2023). These communities are in greater need of targeted investments for measures that improve public health.

Resource Conservation

Some GHG reduction measures are tied to greater resource conservation by eliminating waste and optimizing resource use. This includes contributing to the responsible management and production of natural resources, such as water and green spaces, and to the conservation of energy and raw materials. In addition, sustainable land use practices preserve ecosystems that provide these resources, which provides long-term value to future generations.

Economic Development

The implementation of many GHG reduction measures aligns with the state's climate-related policies and regulations geared towards generating economic opportunities and benefits through the creation of new "green" jobs and businesses. As more agencies invest in climate action, this will lead to transformations in the energy, transportation, agriculture, waste management, and water sectors. These investments foster technological developments and sustainable economic activity that can provide future cost-savings to residents and businesses, through increased energy efficiency, water efficiency, use of renewable sources, and use of active and public transportation.

Community Awareness & Capacity Building

This type of measure helps raise awareness and knowledge of climate change action and planning, including awareness for expected hazards and local vulnerabilities. Expanding information sharing increases individual and collective capacity for communities to address climate change in their day-to-day lives, as part of their sustainability activities including commutes, purchases, material discards, and other actions. Residents become more empowered to take action when they are well informed and are also better able to participate directly in planning processes. This also helps to increase local support for cities to invest resources and funding for climate action.

Parks and Urban Greening

Urban greening measures reduce GHG emissions and also offer co-benefits to LIDACs. Communities with insufficient parks and urban green space experience diminished air quality, limited options for comfortable and safe active transportation, reduced opportunities for outdoor recreation, and negative impacts on health. Urban greening provides aesthetic improvements to the environment and promotes physical activity, improved physical and mental health, placemaking and community gathering, and outdoor recreation. Air quality can be improved through tree planting and other greening techniques that increase oxygen production and pollutant filtering. Measures that promote urban greening can also mitigate hazards such as stormwater flooding and the urban heat island effect, to which low income and disadvantaged communities are particularly vulnerable.

Community Resilience

Measures that promote community resilience can be particularly beneficial to LIDACs, which due to historic disinvestment are particularly vulnerable to climate change hazards. With fewer resources, LIDACs face greater challenges in anticipating, preparing for, and recovering from climate-related shocks like heat waves, wildfires, and flood events, as well as infrastructure disruptions such as power outages and stormwater system backups. Measures that promote urban greening, energy efficiency, water conservation, and other sustainability benefits not only reduce GHG emissions but also enhance overall community resilience, particularly for LIDACs.

Socioeconomic Equity and Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people, regardless of race or income, in the development, implementation, and enforcement of environmental laws, regulations, and policies. GHG reduction measures that promote environmental justice include those which will reduce the disproportionate burden of environmental harm experienced by low income and disadvantaged communities. Socioeconomic equity refers to the fair distribution of resources, opportunities, and privileges within a society, aiming to address and reduce disparities in wealth, income, and access to essential services.

LIDACs often bear the brunt of environmental harm, leading to adverse health outcomes and reduced quality of life. Disparities in wealth and access to essential services further exacerbate existing inequalities. Measures that promote job growth within LIDACs contribute to socioeconomic equity, while measures that reduce air pollution in LIDACs contribute to environmental justice.

Summary of PCAP Co-Benefits

Table 5-6 identifies the anticipated LIDAC co-benefits associated with each measure in the PCAP described in further detail below.

TABLE 5-6. GHG REDUCTION MEASURES AND CO-BENEFITS

Measure	Air Pollution	Other Pollution	Public Health	Resource Conservation	Economic Development	Community Awareness & Capacity Building	Parks & Urban Greening	Community Resilience	Socioeconomic Equity and Environmental Justice
Transportation									
T1: Decarbonize Goods Movement	X	X	X					X	X
T2: Decarbonize Passenger Transport	X	X	X			X		X	X
T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs	X	X	X					X	X
T4: Reduce VMT Through Sustainable Land Use	X	X	X			X	X	X	X
T5: Expand the Active Transportation Network	X	X	X			X	X	X	X
T6: Expand the Transit Network and Increase Ridership	X	X	X			X		X	X
T7: Optimize Traffic Flow to Reduce Idle Time	X	X	X	X					
Energy									
E1: Decarbonize Existing Buildings	X	X	X	X				X	
E2: Decarbonize New Buildings	X	X	X	X	X				
E3: Decarbonize Industrial Processes	X	X	X	X					X
E4: Increase Renewable Energy Generation and Storage	X	X			X				
E5: Improve Grid Efficiency and Resiliency Through Grid Modernization			X	X		X		X	X
E6: Improve Energy Efficiency Through Building Upgrades					X			X	X

Measure	Air Pollution	Other Pollution	Public Health	Resource Conservation	Economic Development	Community Awareness & Capacity Building	Parks & Urban Greening	Community Resilience	Socioeconomic Equity and Environmental Justice
E7: Improve Energy Efficiency Through Urban Greening	X		X	X	X	X	X	X	X
E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations	X	X	X	X				X	X
Solid Waste									
SW1: Increase Organics Diversion	X	X	X	X	X	X		X	X
SW2: Recover and Reuse Materials		X	X	X	X	X		X	X
SW3: Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential	X	X	X	X	X			X	

Source: ESA 2024

5.4 Reduction Measure Benefits Analysis

Implementation of the GHG reduction measures outlined in this plan will yield a range of direct and indirect co-benefits for LIDACs throughout Los Angeles and Orange counties. The following section details specific co-benefits associated with the implementation of each reduction measure.

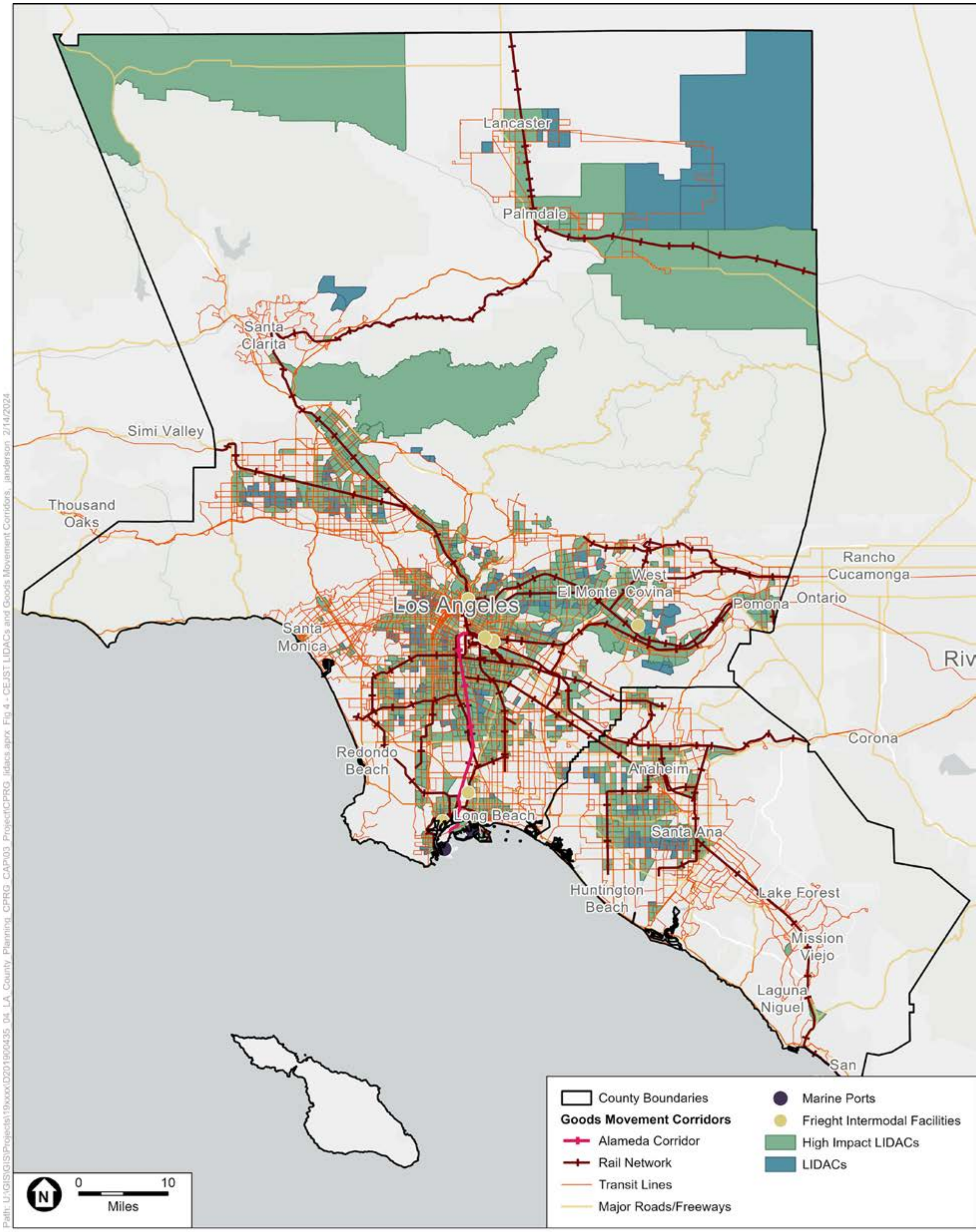
Geographic data denoting the location of various polluting sources was reviewed as a component of the Reduction Measure Benefit Analysis to identify the Census tracts that are most likely to benefit from emission-reducing measures. **Figure 5-5**, **Figure 5-6**, and **Figure 5-7** below show the proximity of LIDACs to transportation hubs and corridors, industrial sources, and landfills, respectively. For the purpose of this analysis, LIDAC Census tracts that are within 0.5 miles of a polluting source are referred to as “high-impact LIDACs”, as these have the greatest exposure and vulnerability risk due to proximity. Where applicable, the specific locations of the high-impact LIDACs that are poised to benefit significantly from a given reduction measure are described. Equitable implementation of this plan will see the reduction measures implemented in a way that optimizes co-benefits to LIDACs.

T1: Decarbonize Goods Movement

Decarbonizing goods movement will result in co-benefits, primarily for air quality improvements along goods movement corridors. These corridors often traverse LIDACs, as shown in Figure 5-5, and the decarbonization efforts will contribute to a reduction in the existing air pollution burden. Reductions in air pollution lead to improved public health outcomes and reduced healthcare costs for individuals within LIDACs. These reductions also support healthier ecosystems and promote the vitality of local plant and tree life, which help mitigate climate change impacts. Moreover, the transition to decarbonized goods movement holds the potential to mitigate noise pollution, fostering a quieter and more pleasant living environment for nearby residents. Ultimately, these co-benefits contribute to the creation of healthier and more resilient communities. Figure 5-5 shows high-impact LIDACs which will benefit directly from the reduction of transportation-based pollution – a list of these LIDACs is provided in Appendix F, *LIDAC Identification*.

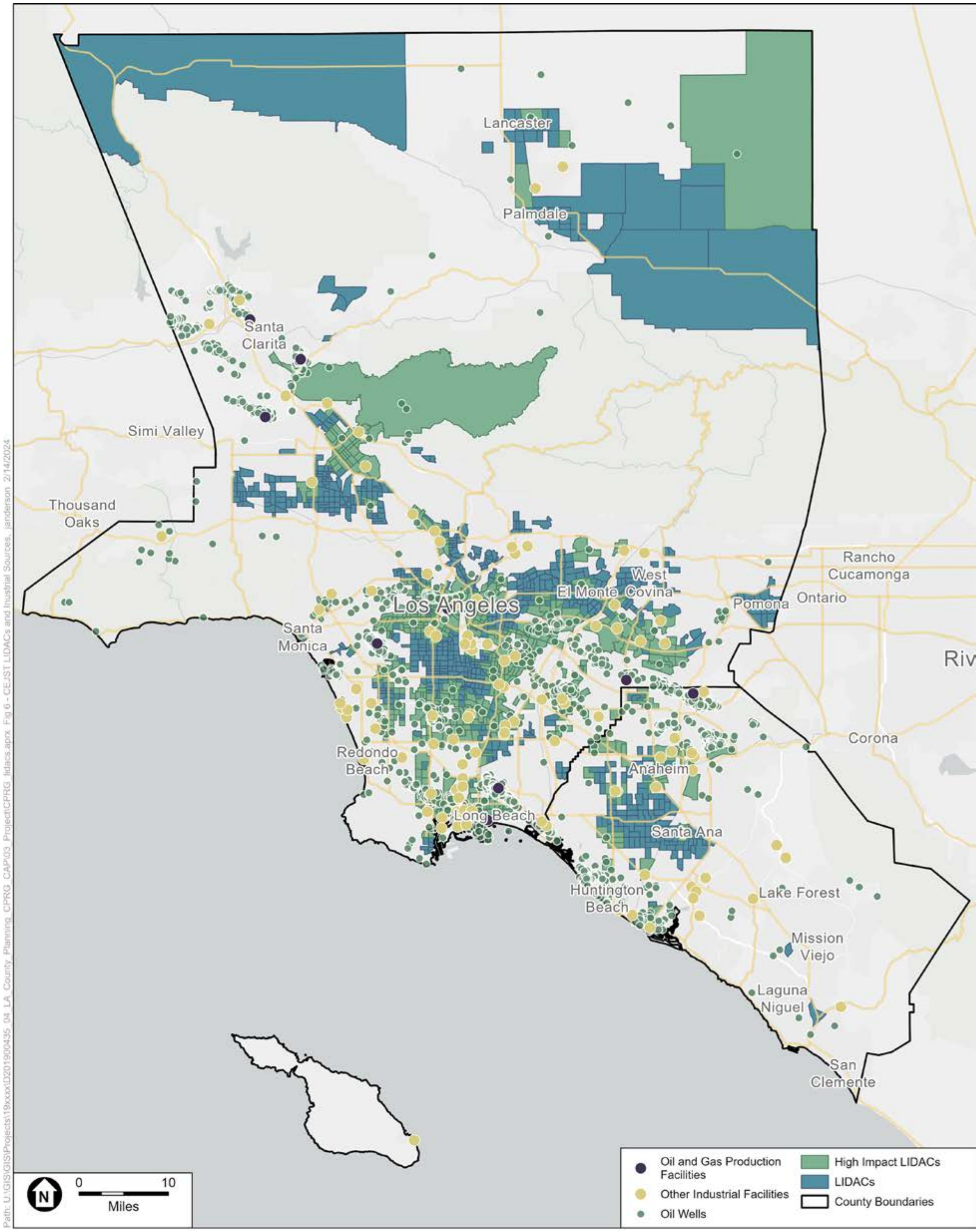
T2: Decarbonize Passenger Transport

The shift to electric passenger vehicles and passenger buses not only reduces GHG emissions but also enhances air quality along transportation corridors that commonly traverse LIDACs. The transition to EVs will contribute to a reduction in air pollution within these communities, directly improving public health outcomes, and lowering healthcare costs. Figure 5-5 shows high-impact LIDACs that will benefit directly from the reduction of pollution from passenger vehicles. A list of these LIDACs is provided in Appendix F, *LIDAC Identification*.



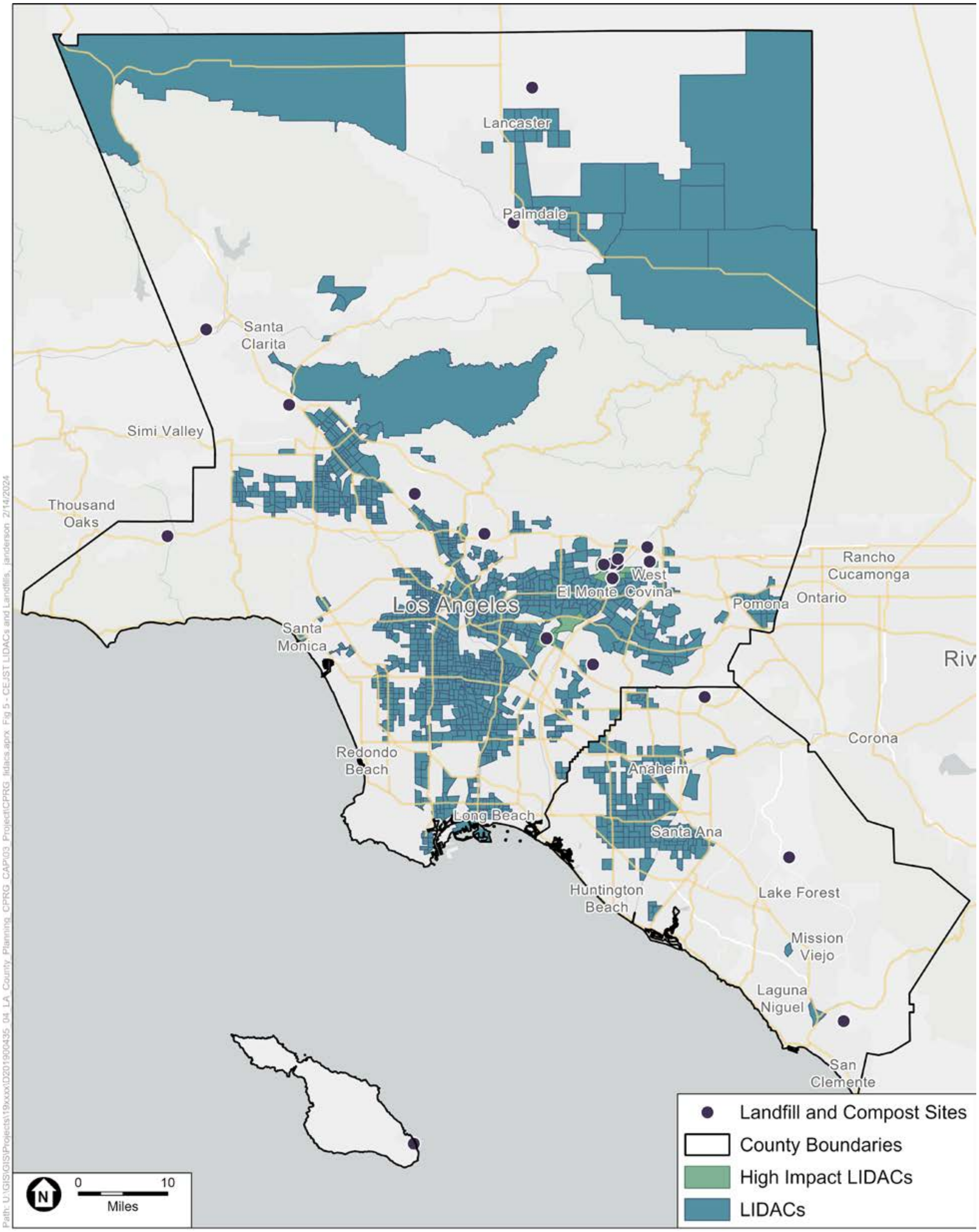
Sources: CEQ, 2023; Fehr & Peers, 2024; ESA, 2024

Figure 5-5.
CEJST LIDACs and Transportation Corridors



Source: CEQ, 2023; CARB, 2020. ESA, 2024

Figure 5-6.
CEJST LIDACs and Industrial Sources



Source: CEQ, 2023; ESA, 2024

Figure 5-7.
CEJST LIDACs and Landfills

T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs

Medium- and heavy-duty vehicles contribute to traffic on transportation corridors. These transportation corridors often traverse LIDACs, as shown in Figure 5-5, and the movement to zero emission vehicles will contribute to a reduction in the existing air pollution burden. Similar to the co-benefits of decarbonizing goods movement, transitioning medium- and heavy-duty vehicles to ZEVs will contribute to improved public health outcomes, reduced healthcare costs, and reduced noise pollution. Figure 5-5 shows high-impact LIDACs which will benefit directly from the reduction of transportation-based pollution – a list of these LIDACs is provided is provided in Appendix F, *LIDAC Identification*.

T4. Reduce VMT Through Sustainable Land Use

Reducing VMT through sustainable land use involves planning and designing future communities and improving existing communities in a way that minimizes the need for extensive car travel. This approach to planning focuses on creating greener, more walkable, bike-friendly, and transit-oriented neighborhoods, reducing the overall distances people need to travel for daily activities. By adopting sustainable land use practices, communities can contribute to reducing VMT, which, in turn, can lead to benefits such as decreased traffic congestion, improved air quality, and a more environmentally friendly and livable urban environments. Implementing such practices in LIDACs helps to ensure the equitable distribution of these benefits.

T5. Expand the Active Transportation Network

Expanding the active transportation network involves improving pedestrian and bike/scooter infrastructure to encourage transitions away from motorized forms of travel. This shift can provide direct benefits to LIDACs by promoting public health and physical activity, connectivity and access, cost savings, and enhanced air quality. Improvements to bicycle and pedestrian transportation infrastructure can be used to promote public safety and reduce vehicular collisions. Public health benefits can also come from improving safe routes to schools, establishing greenways, and reducing vehicle traffic. This measure also expands options for convenient and affordable modes of travel, particularly for low-income households and others who may not own or have access to a personal vehicle.

T6. Expand the Transit Network and Increase Ridership

Expanding the transit network includes improvements to infrastructure, transit services and coverage, and passenger comfort, which help to promote increased ridership. Affordability, safety, and first/last mile connections are critical for serving more populations and disadvantaged communities. Increased ridership leads to fewer private vehicles on the road and reduced GHG emissions, along with reduced air pollution and associated health hazards. Expanding the transit network provides LIDACs with more equitable access to employment centers and recreational opportunities, especially for communities that currently lack access to frequent and reliable transit service.

T7. Optimize Traffic Flow to Reduce Idle Time

Use of traffic signal synchronization and high-occupancy vehicle express lanes helps to improve traffic flows and moderate speed, reducing idle time, unproductive fuel consumption, and congestion. This greatly contributes to lowered GHG emissions and pollution from vehicles, improving environmental conditions for public health and health hazards, particularly along major roadways in LIDACs where there is higher population density. Reduced idle time also contributes to cost savings from reduced fuel expenditures and more efficient trips.

E1. Decarbonize Existing Buildings

Existing buildings contribute significantly to regional GHG emissions due to their energy needs for heating and cooling. Generally, decarbonizing existing buildings requires a transition to renewable electricity as a primary energy source, along with increased energy efficiency and more reliance on renewable or low-carbon fuels where a shift to electrification is not feasible. Building electrification can provide multiple co-benefits for lower-income and rent-burdened households, including reduced utility bills, better indoor air quality and improved energy resilience.

E2. Decarbonize New Buildings

Decarbonization and electrification of new developments has benefits similar to the decarbonization of existing buildings. New construction offers opportunities to use less GHG-intensive materials and construction methods. The push to decarbonize new buildings is also spurring investment in new technologies, creating new business and green job opportunities, and helping to increase building values. As with decarbonization of existing buildings, this measure helps to improve health, reduce utility costs for owners and renters, and provide cost-savings.

E3. Decarbonize Industrial Processes

Decarbonizing industrial processes through the expansion of emerging clean energy technologies leads to improvements in energy efficiency, air quality, and environmental and public health. These benefits are particularly relevant to frontline communities that live in close proximity to heavy industry areas where exposure to pollution and health hazards is typically elevated. Figure 5-6 shows the location of high-impact LIDACs that will benefit directly from the decarbonization of industrial processes. A list of these LIDACs is provided in Appendix F, *LIDAC Identification.*

E4. Increase Renewable Energy Generation and Storage Potential

Increasing renewable energy generation and storage capacity reduces the need for fossil fuel combustion and facilitates pathways for achieving carbon neutrality goals. The renewable energy economy is providing new employment opportunities and has the potential to reduce utility costs, benefits that are particularly important for LIDAC communities. For property owners, access to onsite generation and storage helps to increase local energy resiliency.

E5. Improve Grid Efficiency and Resiliency Through Grid Modernization

Modernizing the electricity grid to optimize expanded energy storage, distributed energy resources, and interconnections with microgrids helps to balance the generation and consumption of unpredictable sources of renewable energy (e.g., solar and wind). This measure provides for greater flexibility and reliability regarding the use of renewable energy and provides resilience during outages or other emergencies. The expansion of microgrids and energy storage can also further increase access to renewable energy by LIDACs.

E6. Improve Energy Efficiency Through Building Upgrades

Enhancing energy efficiency via building upgrades includes retrofitting existing housing stock to minimize overall energy consumption. Along with building electrification, energy efficiency initiatives spur investments in new technologies, create job opportunities, and enhance the value of existing affordable housing. This measure can also be implemented to yield saving opportunities for LIDACs from lowered utility bills.

E7. Improve Energy Efficiency Through Urban Greening

Urban greening initiatives such as adopting an Urban Forest Management Plan yield co-benefits for LIDACs in several ways. Increased tree canopy cover in urban areas can counteract the urban heat island effect, help reduce air pollution, and limit flooding impacts. Mitigation of extreme heat events helps reduce energy consumption, avoid higher utility costs, and leads to better health outcomes for residents and workers. Enhanced green spaces that are accessible to LIDACs help address environmental disparities and enhance overall well-being, including mental and physical health. The implementation of an Urban Forest Management Plan can also create green job opportunities for these communities. Additionally, the promotion of active transportation through well-connected green corridors and pedestrian-friendly infrastructure can be used to improve mobility and accessibility for these communities.

E8. Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations

Oil and gas extraction activities, which contribute significantly to GHG emissions, are often difficult to monitor and control. Phasing out oil and gas operations, which have local air quality impacts, will help protect more vulnerable populations who often live in close proximity to such operations. Figure 5-6 shows high-impact LIDAC communities near active and idle wells in Los Angeles and Orange counties. Sunsetting oil and gas should be prioritized within and near LIDACs to provide the greatest public health benefits to those who are most impacted and should include workforce transition plans.

SW1. Increase Organics Diversion

The diversion of organics from landfill disposal can generate local jobs in waste management, food recovery, and composting, providing economic opportunities within LIDACs. Collaboration with local foodbanks can be leveraged to improve food access in LIDACs. Also, by implementing ordinances and service improvements, these measures can reduce environmental hazards associated with improper waste disposal, contributing to improved air and water quality. Education and outreach components can also empower residents with knowledge about sustainable waste practices, fostering a sense of environmental stewardship. Figure 5-7 shows the location of existing landfills in the MSA and their proximity to LIDACs.

SW2. Recover and Reuse Materials

GHG emission reduction efforts centered around reducing waste generation, conserving resources, and promoting circular economy practices offer valuable co-benefits for LIDACs. By expanding the recovery and reuse of materials, these measures can stimulate local economic opportunities within LIDACs, creating jobs and supporting recycling industries. Moreover, the reduction of waste contributes to a cleaner and healthier environment in these communities. Circular economy practices not only enhance resource efficiency but also have the potential to yield more affordable and sustainable products and services, directly impacting the accessibility and affordability of goods. Additionally, emphasizing community engagement and education empowers LIDACs to actively participate in sustainable waste management, fostering a sense of environmental responsibility and community resilience.

SW3. Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential

Decreasing dependence on landfills through the increased integration of waste-to-energy technologies can create local employment opportunities within LIDACs, and by keeping materials out of landfills, can improve the air and water quality for communities that live nearby. However, such facilities also have the potential to generate local air pollution, so locating facilities near LIDACs has its own set of challenges and environmental justice issues. Generally, waste-to-energy facilities also contribute to a more sustainable energy landscape, potentially leading to reduced energy costs for residents in LIDACs.

CHAPTER 6
Stakeholder Engagement Activities

6.1 Engagement Summary

This engagement summary offers a comprehensive overview of the diverse activities carried out during the development of the PCAP. To ensure robust community involvement in shaping the PCAP, the plan contributors designed an engagement strategy aligned with the CPRG PCAP timeline, that can be continued and expanded on during CCAP engagement. As a result, the focus of the engagement process was directed towards forging connections with, and gaining feedback from, key stakeholders in Los Angeles and Orange counties through a number of targeted channels. Alignment with the program's core objectives and timeline remained a guiding principle throughout the engagement process.

Recognizing the CPRG program's emphasis on the swift rollout of programs and funding opportunities, the engagement process focused on identifying strategies that are existing, in advanced stages of development, or are realistically expected to be in place during the 2025-2030 timeframe. Strategies that offer significant benefits for LIDACs, or that can be adjusted to provide such benefits directly or indirectly were also a key focus of the engagement.

Engagement activities included workshops with community-based organizations (CBOs), development of a steering committee, participation in municipal meetings and agency committees throughout the region, events with city staff and elected officials, one-on-one meetings with stakeholders, and an online survey. Existing CAPs throughout the MSA were also reviewed to identify community feedback from LIDACs that could be integrated into the PCAP, and the subsequent CCAP.

Workshops with Community Based Organizations

Workshops have been conducted with CBOs from across Los Angeles county and Orange county and served to inform the CPRG planning process. These workshops engaged organizations specializing in key areas such as community development, environmental justice, climate change, climate justice, and workforce development. Within both Los Angeles county and Orange county, SCAG conducted two CBO workshops each between January and March 2024, with each workshop including representatives from six CBOs. Insights from these workshops helped inform the PCAP and will be incorporated into forthcoming implementation grant applications. This feedback will also inform the development of the CCAP and further engagement and outreach.

PCAP Steering Committee

A steering committee, comprising regional, county, and local agencies, was established to facilitate regional coordination, gather input, and engage with a range of stakeholders and decision-makers during the development of the PCAP (participating agencies are listed in **Table 6-1** below). Collectively the agencies in the Steering Committee represent a broad cross-section of the MSA's population, economy, and regional GHG emissions across a number of sectors. While they have a range of responsibilities and authorities, they also play a key role in planning and implementing local and regional sustainability efforts that are in alignment with CPRG goals and objectives. The Steering Committee was developed in order to leverage the combined technical expertise and collective engagement capacity of the member agencies under the compressed PCAP timeline. In order to garner broader regional feedback, a variety of engagement approaches were utilized to expand engagement beyond these core agencies.

TABLE 6-1. MSA STEERING COMMITTEE

Level of Government	Agencies
Regional	• Southern California Association of Governments (SCAG) • South Coast Air Quality Management District (SCAQMD)
County	• County of Los Angeles • County of Orange • Los Angeles Metropolitan Transportation Authority (Metro) • Orange County Transportation Authority (OCTA)
City	• Anaheim • Los Angeles • Long Beach

The member agencies of the Steering Committee also conducted engagement through key regional networks, such as the Los Angeles Regional Climate Collaborative, and small-group discussions to grow awareness of CPRG and generate feedback that was integrated into the PCAP. These network and small group discussions consisted of CBOs, academic institutions, and private sector entities, as well as individual cities and city departments.

Engagement with Municipalities and Stakeholder Agencies

Active engagement in municipal meetings and collaboration with agency committees across the region facilitated information gathering and feedback from local government staff and elected officials. This approach ensured alignment with regional objectives and helped garner support for regional action on GHG emissions reduction. Meetings and events held with municipalities and agencies were focused on sharing the goals and timeline of the CPRG program, emphasizing the importance of alignment between the PCAP and the expected implementation grant applications, highlighting the central goal of LIDAC benefits in the PCAP and any successful funding opportunities, and receiving feedback to inform the CPRG planning process and implementation applications.

Engagement efforts with these stakeholders took the form of informational presentations, discussion groups, stakeholder sessions, one-on-one meetings, and in-person convenings. The Steering Committee engaged with subregional Councils of Governments (COGs), agency committees, and other community organizations with a priority on those that represent LIDACs. Individual member agencies also leveraged established policy committees consisting of elected representatives as well as advisory committees consisting of community, academic, private sector, and agency officials to inform the PCAP.

LIDAC Engagement

Targeted engagement was conducted to help increase participation of LIDACs in the CPRG process. Recognizing that cities or jurisdictions with a high percentage of LIDACs often have limited capacity for climate action planning and grant administration, engaging with COGs representing these areas has been an important element in ensuring LIDAC feedback is incorporated into the PCAP. Due to the resource constraints of many of these cities, COGs functioned as an important forum to facilitate feedback, and COG engagement with cities that represent a high proportion of LIDACs was prioritized. This approach was particularly necessary and effective in Los Angeles county, which has a total of 88 cities. In Orange county a convening was held that was attended by staff and elected officials from a majority of its 34 cities to grow CPRG awareness, gather feedback, and facilitate coordination between entities.

Summary of Feedback Received

The following important insights were gained from the engagement process up to this stage.

- Regional collaboration is key for addressing climate change and related issues that require regional partnerships, such as air pollution and associated impacts that disproportionately burden LIDACs.
- Stakeholders were supportive of climate action generally and implementation measures specifically but expressed the importance of low-income and disadvantaged communities being able to access the benefits. Examples provided included the affordability of electric vehicles and availability of efficient and reliable charging infrastructure; the importance of reliable, frequent, safe, and fast transit service; and ensuring that investments focus on maintaining and/or enhancing the affordability of energy and housing.
- Communities are already experiencing the impacts of climate change. Stakeholders referenced more frequent and intense heat, storms, and flooding as the primary challenges faced, along with inadequate or underinvestment in infrastructure that exacerbate the impacts of climate change and extreme weather. These challenges combine to cause issues such as polluted run-off that brings contaminated materials into communities.
- Effective climate action will ensure that climate investments that result from the CPRG, or through other funding sources, will be structured to prioritize direct benefits to LIDACs that improve health, economic opportunities, and overall quality of life.

- In addition to health benefits from improved air quality, stakeholders mentioned reduced energy costs, improved mobility and access to high-quality transportation options, job creation, and improved living conditions in LIDACs as priority benefits.

6.2 Survey and Information Sharing

To further inform the CPRG planning process and resulting implementation grant applications, an on-going survey is being conducted, targeted at local jurisdictions to gather information on their climate action priorities and potential projects for which they may seek implementation grant funding. The results of this survey are regularly updated and shared on a dedicated CPRG webpage (hosted by SCAG) to inform the PCAP and function as a forum to share local and regional priorities and potential projects that could become parts of regional implementation grant applications.

6.3 Analysis of Existing CAPs

As noted above, insights drawn from past planning processes, especially CAPs, played a significant role in informing the CPRG and shaping the measures, strategies, and projects. Utilizing insights and lessons learned from previous efforts serves to leverage best practices during each phase of the planning process, especially as it relates to benefits to LIDACs.

The analysis of existing CAPs in the region has informed the MSA planning process and showed that roughly half of Orange county's 34 city governments have completed CAPs. Of these, approximately a third represent LIDACs. Of Los Angeles county's 88 cities, just over half have completed CAPs, and half represent LIDACs.

A number of more recently adopted CAPs that were reviewed such as Long Beach, Los Angeles County, and Palmdale demonstrate extensive engagement processes and informed measures and strategies that targeted and prioritized benefits to LIDACs. Examples of engagement techniques used in the development of these plans included workshops, surveys, focus groups and webinars. On the other hand, several older CAPs did not specifically target LIDAC benefits, but a substantial proportion of frequently occurring measures in these plans have potential to result in direct and indirect benefits to LIDACs during implementation. Each of the CAPs within the MSA is informed by dedicated engagement efforts. As a result, the policies and strategies they contain are able to provide context as to each community's priorities around climate action and GHG reduction measures.

Key Takeaways

Key takeaways from the analysis of existing CAPs include:

- A need to focus on LIDAC and frontline communities with the greatest impacts from climate change;
- The provision of a just transition to a low-carbon economy;
- Measures that address public health inequities; and
- Meaningful inclusion of communities in ongoing discussions and decision-making.

CHAPTER 7
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Appendix A

MSA Climate Planning

APPENDIX A
MSA Climate Planning

This appendix provides a summary of the climate-related plans within the Los Angeles-Long Beach-Anaheim MSA that were reviewed when developing the PCAP's GHG reduction measures. A thorough process was undertaken for identifying the most current climate-related plan for each jurisdiction and entity in the MSA. This work involved close coordination with the PCAP Steering Committee,[1] as well as review of digital resources and databases, including the California Climate Action Plan Database from the California Polytechnic State University, among other resources. **Table A-1** presents a summary of the MSA entities, entity types, and climate-related plans that were reviewed during development of the PCAP.

A comprehensive review of these plans informed the development of the GHG reduction measures presented in the PCAP. The MSA's diverse entities, entity types, and their respective climate plans offer valuable insights and comparisons for crafting the PCAP's measures, performance goals, and strategies. Examining the range of climate-related plans from each entity helps identify a variety of GHG emission reduction measures and strategies from regional and local levels. **Table A-2** presents a statistical summary of all uniquely identified GHG emission reduction strategies, measures, and actions from the climate-related plans in the MSA, classified by the PCAP's key sectors of energy, transportation, and solid waste. Each of these measures, strategies, and actions were reviewed and considered within the development of the PCAP's measures. The analysis helped determine the most suitable reduction measures for inclusion in the PCAP, with a focus on those that address emissions from energy, transportation, and solid waste sectors, as these present the greatest areas of opportunity for climate action and community co-benefits across the MSA.

Table A-3 lists the MSA plans reviewed for the purposes of this analysis and identifies key metrics for each, including the year developed, geographic reach, inventory years, target years, and targets set.

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1 The PCAP Steering Committee includes the following entities: Southern California Association of Governments (SCAG), South Coast Air Quality Management District (SCAQMD), Los Angeles County Metropolitan Transportation Authority (Metro), Orange County Transit Authority (OCTA), Los Angeles County, Orange County, City of Los Angeles, City of Long Beach, and City of Anaheim.

Table A-1. MSA Climate-Related Plans – Summary

Type	Title	Count
Entities		
City	City of Long Beach, City of Agoura Hills, City of Pasadena, City of Lancaster, City of Bellflower, City of Lawndale, City of Lomita, City of Manhattan Beach, City of Monterey Park, City of Norwalk, City of Palmdale, City of Palos Verdes Estates, City of Paramount, City of Beverly Hills, City of Burbank, City of Carson, City of Rancho Palos Verdes, City of Diamond Bar, City of Redondo Beach, City of Rolling Hills, City of Rolling Hills Estates, City of El Segundo, City of Gardena, City of Glendale, City of Hawthorne, City of Hermosa Beach, City of West Hollywood, City of Inglewood, City of Torrance, City of La Cañada Flintridge, City of Santa Clarita, City of Santa Monica	41
County	Los Angeles County	1
Utility	Anaheim Public Utilities, Southern California Edison	2
Port	Port of Los Angeles, Port of Long Beach	2
Airport	Los Angeles World Airports, Long Beach Airport, John Wayne Airport	3
Other Agency	South Coast Air Quality Management District, Southern California Association of Governments, Los Angeles County Metropolitan Transportation Authority, Metropolitan Water District of Southern California, California Air Resources Board	5
Plans		
Climate Action Plan	City of Bellflower CAP, City of Carson CAP, City of Diamond Bar CAP, City of El Segundo CAP, City of Fullerton CAP, City of Gardena CAP, City of Hawthorne CAP, City of La Cañada Flintridge CAP, City of La Habra CAP, City of Laguna Beach Climate Protection Action Plan, City of Lancaster CAP, City of Long Beach CAP, City of Manhattan Beach CAP, City of Monterey Park CAP, City of Palmdale CAP, City of Palos Verdes Estates CAP, City of Paramount CAP, City of Pasadena CAP, City of Rolling Hills CAP, City of San Clemente CAP, City of Santa Clarita CAP, City of South Pasadena CAP, City of Torrance CAP, City of West Hollywood CAP, County of Los Angeles CAP, John Wayne Airport CAP, Metropolitan Water District of Southern California CAP	27
Sustainability Plan	City of Glendale Sustainability Plan, City of Mission Viejo Sustainability Plan, L.A.'s Green New Deal, Long Beach Airport Sustainability Plan Outline, Moving Beyond Sustainability, Los Angeles World Airports Sustainability Report	6
Energy Efficiency and Climate Action Plan	City of Dana Point Energy Efficiency and Conservation Plan, City of Hermosa Beach EECAP, City of Inglewood Energy and Climate Action Plan, City of Lawndale EECAP, City of Lomita EECAP, City of Norwalk Energy Action Plan, City of Redondo Beach EECAP, City of Rolling Hills Estates EECAP	8
Climate Action/Adaptation Plan	City of Agoura Hills CAAP, City of Beverly Hills CAAP, City of Santa Ana Climate Adaptation Plan, City of Santa Monica CAAP, LA Metro CAAP	5
Greenhouse Gas Reduction Plan	Anaheim Public Utilities GHGRP, City of Burbank GHGRP, City of Rancho Palos Verdes Emissions Reduction Action Plan	3
Other	SCAQMD Air Quality Management Plan, SCAG Connect SoCal, San Pedro Bay Ports Clean Air Action Plan, CARB Scoping Plan, SCE’s Pathway 2045	5

Table A-2. Strategy, Measure, and Action Counts by Sector

Sector	Strategies	Measures	Actions
Energy	50	148	425
Transportation	44	125	435
Solid Waste	41	143	458
Total	**135**	**416**	**1,318**

Table A-3. MSA Climate-Related Plans – Key Metrics

Entity	Plan Type	Year	County	Inventory Years	Target Years	Targets
South Coast Air Quality Management District	Air Quality Management Plan (AQMP)	2022	Both	N/A	N/A	N/A
Southern California Association of Governments	Regional Transportation Plan/ Sustainable Communities Strategy (RTP/SCS)	2020	Both	N/A	N/A	N/A
Southern California Edison	Clean Power and Electrification Pathway	2017	Both	N/A	N/A	N/A
Metropolitan Water District of Southern California	Climate Action Plan (CAP)	2022	Both	1990, 2008, 2017	2030	2030: 40% below 1990 levels
California Air Resources Board	Scoping Plan	2022	Both	N/A	2030, 2045	2030: 40% below 1990 levels 2045: carbon neutrality
City of Long Beach	Climate Action Plan (CAP)	2022	Los Angeles	2015	2030, 2045	2030: 3.04 MTCO2e/SP; equivalent to a 50% reduction in emissions per SP from 2015 baseline 2045: net carbon neutral goal (aspirational)
City of Agoura Hills	Climate Action and Adaptation Plan (CAAP)	2022	Los Angeles	2018	2030	2030: 49% below 2005 to 2008 levels/ 36.9% below 2018 levels
City of Pasadena	Climate Action Plan (CAP)	2018	Los Angeles	2009, 2013	2020, 2030, 2035, 2050	2020: 27% below 2009 levels 2030: 49% below 2009 levels 2035: 59% below 2009 levels 2050: 83% below 2009 levels

Entity	Plan Type	Year	County	Inventory Years	Target Years	Targets
City of Lancaster	Draft Climate Action Plan (DCAP)	2016	Los Angeles	2010, 2015	2020, 2030, 2040, 2050	2020: 15% below 2010 levels 2030: 40% below the AB 32 target of 15% below baseline, consistent with EO B-30-15 2050: 80% below the AB 32 target of 15% below baseline, consistent with EO S-03-05
City of Bellflower	Climate Action Plan (CAP)		Los Angeles	2010	2020	2020: 17% below 2010 levels
City of Lawndale	Energy Efficiency Climate Action Plan (EECAP)	2015	Los Angeles	2005, 2007, 2010, 2012, 2014	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Lomita	Energy Efficiency Climate Action Plan (EECAP)	2015	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Manhattan Beach	Climate Action Plan (CAP)	2010	Los Angeles	2005, 2007	2012	2012: 20% below 2005 levels
City of Monterey Park	Climate Action Plan (CAP)	2012	Los Angeles	2009	2020, 2035	2020: 15% below 2009 levels 2035: 49% below 2009 levels
City of Norwalk	Energy Action Plan (EAP)	2015	Los Angeles	2010	2015, 2020, 2025	2015: 10% below 2010 levels 2020: 20% below 2010 levels 2025: 25% below 2010 levels
City of Palmdale	Climate Action Plan (2045 General Plan Chapter 14: Sustainability, Climate Action, and Resilience)	2022	Los Angeles	1990, 2005, 2017	2030, 2045	2030: 40% below 1990 levels 2045: carbon neutrality
City of Palos Verdes Estates	Climate Action Plan (CAP)	2018	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Paramount	Climate Action Plan (CAP)	2021	Los Angeles	2010	2030, 2040, 2050	2030: 21.4% below BAU forecast 2040: 30.2% below BAU forecast 2050: 41.2% below BAU forecast
City of Beverly Hills	Climate Action and Adaptation Plan (CAAP)	2022	Los Angeles	2019	2030, 2040, 2045	2030: 40% below 1990 levels 2040: 80% below 1990 levels 2045: achieve carbon neutrality (Assembly Bill 1279)
City of Burbank	Greenhouse Gas Reduction Plan (GHGRP)	2022	Los Angeles	2010, 2019	2030, 2035, 2045	2030: 49% below 2012 levels 2035: 66% below 2010 levels 2045: achieve carbon neutrality
City of Carson	Climate Action Plan (CAP)	2017	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels

Entity	Plan Type	Year	County	Inventory Years	Target Years	Targets
City of Rancho Palos Verdes	Emissions Reduction Action Plan (ERAP)	2017	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Diamond Bar	Climate Action Plan (CAP)	2019	Los Angeles	2016	2030, 2040	2030: 377,112 MTCO2e per year, 6.0 MTCO2e per capita per year 2040: 266,740 MTCO2e per year, 4.0 MTCO2e per capita per year
City of Redondo Beach	Energy Efficiency Climate Action Plan (EECAP)	2015	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Rolling Hills	Climate Action Plan (CAP)	2018	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Rolling Hills Estates	Energy Efficiency Climate Action Plan (EECAP)	2015	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of El Segundo	Climate Action Plan (CAP)	2017	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Gardena	Climate Action Plan (CAP)	2017	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Glendale	Sustainability Plan	2012	Los Angeles	2004, 2009	2025, 2030, 2035	2020: 8% below 2004 levels 2035: 13% below 2004 levels
City of Hawthorne	Climate Action Plan (CAP)	2017	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of Hermosa Beach	Energy Efficiency Climate Action Plan (EECAP)	2015	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of West Hollywood	Climate Action Plan (CAP)	2021	Los Angeles	2008, 2018	2025, 2035	2025: 47.5% below 2018 levels 2035: 68.4% below 2018 levels / carbon neutrality
City of Inglewood	Energy and Climate Action Plan (ECAP)	2013	Los Angeles	2005, 2007	2020, 2035	2020: 17% below BAU emissions 2035: 39% below BAU emissions
City of Torrance	Climate Action Plan (CAP)	2017	Los Angeles	2005, 2007, 2010, 2012	2020, 2035	2020: 15% below 2005 levels 2035: 49% below 2005 levels
City of La Cañada Flintridge	Climate Action Plan (CAP)	2016	Los Angeles	2007, 2014	2020, 2035	2020: 15% below 2007 levels 2035: 58% below 2007 levels
City of Santa Clarita	Climate Action Plan (CAP)	2012	Los Angeles	2005	2020	2020: 1,645,190 MT CO2e
City of Santa Monica	Climate Action and Adaptation Plan (CAAP)	2019	Los Angeles	1990	2030	2030: 80% below 1990 levels (carbon neutrality)

Entity	Plan Type	Year	County	Inventory Years	Target Years	Targets
County of Los Angeles	Climate Action Plan (CAP)	2023	Los Angeles	2015, 2018	2030, 2035, 2045	2030: 40% below 2015 levels 2035: 50% below 2015 levels 2045: 83% below 2015 levels
City of South Pasadena	Climate Action Plan (CAP)	2020	Los Angeles	2016	2030, 2045	2030: 2.9 MT CO2e per capita 2040: 0.0 MT CO2e per capita
Port of Los Angeles & Port of Long Beach	Clean Air Action Plan	2017	Los Angeles	N/A	N/A	2030: 40% below 1990 levels 2050: 80% below 1990 levels
Los Angeles World Airports	Sustainability Report	2022	Los Angeles	N/A	N/A	N/A
Long Beach Airport	Sustainability Plan Outline	2019	Los Angeles	N/A	N/A	N/A
LA Metro	Sustainability Strategic Plan	2020	Los Angeles	2017		
LA Metro	Climate Action and Adaptation Plan (CAAP)	2019	Los Angeles	2010, 2017	2030, 2050	2030: 79% below 2017 levels 2050: 100% (zero emissions) by 2050
City of Los Angeles	Sustainability Plan	2019	Los Angeles	2008	2025, 2035, 2045	2025: 50% below 1990 levels 2035: 73% below 1990 levels 2050: carbon neutral
John Wayne Airport	Climate Action Plan (CAP)	2018	Orange	2013	2025, 2030	
City of La Habra	Climate Action Plan (CAP)	2014	Orange	2010	2020, 2035	2020: 15% below 2010 emissions 2035: 30% below 2010 emissions
City of San Clemente	Climate Action Plan (CAP)	2012	Orange	2009	2020, 2030	2020: 14% (rounded to 15% for simplicity) below 2009 levels 2030: 37.7% (rounded to 40% for simplicity) below 2009 levels
City of Dana Point	Energy Efficiency and Conservation Plan (EECP)	2011	Orange	1990, 2004	2020, 2050	2020: 1990 levels 2050: 80% below 1990 levels
City of Laguna Beach	Climate Protection Action Plan (CPAP)	2009	Orange	1990	2050	2050: 80% below 1990 levels
City of Mission Viejo	Sustainability Action Plan (SAP)	2013	Orange	2008	2020, 2035	2020: 18% reduction from 2008 levels 2035: 27% reduction from 2008 levels
Anaheim Public Utilities	Greenhouse Gas Reduction Plan (GHGRP)	2020	Orange	2015, 2020	2045	2045: 100% clean energy profiles
City of Santa Ana	Climate Adaptation Plan	2015	Orange	2008	2020, 2035	2020: 15% below 2008 levels 2035: 30% below 2008 levels
City of Fullerton	Climate Action Plan (CAP)	2012	Orange	2009	2020	2020: 15% below 2009 levels

Appendix B

GHG Inventory and Forecast Methods

APPENDIX B
GHG Inventory and Forecast Methods

B.1 Purpose

This appendix describes the GHG inventory accounting methods for community-induced activities for calendar year 2018 for Los Angeles and Orange counties (henceforth referred to as "the MSA" unless otherwise specified). The 2018 inventory represents the baseline year for emissions forecasting and target-setting (as part of the forthcoming CCAP). Appendix B also presents methods for the BAU and adjusted BAU forecasts for 2030 and 2045. The document is organized into two sections corresponding with the following objectives:

- **Section B.2: 2018 Greenhouse Gas Emissions Inventory:** This section describes the methods for estimating baseline 2018 GHG emissions from community-induced activities and emissions sources. The community-scale inventory includes emissions from transportation, energy, and solid waste.
- **Section B.3: 2018 to 2045 Business-as-Usual Forecasts:** This section describes the approach for modeling the BAU scenario which projects future emissions based on current population and regional growth trends, land use growth patterns, and regulations or policies introduced before the 2018 inventory year. The BAU scenario demonstrates the growth in GHG emissions that would occur if no further action were to be taken by the MSA or the State of California after 2018.
- **Section B.4: 2018 to 2045 Adjusted Business-as-Usual Forecasts:** This section describes the approach for modeling the adjusted BAU scenario which projects future emissions based on current population and regional growth trends, land use growth patterns, and regulations or policies which began implementation before the 2018 inventory year. The adjusted BAU scenario also considers legislative actions and increases in efficiency expected through implementation of State actions.

B.2 2018 Greenhouse Gas Emissions Inventory

Introduction

The 2018 GHG emissions inventories for the MSA was developed using the Global Protocol for Community-scale GHG Emission Inventories (GPC).[1] This protocol is used for calculating and reporting emissions from community activities and sources from seven gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrous trifluoride (NF_3).[2] GHG emissions from these activities are organized into sectors. The protocol further offers two related frameworks—the Scopes Framework and the City-induced Framework—for reporting emissions from each sector:

Scopes Framework: This framework captures GHG emissions produced within a geographic boundary by categorizing emissions as scope 1, 2, and 3 emissions in each Sector:

- Scope 1: Emissions produced from activities and sources within the MSA boundaries.
- Scope 2: Emissions generated from the use of grid-supplied electricity, heat, steam and/or cooling within the MSA boundaries; and
- Scope 3: Emissions occurring outside the MSA boundaries due to activities taking place within the MSA boundaries.

City-induced Framework: This framework measures GHG emissions attributable to activities and sources within a geographic boundary and covers selected scope 1, 2, and 3 emissions from each sector. This framework offers two reporting levels:

- **BASIC:** Includes emissions from in-boundary transportation, building energy, and in-boundary generated waste.
- **BASIC+:** Includes all BASIC requirements as well as emissions from transmission and distribution grid losses; transboundary transportation; in-boundary generated waste emission sources; industrial processes and product use (IPPU); and agriculture, forestry, and other land use (AFOLU).

The 2018 GHG emissions inventories for the MSA use the City-induced BASIC Framework with global warming potential (GWP) values from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5)[3], unless otherwise specified. The inventory is prepared using sector-specific generation and resource consumption data for relevant sub-sectors included in the BASIC protocol. The accounting methods, data sources, and emission factors used for accounting 2018 emissions are detailed in the subsequent sections.

1 World Resources Institute, C40 Cities Climate Leadership Group, and ICLEI - Local Governments for Sustainability. *Global Protocol for Community-scale GHG Emission Inventories*, Version 1.1. December 2014. Available at: https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities. Accessed January 2021.

2 The GHG emissions inventories conducted for the PCAP capture CO_2, CH_4, and N_2O.

3 IPCC, Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 2014. Available at: https://archive.ipcc.ch/report/ar5/syr/. Accessed January 2021.

Transportation

The transportation emissions sector includes on-road transportation (passenger vehicles, trucks, and buses), off-road goods movement (ports, airports, cargo-handling equipment for rail, and transportation refrigeration units), and passenger rail. **Table B.1** presents emissions for the transportation sector. **Figure B.1** shows the contribution of each sub-sector to the transportation sector for both the County inventories within the MSA.

TABLE B.1 TRANSPORTATION GHG EMISSIONS BY COUNTY AND SUB-SECTOR

County / Sub-Sector	Emissions (MTCO2e)
Los Angeles	29,352,846
On-Road	27,968,741
Passenger Rail	82,136
Off-Road Goods Movement	1,301,969
Orange	9,579,313
On-Road	9,500,592
Passenger Rail	52,884
Off-Road Goods Movement	25,836
Total	38,932,159

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

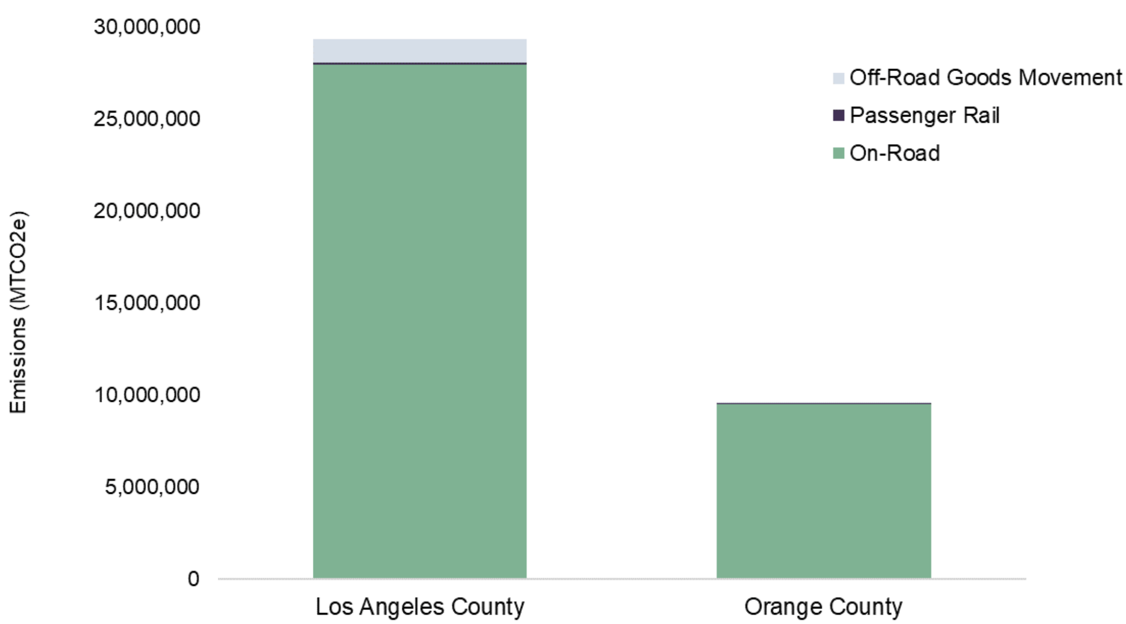

Figure B.1
Transportation GHG Emissions by County and Sub-Sector

On-Road Transportation

The on-road transportation subsector includes direct scope 1 tailpipe emissions from fuel combustion (gasoline, diesel, and natural gas) and indirect scope 2 electricity consumption in on-road passenger vehicles, trucks, and buses. Note that while MSA transit agencies have GHG inventories for the transportation services provided by the respective agencies, they do not estimate emissions by local jurisdiction. Therefore, bus emissions are independently estimated for the MSA. **Table B.2** presents activity data, and emissions for the on-road transportation sector. **Figure B.2** shows the contribution of each subsector to the on-road transportation sector for both the County inventories within the MSA.

Emissions from passenger vehicles and trucks are estimated based on daily vehicle trips and VMT by each vehicle type. VMT for the MSA is estimated using a trip-based travel forecasting model developed by SCAG. SCAG's 2016 Regional Travel Demand Model, the version for which a complete dataset was available at the time of modeling, was used by Fehr and Peers to analyze the transportation network and socioeconomic data such as population, household, and employment, to forecast daily vehicle trips and VMT for each traffic analysis zone (TAZ) within the MSA.[4]

TABLE B.2 ON-ROAD TRANSPORTATION ACTIVITY AND GHG EMISSIONS BY COUNTY AND VEHICLE TYPE

County / Vehicle Type	Activity (VMT/year)	Emissions (MTCO2e)
Los Angeles	68,329,818,521	27,968,741
Passenger	65,540,708,129	24,309,834
Truck	2,597,485,301	3,258,872
Bus	191,625,091	400,035
Orange	24,337,429,043	9,500,592
Passenger	23,394,483,408	8,440,618
Truck	914,467,688	1,001,663
Bus	28,477,947	58,312
Total	92,667,247,564	37,469,333

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled.

4 VMT estimates for large urban areas are commonly developed using regional travel demand models. These models are developed and periodically updated, calibrated, and validated for use in long range infrastructure planning, environmental impact assessments, and air quality conformity analyses by local and regional agencies. Trip-based travel forecasting models generate (output) daily vehicle trips for each TAZ across various trip purposes based on inputs such as the transportation network and socioeconomic data such as population, household, and employment. SCAG staff maintain a regional travel demand model that uses a four-step model process to arrive at a set of forecast vehicle trips based on the data described above.

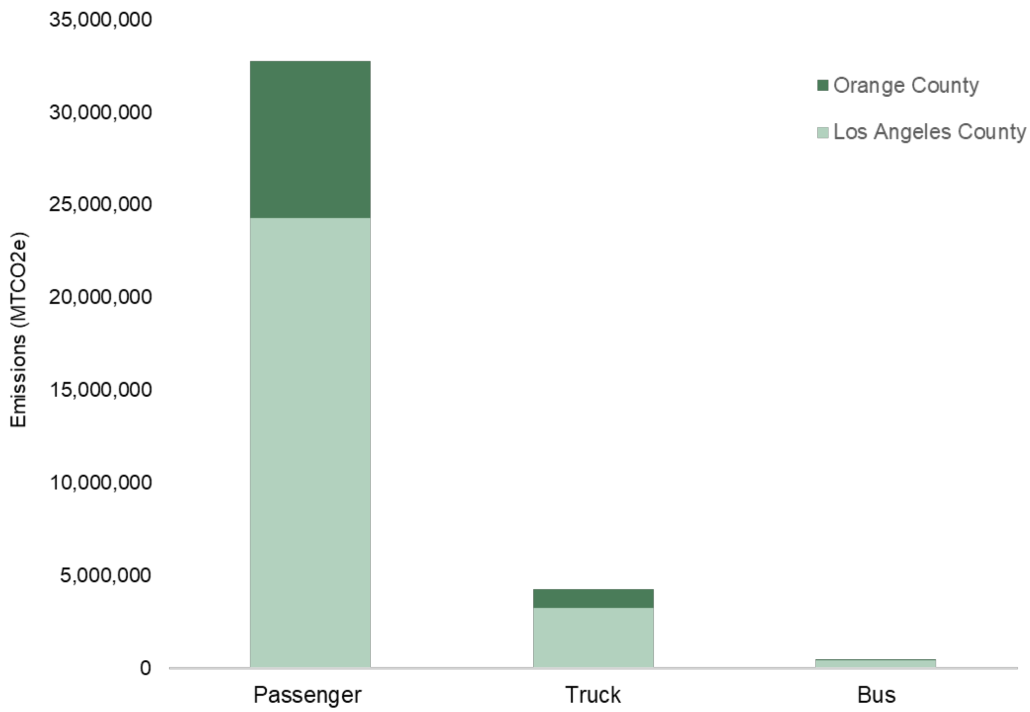

Figure B.2
On-Road Transportation Emissions by County and Vehicle Type

The 2016 SCAG model has a base year of 2012 and horizon year of 2040. VMT for the inventory year was linearly interpolated from the 2012 and 2040 model values. Daily VMT are estimated using the origin-destination analysis approach (Full Accounting Method). The Full Accounting Method accounts for VMT depending on where the trip is starting and ending. This method tracks (and "fully accounts" for) all the vehicle trips being generated by a geographic area (i.e., a city) across the entire regional network, and allows for the isolation of different types of VMT as follows.

- Internal-internal (II) VMT: Includes all trips that begin and end entirely within the geographic area of study.
- One-half of internal-external (IX) VMT: Includes one-half of trips with an origin within the geographic area of study and a destination outside of this area. This assumes that the geographic area under study shares half the responsibility for trips traveling to other areas.
- One-half of external-internal (XI) VMT: Includes one-half of trips with an origin outside of the geographic area of study and a destination within this area. Similar to the IX trips, the geographic area of study shares the responsibility of trips traveling from other areas.
- External-external (XX) VMT: Trips through the geographic area of study are not included. This approach is consistent with the concept used for the IX and XI trips. Therefore, the XX VMT would be assigned to other areas that are generating the trips.

The Full Accounting Method was utilized to develop the VMT estimates for the MSA because it more fully accounts for the length of regional travel generated in the MSA, not just the travel occurring on the MSA's in-boundary roadways, and is consistent with the GPC. As noted above, the inventory includes emissions from trips that begin and/or end within the MSA. It does not include through trips that neither begin nor end within the unincorporated areas. Daily VMT are then multiplied by 347 days for passenger vehicles, 312 days for trucks, and 327 days for buses to calculate annual VMT.[5] VMT was estimated for passenger vehicles (light-duty cars and trucks), trucks (medium- and heavy-duty trucks), and buses.

Emissions were calculated using CARB's EMission FACtors 2021 model (EMFAC2021). EMFAC2021 generates vehicle emission rates by area, year, vehicle type, fuel type, speed, and other parameters. EMFAC2021 was run for both Los Angeles and Orange Counties for 2018 in "emission rate" mode to generate vehicle travel emission factors for all vehicle types and fuel types for aggregated (average) speeds. The EMFAC vehicle type categories were aligned with the three categories of VMT provided by Fehr & Peers (passenger, truck, and bus).[6] The EMFAC emission factors by vehicle type and fuel assigned to passenger VMT, truck VMT, and bus VMT were then weighted using County-wide VMT and trip generation profiles for each vehicle type modeled in EMFAC2021.[7] **Table B.3** shows the emission factors used for each vehicle type. GHG emissions were then calculated by multiplying the weighted emission factors for passenger vehicles, trucks, and buses by the origin-destination VMT for passenger vehicles, trucks, and buses supplied by Fehr & Peers.

TABLE B.3 ON-ROAD TRANSPORTATION EMISSION FACTORS BY COUNTY AND VEHICLE TYPE

County / Vehicle Type	2018 Emission Factor (g CO2e/mile)
Los Angeles	
Passenger	370.9
Truck	1,254.6
Bus	2,087.6
Orange	
Passenger	360.8
Truck	1,095.4
Bus	2,047.6

Source: EMFAC2021

Abbreviations: g CO2e = grams of carbon dioxide equivalent

5 The annualization factor of 347 days for passenger vehicles, 312 days for trucks, and 327 days for buses were provided by Fehr & Peers to estimate annual vehicle activity based on daily vehicle activity generated by SCAG's 2016 Regional Travel Demand Model.

6 The "passenger vehicle" category corresponds to EMFAC vehicle categories LDA, LDT1, LDT2, MCY, and MDV. The "trucks" category corresponds to EMFAC vehicle categories LHDT1, LHDT2, MHDT, HHDT.

7 For example, if the LDA vehicle type represents 70% of VMT at an emission rate of 300 grams CO2 per mile and the LDT1 vehicle type represents 30% of VMT at an emission rate of 350 grams CO2 per mile, the VMT-weighted emission rate for LDA and LDT1 vehicles combined is calculated as follows: 70% * 300 + 30% * 350 = 315 grams CO2 per mile.

Data Sources

- 2016 SCAG Regional Travel Demand Model, provided by SCAG
- Fehr & Peers Modeling Analysis (September 2023)
- EMFAC2021 Model. Link: https://arb.ca.gov/emfac/emissions-inventory/c3a757e884363e857de19a89c291e03223b875bc

Passenger Rail

The Passenger Rail inventory includes emissions associated with Amtrak and Metrolink rail services. To calculate Metrolink emissions, locomotive fuel use was obtained from the National Transit Database and multiplied by a standard emission factor for diesel fuel. Metrolink emissions were separated by county based on operating route miles within Los Angeles and Orange counties, respectively.

Amtrak's total ridership, ridership by station, and total emissions were obtained from the agency's website. Amtrak emissions were calculated by apportioning Amtrak's total emissions to Los Angeles and Orange counties based on ridership share by station. Amtrak stations in Los Angeles include Burbank, Chatsworth, Glendale, Los Angeles, Pomona, and Van Nuys. Amtrak stations in Orange County include Anaheim, Fullerton, Irvine, San Clemente, San Juan Capistrano, and Santa Ana.

Data Sources

- Amtrak, Amtrak Sustainability Report FY2019. Link: https://media.amtrak.com/wp-content/uploads/2019/11/FY19-Year-End-Ridership.pdf
- Amtrak, California Station Ridership – Fact Sheet FY2019. Link: https://media.amtrak.com/wp-content/uploads/2019/11/FY19-Year-End-Ridership.pdf.
- Amtrak, National Ridership FY2019. Link: https://media.amtrak.com/wp-content/uploads/2019/11/FY19-Year-End-Ridership.pdf.
- Federal Transit Administration, National Transit Database, Energy Consumption by Transportation Agency. Link: https://www.transit.dot.gov/ntd/ntd-data
- Metrolink, Route Miles – Southern California Regional Rail Authority, 2018-2019 Fact Sheet. Link: https://metrolinktrains.com/globalassets/about/agency/facts-and-numbers/fact-sheet-for-website-q1-fy-19.pdf

Off-Road Goods Movement

Off-road goods movement is a subsector of transportation that includes emissions from ports, airports, cargo-handling equipment (CHE) associated with rail, and transportation refrigeration units (TRUs). On-road transportation emissions from goods movement are captured under the "Truck" category in the on-road transportation emissions subsector above.

Ports

The Ports emissions inventory includes ocean-going vessels, harbor craft, cargo-handling equipment, and locomotives associated with the Port of Los Angeles (POLA) and the Port of Long Beach (POLB). Emissions were incorporated from the POLA's and POLB's 2018 emissions inventories. On-road emissions from the ports' inventories were excluded to avoid double counting with the on-road transportation emissions already accounted for under the "On-Road Transportation" category, above.

Data Sources

- POLA, Inventory of Air Emissions – 2018. September 2019. Link: https://www.portoflosangeles.org/environment/air-quality/air-emissions-inventory
- POLB, Air Emissions Inventory – 2018. September 2019. Link: https://safety4sea.com/wp-content/uploads/2019/09/Port-of-Long-Beach-Air-Emissions-Inventory-2018-2019_09.pdf

Airports

The Airports emissions inventory includes Scope 1 and Scope 2 emissions from airport operations within LA and Orange Counties. The inventory accounts for emissions from Los Angeles International Airport (LAX), Long Beach Airport, Hollywood-Burbank Airport, Van Nuys Airport, and John Wayne Airport. Note that John Wayne Airport's inventory is for 2016 and emissions are assumed to remain constant for inventory year 2018.

Data Sources

- Los Angeles World Airports (LAWA), 2022. 2022 Sustainability Report. Link: https://www.lawa.org/lawa-sustainability/documents.
- John Wayne Airport General Aviation Improvement Program EIR, 2019. Section 4.4, Greenhouse Gas Emissions. Link: https://files.ocair.com/media/2020-12/DPEIR%20627%20JWA%20GIAP_4.4%20Green%20Gas%20Emissions.pdf?VersionId=hL96d16Y.E.XprCc8XOgmXgF9h6O5fQJ
- Hollywood-Burbank Airport reports emissions to the Airport Accreditation Program. Emissions were provided by Maggie Martinez, Director of Noise & Environmental Affairs at Hollywood-Burbank Airport on October 4, 2023.
- Long Beach Airport reports emissions to the Airport Accreditation Program. Emissions were provided by Gilbert Contreras, Administrative Analyst at Long Beach Airport on September 14, 2023.

Rail Cargo-Handling Equipment and Transportation Refrigeration Units

Rail CHE and TRU emissions were calculated using CARB's OFFROAD2021 Emissions Inventory Tool. OFFROAD2021 includes many offroad equipment types by sector and subsector. The "Cargo Handling Equipment" sector of OFFROAD2021 includes the subsectors "Port" and "Rail," the latter of which was used to estimate the rail CHE portion of the inventory. The "Transportation Refrigeration Unit" sector of OFFROAD2021 was used to estimate the TRU portion of the inventory. Total fuel consumption by sector and by county was provided in the OFFROAD2021 output and used to calculate the GHG emissions using standard emission factors for diesel fuel.

Data Sources

- CARB, OFFROAD2021 Emissions Inventory Tool. Link: https://arb.ca.gov/emfac/offroad/emissions-inventory/27f41a455acc47b709262cf6d03f59fdca541a13

Building Energy

This sector includes emissions from energy use (electricity and natural gas) in residential, commercial/institutional/agricultural, and manufacturing/industrial buildings. **Table B.4** presents scopes, activity data, and emissions for the building energy sector. **Figure B.3** shows 2018 GHG emissions from energy use by subsector. **Table B.5** presents the emission factors used for each utility.

TABLE B.4 BUILDING ENERGY ACTIVITY AND GHG EMISSIONS BY COUNTY AND SUBSECTOR

Region / Land Use Type	Activity (MMBtu)	Emissions (MTCO2e)
Los Angeles County	356,224,244	27,364,704
Single-Family Residential	102,606,207	7,226,786
Multi-Family Residential	83,349,729	5,994,731
Commercial	115,292,794	10,097,726
Industrial	54,975,514	4,045,461
Orange County	134,475,844	8,777,970
Single-Family Residential	37,244,041	2,329,913
Multi-Family Residential	20,190,996	1,278,106
Commercial	45,281,915	2,999,573
Industrial	31,758,892	2,170,378
MSA	490,700,088	36,142,674
Single-Family Residential	139,850,248	9,556,699
Multi-Family Residential	103,540,725	7,272,837
Commercial	160,574,708	13,097,299
Industrial	86,734,406	6,215,839

Abbreviations: MMBtu = million British thermal units; MTCO2e = metric tons of carbon dioxide equivalent

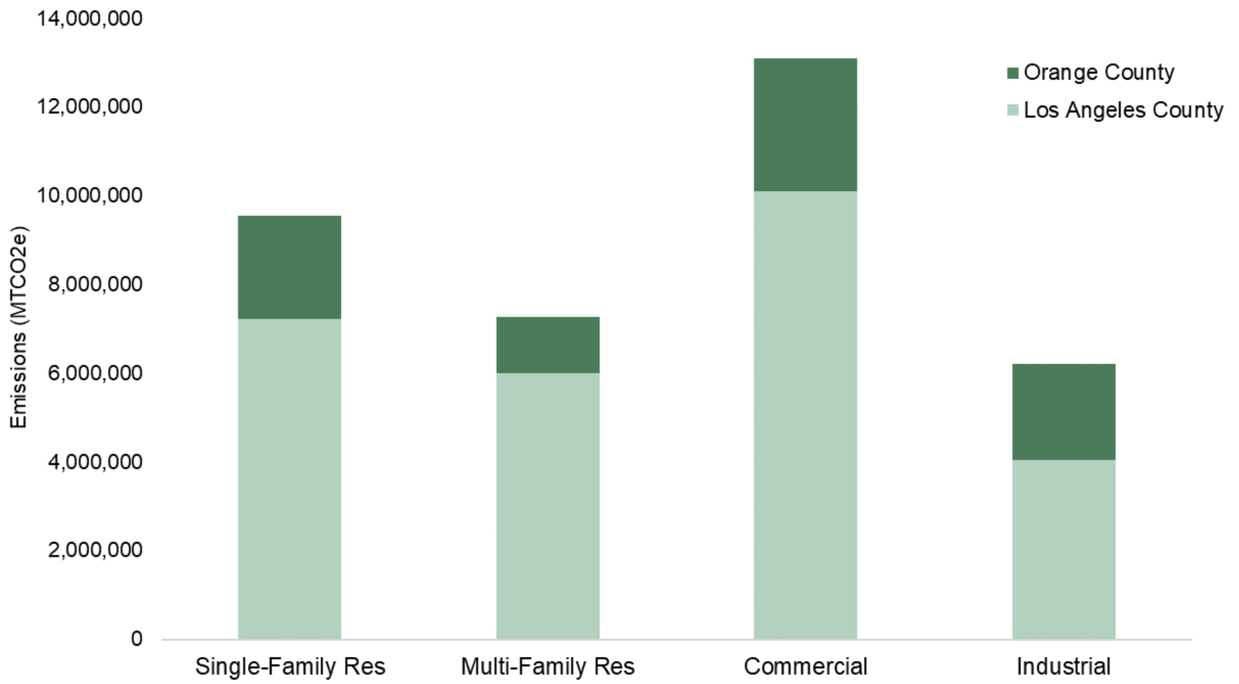

Figure B.3
Building Energy Emissions by County and Subsector

Table B.5 Electricity Emission Factor by Utility

Region / Utility	Emission Factor (lbs CO2e per MWh)
Los Angeles County	
SCE	513.0
CPA - Lean	10.6
CPA - Clean	9.8
CPA - Green	0.0
LADWP	1,131.0
Pasadena Water & Power	1,519.0
Azusa	575.9
Burbank Water & Power	992.1
Glendale Water & Power	683.4
City of Industry	575.9
City of Vernon	575.9
Orange County	
SCE	513.0
SDG&E	664.0
Anaheim Public Utility	1,044.0

Residential Buildings

This category includes direct emissions from the consumption of natural gas and indirect emissions from grid-supplied electricity consumed by residential buildings in the MSA. Direct GHG emissions from natural gas consumption in residential buildings are calculated using SoCalGas natural gas consumption data and emission factors from the Climate Registry. Indirect GHG emissions from electricity consumption in residential buildings are calculated using data provided by Southern California Edison (SCE), Clean Power Alliance (CPA), Anaheim Public Utility, San Diego Gas & Electric (SD&GE), the CEC, and the EPA,[8] including electricity consumption, emission factors, and power mix. Emissions associated with transmission and distribution losses are accounted using a loss factor of 4.8 percent for California from the EPA's eGRID2018 Summary Table (WECC California subregion).

Data Sources

- Natural gas and electricity consumption data provided by SCE, SoCalGas, SDG&E, and Anaheim Public Utility
- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- The Climate Registry, 2018 Default Emission Factors. Link: https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf
- EPA eGRID. Link: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Commercial and Institutional Buildings

This category includes direct emissions from the consumption of natural gas and indirect emissions from grid-supplied electricity consumed by non-residential buildings including commercial, municipal, institutional (such as schools, hospitals, and other public facilities), and agricultural buildings. Direct GHG emissions from natural gas consumption in non-residential buildings are calculated using SoCalGas natural gas consumption data and emission factors from The Climate Registry.

In June 2018, non-residential customers in participating cities were automatically enrolled in the CPA. The CPA is a community choice aggregation (CCA) which provides electricity to Los

[8] CEC's Power Content Labels were used to obtain emission factors for utilities that did not disclose their emission factors on their respective websites. These utilities include LADWP, Pasadena Water & Power, Burbank Water & Power, and Glendale Water & Power. EPA's eGRID tool was used for City of Azusa, City of Industry, and City of Vernon due to unavailability of utility-specific data.

Angeles and Ventura Counties. For purposes of the 2018 GHG inventory, it is assumed that half the annual electricity consumption is attributed to SCE and half to CPA because full CPA enrollment for non-residential customers was not completely in effect until 2019. Under the Clean rate option in 2018, non-residential customers received 61 percent of their electricity from eligible renewable sources via the CPA, 26 percent from carbon-free sources like hydropower, and 13 percent from unspecified fossil-fuel sources like natural gas and coal. GHG emissions from CPA-provided electricity are calculated using CPA data including electricity consumption, emission factors, and power mix. Emissions associated with transmission and distribution losses are accounted using a loss factor of 4.8 percent for California from the U.S. EPA's eGRID2018 Summary Table (WECC California subregion).[9]

Data Sources

- CPA Member Status Report (as of January 2019). Link: https://cleanpoweralliance.org/agendas-minutes/
- Natural gas and electricity consumption data provided by SCE, SoCalGas, SDG&E, and Anaheim Public Utility
- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- The Climate Registry, 2018 Default Emission Factors. Link: https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf
- EPA eGRID. Link: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Manufacturing and Industrial Buildings

This category includes direct emissions from the consumption of natural gas and indirect emissions from grid-supplied electricity consumption in manufacturing and industrial buildings.

GHG emissions from natural gas and electricity consumption are estimated using the same assumptions and methods stated under Commercial and Institutional Buildings above.

Data Sources

- CPA Member Status Report (as of January 2019). Link: https://cleanpoweralliance.org/agendas-minutes/

9 EPA, eGRID. 2018. Available at: https://www.epa.gov/egrid. Accessed January 2021.

- Natural gas and electricity consumption data provided by SCE, SoCalGas, SDG&E, and Anaheim Public Utility
- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- The Climate Registry, 2018 Default Emission Factors. Link: https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf
- EPA eGRID. Link: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid

Solid Waste

Los Angeles County

Emissions generated at landfills by solid waste generated within Los Angeles County are reported under the solid waste sector. GHGs from solid waste are comprised mainly of CH_4 emissions with a small percentage being attributed to CO_2 as a result of methane oxidizing in the cover soil of a landfill.

Landfill-related emissions are estimated using CARB's first order of decay (FOD) model, based on waste disposal tonnage and composition data from CalRecycle's Solid Waste Information System (SWIS) and Los Angeles County Public Works Solid Waste Information Management System (SWIMS) reports. Using these reports, County disposal tonnage data were obtained for 62 open and closed landfills where County residents and businesses disposed their municipal solid waste prior to 2018.

Most of the 62 in- and out-of-county landfills used by County residents and businesses have landfill gas (LFG) collection systems with combustion control. These systems collect LFG for flaring, energy production, or for producing liquified natural gas (LNG), CNG and producer gas. GHG emissions from landfill gas collection are estimated based on LFG collection rate, LFG flow to energy, and methane content from CalRecycle's 2010 Landfill Gas Master. To determine Los Angeles County's share of methane removal at these landfills (since many other jurisdictions contribute waste to these same landfills), total emissions from these landfills were apportioned based on waste disposed in the landfills by Los Angeles County versus California. California's disposal tonnage data are obtained using CalRecycle's SWIS reports for statewide disposal at the same facilities, where County residents and businesses deposited municipal solid waste between 1998 and 2018. The same was done to estimate the County's share of emissions at these landfills.

However, if the methane is recovered (via biogas or digester gas) and used for electricity generation, then the emissions are reported under the stationary energy sector as waste-to-energy facilities or biomass and auxiliary power facilities.

Orange County

Solid waste disposal tonnage for 2018 was provided by Orange County Waste and Recycling. The disposed waste tonnage for each year was characterized using data from CalRecycle. Emission factors for each waste category, in units of metric tons of CH_4 per ton of waste, were obtained from the ICLEI Community Protocol. These emission factors were then applied to the characterized solid waste data to estimate GHG emissions associated with disposal of waste in the landfill.

Table B.5 presents scopes, activity data, and emissions for the water and wastewater sector. **Figure B.4** shows 2018 GHG emissions from solid waste by county.

TABLE B.5 SOLID WASTE ACTIVITY AND GHG EMISSIONS BY COUNTY

County	Activity (tons/year)	Emissions (MTCO2e)
Los Angeles	9,625,184	4,205,841
Orange	3,181,789	1,359,771
Total	12,806,973	5,565,612

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

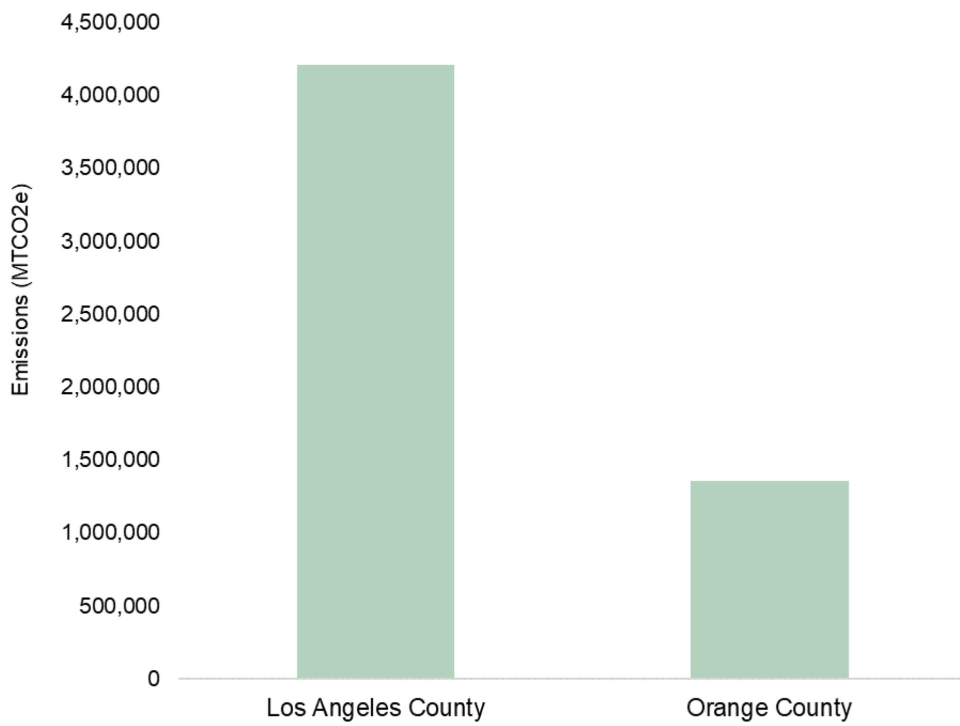

Figure B.4
Solid Waste Emissions by County

Data Sources

- CARB FOD Model. Link: https://ww2.arb.ca.gov/resources/documents/landfill-methane-emissions-tool
- CalRecycle SWIS Reports. Link: https://www2.calrecycle.ca.gov/SolidWaste/Site/Search
- LADPW SWIMS Reports. Link: https://dpw.lacounty.gov/epd/swims/OnlineServices/reports.aspx
- Calrecycle 2018 Disposal Facility Based Characterization of Solid Waste in California. Link: https://www2.calrecycle.ca.gov/Publications/Details/1666
- CalRecycle Landfill Gas Master. Link: https://www2.calrecycle.ca.gov/PublicNotices/Documents/1642

B.3 Business-as-Usual Forecasts

This section describes the approach for modeling BAU emissions, which represents future emissions based on current population and regional growth trends, land use growth patterns, and regulations or policies which began implementation before the 2018 baseline year. The BAU scenario demonstrates the growth in GHG emissions that would occur if no further action were to be taken by the MSA, State, or Federal Government after 2018. The BAU forecast serves as a reference point for other forecasting scenarios, which includes the Adjusted BAU that incorporates State regulations.

Each sector of the inventory was forecasted to 2030 and 2045 using the SED obtained from the SCAG Transportation Model, which was used by Fehr & Peers to model future VMT and which uses SED from the 2016 SCAG RTP/SCS.[10] Population, housing, and employment data were available for 2016 and 2040, which were interpolated and extrapolated upon to obtain 2018, 2030, and 2045 SED for each jurisdiction within the MSA.

In addition, changes were made to the 2016 SCAG model inputs to reflect more recent Work from Home (WfH) assumptions. The WfH assumptions, provided by SCAG, were used to develop an estimate of WfH conditions in 2040 for each household income range included in the 2016 SCAG model. The 2040 SCAG model was then updated to reflect these WfH assumptions for use in the VMT inventory estimates.[11] **Table B.6** presents the SED used for the BAU forecast, while **Table B.7** indicates which sets of socioeconomic and activity data were used to forecast each sector.

Transportation

Table B.8 presents emissions for 2018 along with the BAU forecast for 2030 and 2045 for the transportation sector.

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10 Fehr & Peers, 2023. 2016 SCAG Regional Travel Demand Model, County of Los Angeles and Orange population, housing, and employment data for 2012 and 2040. This SED data is also used by the South Coast Association of Government's 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) to forecast future conditions.

11 See Attachment A for more information regarding VMT modeling assumptions.

TABLE B.6 LOS ANGELES AND ORANGE COUNTY SOCIOECONOMIC DATA

County / Metric	2018	2030	2045
Los Angeles			
Population	10,235,862	10,930,226	11,798,181
Households	3,421,269	3,706,415	4,062,847
Employment	4,514,958	4,900,480	5,382,382
Service Population	14,750,820	15,830,706	17,180,564
Orange			
Population	3,200,309	3,342,166	3,519,488
Households	1,045,118	1,103,603	1,176,709
Employment	1,666,132	1,793,125	1,951,866
Service Population	4,866,441	5,135,291	5,471,354

Note: Service population is the sum of population and employment.
Source: Fehr & Peers, 2023.

TABLE B.7 2030 AND 2045 FORECASTING METHODS BY SECTOR

Sector	Data Forecasted	Socioeconomic Metric Used
Transportation	Vehicle miles traveled (VMT)	Population, Households, Employment
Residential Energy	Electricity consumption (MWh) and natural gas consumption (therms)	Households
Non-Residential Energy	Electricity consumption (MWh) and natural gas consumption (therms)	Service Population
Solid Waste	Waste disposed (tons)	Service Population

TABLE B.8 TRANSPORTATION GHG EMISSIONS BY SUBSECTOR – 2018 INVENTORY AND BAU FORECASTS

County / Sub-Sector	Emissions by Year (MTCO2e)		
	2018	2030	2045
Los Angeles	29,352,846	29,202,880	29,167,457
On-Road	27,968,741	27,705,842	27,508,264
Passenger Rail	82,136	88,149	95,665
Off-Road Goods Movement	1,301,969	1,452,554	1,728,142
Orange	9,579,313	9,316,614	9,038,534
On-Road	9,500,592	9,232,306	8,943,098
Passenger Rail	52,884	55,806	59,458
Off-Road Goods Movement	25,828	28,446	35,862
Total	38,932,159	38,519,494	38,205,990

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

On-Road Transportation

Table B.9 presents emissions for 2018 along with the BAU forecast for 2030 and 2045 for the on-road transportation subsector.

TABLE B.9 ON-ROAD TRANSPORTATION GHG EMISSIONS – 2018 INVENTORY AND BAU FORECASTS

County	Emissions by Year (MTCO2e)		
	2018	2030	2045
Los Angeles	27,968,741	27,705,842	27,508,264
Orange	9,500,592	9,232,306	8,943,098
Total	37,469,333	36,938,149	36,451,363

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

VMT from passenger vehicles and trucks were estimated using SCAG's 2016 Regional Travel Demand Model, which forecasts VMT for the year 2040. This model is a trip-based travel forecasting model that generates daily vehicle trips for each TAZ across various trip purposes based on inputs such as the transportation network and socioeconomic data such as population, household, and employment. VMT was provided by F&P for years 2016 and 2040 and was linearly interpolated for 2030. VMT for year 2045 was linearly extrapolated based on the 2016 to 2040 VMT projection.

GHG emissions are calculated using VMT and the weighted emission factors for 2018 by vehicle type (passenger vehicles, trucks, and buses)[12] from the EMFAC2021 model (see transportation section above for discussion).[13] The 2018 emission factor was applied to every years 2030 and 2045 VMT to represent no changes in the vehicle fleet due to federal, state, or local action.

Data Sources

- EMFAC2021 Model. Link: https://arb.ca.gov/emfac/emissions-inventory/c3a757e884363e857de19a89c291e03223b875bc
- SCAG Regional Travel Demand Model. Provided by SCAG via Fehr & Peers.
- Fehr & Peers Modeling Analysis (September 2023)

Passenger Rail

Passenger rail emissions were calculated by forecasting 2018 emissions using service population data for each of the Counties for year 2030 and 2045.

[12] Passenger vehicles correspond to EMFAC categories LDA, LDT1, LDT2, MCY, and MD. Trucks correspond to EMFAC categories LHDT1, LHDT2, MHDT, HHDT, and MH.

[13] CARB, EMFAC2021 Model. 2021. Available at: https://arb.ca.gov/emfac/emissions-inventory/4c9f04282a1f85d62a27721058b5a3bb6fd22fb9. Accessed October 2021.

Off-Road Goods Movement

Table B.10 presents emissions for 2018 along with the BAU forecast for 2030 and 2045 for the off-road goods movement sector.

TABLE B.10 OFF-ROAD GOODS MOVEMENT GHG EMISSIONS – 2018 INVENTORY AND BAU FORECASTS

County	Emissions by Year (MTCO2e)		
	2018	2030	2045
Los Angeles	1,301,969	1,408,889	1,563,527
Orange	25,836	28,502	35,978
Total	1,327,805	1,437,391	1,599,504

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

Ports

Port emissions were calculated by forecasting 2018 emissions using service population data for each of the Counties for year 2030 and 2045, with the exception of CHE, which is forecasted using OFFROAD2021 outputs for years 2030 and 2045.

Airports

Airport emissions were calculated by forecasting 2018 emissions using service population data for each of the Counties for year 2030 and 2045.

Cargo-Handling Equipment – Rail and Transportation Refrigeration Units

Rail CHE and TRU emissions are forecasted using OFFROAD2021 output. For each equipment type, the average 2018 emission rate (MTCO2e/hour) was determined and applied to the 2030 and 2045 activity data (hours).

Building Energy

Table B.11 presents emissions for 2018 along with the BAU forecast for 2030 and 2045 for the building energy sector.

TABLE B.11 BUILDING ENERGY GHG EMISSIONS – 2018 INVENTORY AND BAU FORECASTS

County	Emissions by Year (MTCO2e)		
	2018	2030	2045
Los Angeles	27,364,704	29,595,524	32,384,296
Orange	8,777,970	9,401,786	10,076,483
Total	36,142,674	38,997,310	42,460,779

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

Residential Buildings

Energy consumption (electricity and natural gas) in residential buildings is forecasted based on the growth rate of households between 2018 and 2030 or 2045, respectively. The 2018 emission factors for electricity generation and natural gas combustion were applied to 2030 and 2045 activity data to represent no changes in the average energy efficiency of buildings within the MSA due to federal, state, or local action.

Data Sources

- Electricity and natural gas consumption data provided by SCE, SoCalGas, SDG&E, and Anaheim Public Utility
- SCE Emission Factor. Link: https://www.edison.com/content/dam/eix/documents/sustainability/eix-esg-pilot-quantitative-section-sce.pdf
- CPA Emission Factor. Link: https://www.theclimateregistry.org/our-members/cris-public-reports/
- CPA Member Status Report (July 28, 2021). Provided by CPA via LA County CSO.
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- The Climate Registry, 2018 Default Emission Factors. Link: https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf
- EPA eGRID. Link: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid
- Climate Registry Information System (CRIS). Link: https://cris4.org/(S(zr3twbbnour5a5jfb1iykcxa))/frmLILogin.aspx
- UCLA analysis of LA County Parcel Assessor’s Data. Provided by UCLA Institute of Environmental Studies.

Commercial, Institutional, Manufacturing, and Industrial Buildings

Energy consumption (electricity and natural gas) in commercial, institutional, manufacturing, and industrial buildings is forecasted based on the growth rate of service population between 2018 and 2030 or 2045, respectively. The 2018 emission factors for electricity generation and natural gas combustion were applied to 2030 and 2045 activity data to represent no changes in the energy efficiency of buildings due to federal, state, or local action.

Data Sources

- CPA Member Status Report (as of January 2019). Link: https://cleanpoweralliance.org/agendas-minutes/
- Electricity and natural gas consumption data provided by SCE, SoCalGas, SDG&E, and Anaheim Public Utility

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- CPA Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- The Climate Registry, 2018 Default Emission Factors. Link: https://www.theclimateregistry.org/wp-content/uploads/2018/06/The-Climate-Registry-2018-Default-Emission-Factor-Document.pdf
- EPA eGRID. Link: https://www.epa.gov/energy/emissions-generation-resource-integrated-database-egrid
- UCLA analysis of LA County Parcel Assessor's Data. Provided by UCLA Institute of Environmental Studies.

Solid Waste

BAU emissions are forecasted for the years 2030 and 2045 for emissions generated at landfills by solid waste generated within the MSA and are reported under the solid waste sector. **Table B.12** presents emissions for 2018 along with the BAU forecast for 2030 and 2045 for the solid waste sector.

TABLE B.12 SOLID WASTE GHG EMISSIONS – 2018 INVENTORY AND BAU FORECASTS

County	Emissions by Year (MTCO2e)		
	2018	2030	2045
Los Angeles	4,205,841	4,506,798	4,882,995
Orange	1,359,771	1,433,598	1,525,883
Total	5,565,612	5,940,397	6,408,877

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

Emissions from solid waste in Los Angeles and Orange Counties were calculated by forecasting 2018 emissions using service population data for each jurisdiction within the Counties for year 2030 and 2045. Emission factors, diversion rates, and methane capture rates are assumed to remain constant.

Data Sources

- SCAG Regional Travel Demand Model. Provided by SCAG via Fehr & Peers.

Summary Emissions

Table B.13 and **Figure B.5** present total MSA GHG emissions for all sectors for the 2018 GHG inventory and the 2030 and 2045 BAU forecasts.

TABLE B.13 GHG EMISSIONS SUMMARY BY SECTOR AND SUBSECTOR – 2018 INVENTORY AND BAU FORECASTS

Region / Sector	Emissions by Year (MTCO2e)		
	2018	2030	2045
Los Angeles County	60,923,391	63,305,202	66,434,747
Transportation	29,352,846	29,202,880	29,167,457
Energy	27,364,704	29,595,524	32,384,296
Solid Waste	4,205,841	4,506,798	4,882,995
Orange County	19,717,054	20,151,998	20,640,899
Transportation	9,579,313	9,316,614	9,038,534
Energy	8,777,970	9,401,786	10,076,483
Solid Waste	1,359,771	1,433,598	1,525,883
MSA	80,640,445	83,457,200	87,075,646
Transportation	38,932,159	38,519,494	38,205,990
Energy	36,142,674	38,997,310	42,460,779
Solid Waste	5,565,612	5,940,397	6,408,877

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

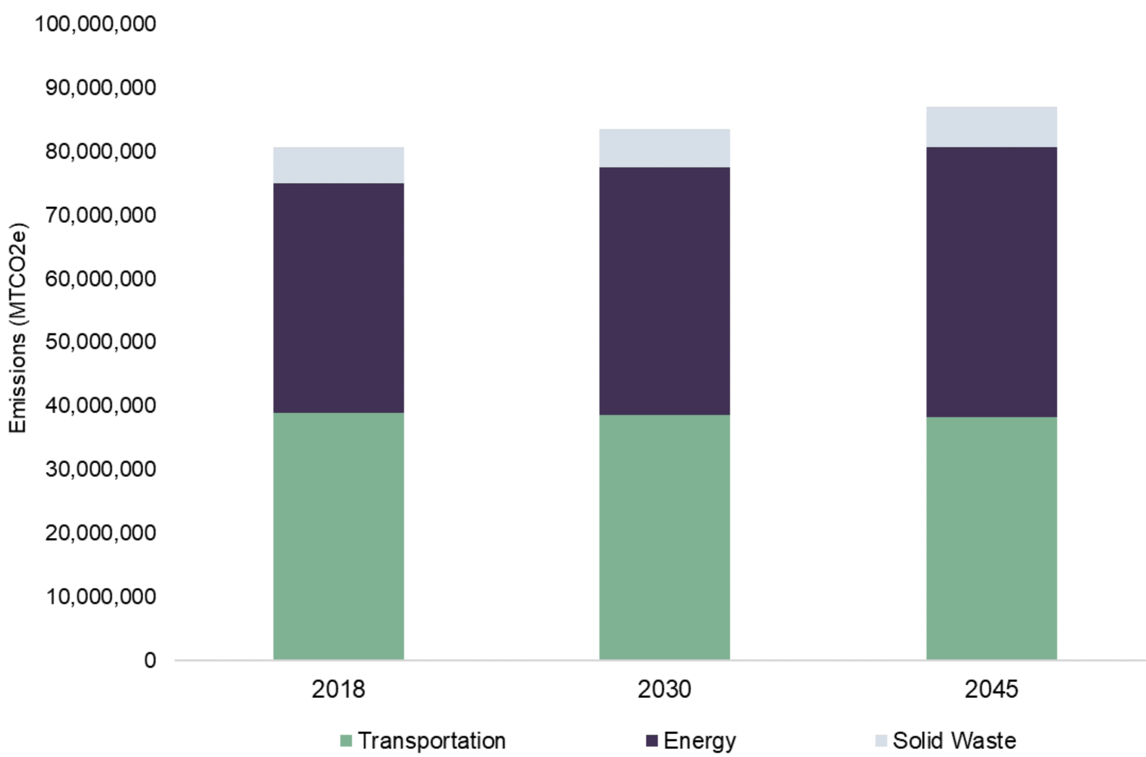

Figure B.5
Total Inventory and BAU Forecast Emissions by Sector and Subsector

B.4 Adjusted Business-as-Usual Forecasts

Like the standard BAU forecast, the Adjusted BAU forecast provides an estimate of future emission levels based on the continuation of existing trends in demographic growth (such as population and housing), activity or resource consumption (such as electricity use), technology changes, and regulation. Unlike the BAU forecast, the Adjusted BAU forecast accounts for expected outcomes of federal, state, and local measures. Specifically, the Adjusted BAU forecast includes the following programs and policies:

- California's Renewable Portfolio Standard (RPS) program, Senate Bill 100 (SB 100), and Senate Bill 1020 targets for renewable energy;
- Advanced Clean Cars I and Pavley;
- CALGreen Title 24 energy efficiency standards and;
- Senate Bill 1383 (SB 1383)

Each of these adjustments are explained in the following sections.

Regulatory Actions

Renewables Portfolio Standard and SB 100

The Clean Energy and Pollution Reduction Act of 2015, or Senate Bill 350 (Chapter 547, Statutes of 2015) was approved by Governor Brown on October 7, 2015. SB 350 increased the standards of the California RPS program by requiring that the amount of electricity generated and sold to retail customers per year from eligible renewable energy resources be increased from 33% to 50% by December 31, 2030. On September 10, 2018, Governor Brown signed SB 100, establishing that 100% of all electricity in California must be obtained from renewable and zero-carbon energy resources by December 31, 2045. SB 100 also creates new standards for the RPS goals that were established by SB 350 in 2015. Specifically, the bill increases required energy from renewable sources for both investor-owned utilities and publicly owned utilities from 50% to 60% by 2030. Incrementally, these energy providers must also have a renewable energy supply of 33% by 2020, 44% by 2024, and 52% by 2027. The updated RPS goals are considered achievable, since many California energy providers are already meeting or exceeding the RPS goals established by SB 350. The Adjusted BAU forecasts accounts for these renewable energy targets, as discussed below.

To account for California's RPS targets under SB 100 in the Adjusted BAU forecast, the GHG emission factors for electricity consumption were adjusted. These emission factors represent indirect GHG emissions generated at power plants and are applied to electricity consumption in the City. The RPS has the effect of lowering indirect emissions associated with electricity consumption because it mandates increasing percentages of renewable sources of power supplied by electricity utilities in future years. The RPS requires 60% eligible renewables by 2030 and 100% carbon-free by 2045.[14]

To adjust for the RPS in future years, indirect electricity emission factors reported for each utility within the MSA, along with the energy power mix, were collected for the years 2018–2021. The CEC reports power mix data in Power Content Labels; these are available through 2021 for all utilities.[15] Based on data reported for 2018–2021, a composite “non-RPS” emission intensity factor was generated for each year. This factor is calculated based on the reported total emission factor and the non-RPS power mix. Then, for each forecast year (2030 and 2045), an emission factor for total delivered electricity was calculated based on these composite “non-RPS” emission intensity factors for each reported year and the projected RPS requirement for eligible renewables for each year.

Pavley Vehicle Standards and Advanced Clean Cars I

In 2002, Governor Gray Davis signed AB 1493. AB 1493 requires that CARB develop and adopt, by January 1, 2005, regulations that achieve “the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks and other vehicles determined by CARB to be vehicles whose primary use is noncommercial personal transportation in the State.” To meet the requirements of AB 1493, in 2004 CARB approved amendments to the California Code of Regulations, adding GHG emissions standards to California’s existing standards for motor vehicle emissions. All mobile sources are required to comply with these regulations as they are phased in from 2009 through 2016. These regulations are known as the Pavley standards (named for the bill’s author, State Senator Fran Pavley).

In January 2012, pursuant to Recommended Measures T-1 and T-4 of the Original Scoping Plan, CARB approved the Advanced Clean Cars I Program, an emissions-control program for model year 2017 through 2025. The program combines the control of smog, soot, and GHGs with requirements for greater numbers of zero-emission vehicles. By 2025, when the rules will be fully implemented, the new automobiles will emit 34 percent fewer global warming gases and 75 percent fewer smog-forming emissions. The program also requires car manufacturers to offer for sale an increasing number of zero-emission vehicles (ZEVs) each year, including battery electric, fuel cell, and plug-in hybrid electric vehicles. In December 2012, CARB adopted regulations allowing car manufacturers to comply with California's GHG emissions requirements for model years 2017–2025 through compliance with the EPA GHG requirements for those same model years.[16] The Adjusted BAU forecasts accounts for these vehicle fleet efficiency standards, as discussed below.

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[14] RPS-eligible resources include solar, wind, geothermal, small hydroelectric, or biopower facilities that are located within the Western Electricity Coordinating Council (WECC) region, which encompasses fourteen western U.S. states and portions of Canada and Mexico. The majority of RPS-eligible electricity currently comes from solar and wind. Large hydroelectric dams and nuclear facilities, two major sources of carbon-free power, are not RPS-eligible.

[15] California Energy Commission (CEC), Power Content Labels, 2021. https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label/annual-power-1. Accessed January 2024.

[16] Advanced Clean Car I program information available online at: https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/about. Accessed January 2024.

CAL Green (Title 24 Building Energy Efficiency Standards)

The CEC first adopted Energy Efficiency Standards for Residential and Nonresidential Buildings (CCR Title 24, Part 6) in 1978 in response to a legislative mandate to reduce energy consumption in the State. Although not originally intended to reduce GHG emissions, increased energy efficiency and reduced consumption of electricity, natural gas, and other fuels would result in fewer GHG emissions from residential and nonresidential buildings subject to the standard. The standards are updated periodically (typically every three years) to allow for the consideration and inclusion of new energy efficiency technologies and methods (CEC, 2016). The current Title 24, Part 6 standards (2019 standards) were made effective on January 1, 2020. The new Title 24, Part 6 standards (2022 standards) were adopted by the CEC in August 2021 and became effective on January 1, 2023. The Adjusted BAU forecasts accounts for these updates to Title 24, as discussed below.

Under the Adjusted BAU scenario, energy use was adjusted to reflect the effects of Title 24 standards. Title 24 Building Efficiency Standards are updated every three years by the California Energy Commission. Energy efficiency improvements were determined by estimating the increased energy efficiency percentages for the 2019 Title 24 standards[17] implemented in 2020, and the 2022 standards implemented in 2023.[18] The 2019 percentages are based on CEC estimates for residential and non-residential buildings and assume that the solar photovoltaic (PV) requirement is met. The 2022 percentages were calculated based on CEC's Draft Environmental Impact Report for the 2022 standards which outlines the changes in building energy use from the 2019 to 2022 standards on a project-by-project basis.[19] Weighted averages were taken to generate efficiency change values for single and multifamily residential buildings for both electricity and natural gas. Because energy efficiency increases are unknown after implementation of 2022 Title 24 Standards, the 2022 Title 24 efficiency increases are applied to future years.

Transportation

Table B.14 presents emissions for 2018 along with the BAU and Adjusted BAU forecasts for 2030 and 2045 for the building energy sector.

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[17] CEC, 2019 Building Energy Efficiency Standards FAQ, 2020. https://www.energy.ca.gov/sites/default/files/2020-03/Title_24_2019_Building_Standards_FAQ_ada.pdf. Accessed January 2022.

[18] CEC, 2022 Building Energy Efficiency Standards Summary, 2021. https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf. Accessed January 2022.

[19] CEC, *Draft Environmental Impact Report: Amendments to the Building Energy Efficiency Standards (2022 Energy Code)*, May 19, 2021. https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency. Accessed January 2022.

TABLE B.14 TRANSPORTATION GHG EMISSIONS BY COUNTY AND SUBSECTOR – 2018 INVENTORY, BAU FORECASTS, AND ADJUSTED BAU FORECASTS

County / Sub-Sector	Emissions by Year (MTCO2e)				
	Inventory	BAU		Adjusted BAU	
	2018	2030	2045	2030	2045
Los Angeles County	29,352,846	29,202,880	29,167,457	22,768,769	19,664,887
On-Road	27,968,741	27,705,842	27,508,264	21,282,017	18,022,413
Passenger Rail	82,136	88,149	95,665	88,149	95,665
Off-Road Goods Movement	1,301,969	1,408,889	1,563,527	1,398,603	1,546,809
Orange County	9,579,313	9,316,614	9,038,534	7,139,204	5,846,727
On-Road	9,500,592	9,232,306	8,943,098	7,056,277	5,753,119
Passenger Rail	52,884	55,806	59,458	55,806	59,458
Off-Road Goods Movement	25,836	28,502	35,978	27,121	34,151
Total	38,932,159	38,519,494	38,205,990	29,907,973	25,511,615

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

On-Road Transportation

Emission calculations for the adjusted BAU scenario utilize the same methodology as the BAU scenario with updated emission factor to account for the Pavley Vehicle Standards and Advanced Clean Cars I program described above. On-road transportation emissions are calculated using BAU forecasted VMT and emission factors weighted by fuel type and vehicle type (passenger vehicles, trucks, and buses)[20] for years 2030 and 2045 from the EMFAC2021 model.[21] **Table B.15** presents the Adjusted BAU transportation emission factors for 2030 and 2050. **Table B.16** presents emissions for 2018 along with the BAU, and Adjusted BAU forecast for 2030 and 2045 for the transportation sector.

Data Sources

- EMFAC2021 Model. Link: https://arb.ca.gov/emfac/emissions-inventory/c3a757e884363e857de19a89c291e03223b875bc
- SCAG Regional Travel Demand Model. Provided by SCAG via Fehr & Peers.
- Fehr & Peers Modeling Analysis (September 2023)

20 Passenger vehicles correspond to EMFAC categories LDA, LDT1, LDT2, MCY, and MD. Trucks correspond to EMFAC categories LHDT1, LHDT2, MHDT, HHDT, and MH.

21 CARB, EMFAC2021 Model, 2021. https://arb.ca.gov/emfac/emissions-inventory/4c9f04282a1f85d62a27721058b5a3bb6fd22fb9. Accessed January 2022.

TABLE B.15 TRANSPORTATION EMISSION FACTORS BY COUNTY AND VEHICLE TYPE – 2018 INVENTORY AND ADJUSTED BAU FORECASTS

Region / Vehicle Type	Adjusted BAU Emission Factor (g CO2e/mile)		
	2018	2030	2045
Los Angeles County			
Passenger	370.9	284.5	251.5
Truck	1,254.6	972.4	709.0
Bus	2,087.6	1,622.6	405.0
Orange County			
Passenger	360.8	273.4	239.6
Truck	1,095.4	882.7	577.8
Bus	2,047.6	1,811.0	449.6

Source: EMFAC2021

Abbreviations: g CO2e = grams of carbon dioxide equivalent

TABLE B.16 ON-ROAD TRANSPORTATION GHG EMISSIONS – 2018 INVENTORY, BAU FORECASTS, AND ADJUSTED BAU FORECASTS

County	Emissions (MTCO2e)				
	Inventory	BAU		Adjusted BAU	
	2018	2030	2045	2030	2045
Los Angeles	29,359,724	29,247,411	29,325,421	22,800,355	19,788,876
Orange	9,572,427	9,306,758	9,024,966	7,129,348	5,833,159
Total	38,932,151	38,554,169	38,350,386	29,929,703	25,622,036

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

Passenger Rail

Passenger rail emissions were calculated by forecasting 2018 emissions using service population data for each of the Counties for year 2030 and 2045.

Off-Road Goods Movements

Ports

Port emissions were calculated by forecasting 2018 emissions using service population data for each of the Counties for year 2030 and 2045, with the exception of CHE, which is forecasted using OFFROAD2021 outputs for years 2030 and 2045.

Airports

Airport emissions were calculated by forecasting 2018 emissions using service population data for each of the Counties for year 2030 and 2045.

Cargo-Handling Equipment – Rail and Transportation Refrigeration Units

Rail CHE and TRU emissions are forecasted using OFFROAD2021 output. For each equipment type, the average emission rate (MTCO2e/hour) was determined for each forecast year and applied to the 2030 and 2045 activity data (hours).

Building Energy

Table B.17 presents emissions for 2018 along with the BAU and Adjusted BAU forecasts for 2030 and 2045 for the building energy sector. **Table B.18** presents the projected emission factors for each utility as well as the weighted average County emission factors.

TABLE B.17 ENERGY GHG EMISSIONS BY COUNTY – 2018 INVENTORY, BAU FORECASTS, AND ADJUSTED BAU FORECASTS

County	Emissions by Year (MTCO2e)				
	Inventory	BAU		Adjusted BAU	
	2018	2030	2045	2030	2045
Los Angeles	27,364,704	29,595,524	32,384,296	18,023,976	9,774,012
Orange	8,777,970	9,401,786	10,076,483	6,833,392	3,855,175
Total	36,142,674	38,997,310	42,460,779	24,857,368	13,629,188

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

TABLE B.18 ELECTRICITY EMISSION FACTOR BY UTILITY

Region / Utility	Emission Factor (lbs CO2e per MWh)		
	2018	2030	2045
Los Angeles County			
SCE	513.0	289.8	0.0
CPA - Lean	10.6	291.4	0.0
CPA - Clean	9.8	270.9	0.0
CPA - Green	0.0	0.0	0.0
LADWP	1,131.0	387.0	0.0
Pasadena Water & Power	1,519.0	576.9	0.0
Azusa	575.9	299.9	0.0
Burbank Water & Power	992.1	542.2	0.0
Glendale Water & Power	683.4	418.7	0.0
City of Industry	575.9	293.83	0.0
City of Vernon	575.9	289.8	0.0
Weighted County Average	**-**	**332.7**	**0.0**

Region / Utility	Emission Factor (lbs CO2e per MWh)		
	2018	2030	2045
Orange County			
SCE	513.0	289.8	0.0
SDG&E	664.0	385.6	0.0
Anaheim Public Utility	1,044.0	662.9	0.0
Weighted County Average	**-**	**342.6**	**0.0**

Solid Waste Disposal

BAU emissions are forecasted for years 2030 and 2045 for emissions generated at landfills and are reported under the solid waste sector. **Table B.19** presents emissions for 2018 along with the BAU forecast for 2030 and 2045 for the solid waste sector.

TABLE B.19 SOLID WASTE GHG EMISSIONS BY COUNTY – 2018 INVENTORY, BAU FORECASTS, AND ADJUSTED FORECASTS

County	Emissions by Year (MTCO2e)				
	Inventory	BAU		Adjusted BAU	
	2018	2030	2045	2030	2045
Los Angeles	4,205,841	4,506,798	4,882,995	1,877,833	2,034,581
Orange	1,359,771	1,433,598	1,525,883	597,333	635,784
Total	5,565,612	5,940,397	6,408,877	17,914,886	2,670,366

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

Emissions from solid waste in Los Angeles and Orange Counties were calculated by forecasting 2018 emissions using service population data for each jurisdiction within the Counties for year 2030 and 2045. Emission factors, diversion rates, and methane capture rates are assumed to remain constant.

Data Sources

- LADPW SWIMS Database. Link: https://dpw.lacounty.gov/epd/swims/OnlineServices/reports.aspx
- SCAG Regional Travel Demand Model. Provided by SCAG via Fehr & Peers.

Summary Emissions

Table B.20 and **Figure B.6** present total MSA GHG emissions for all sectors for the 2018 GHG inventory and the 2030 and 2045 BAU and Adjusted BAU forecasts.

TABLE B.20 EMISSIONS SUMMARY BY SECTOR – 2018 INVENTORY, BAU FORECASTS, AND ADJUSTED BAU EMISSIONS

Region / Sector	Emissions (MTCO2e)				
	Inventory	BAU		Adjusted BAU	
	2018	2030	2045	2030	2045
Los Angeles County	60,923,391	63,305,202	66,434,747	42,670,577	31,473,481
Transportation	29,352,846	29,202,880	29,167,457	22,768,769	19,664,887
Energy	27,364,704	29,595,524	32,384,296	18,023,976	9,774,012
Solid Waste	4,205,841	4,506,798	4,882,995	1,877,833	2,034,581
Orange County	19,717,054	20,151,998	20,640,899	14,569,929	10,337,687
Transportation	9,579,313	9,316,614	9,038,534	7,139,204	5,846,727
Energy	8,777,970	9,401,786	10,076,483	6,833,392	3,855,175
Solid Waste	1,359,771	1,433,598	1,525,883	597,333	635,784
Total MSA	80,640,445	83,457,200	87,075,646	57,240,506	41,811,168
Transportation	38,932,159	38,519,494	38,205,990	29,907,973	25,511,615
Energy	36,142,674	38,997,310	42,460,779	24,857,368	13,629,188
Solid Waste	5,565,612	5,940,397	6,408,877	2,475,165	2,670,366

Abbreviations: MTCO2e = metric tons of carbon dioxide equivalent

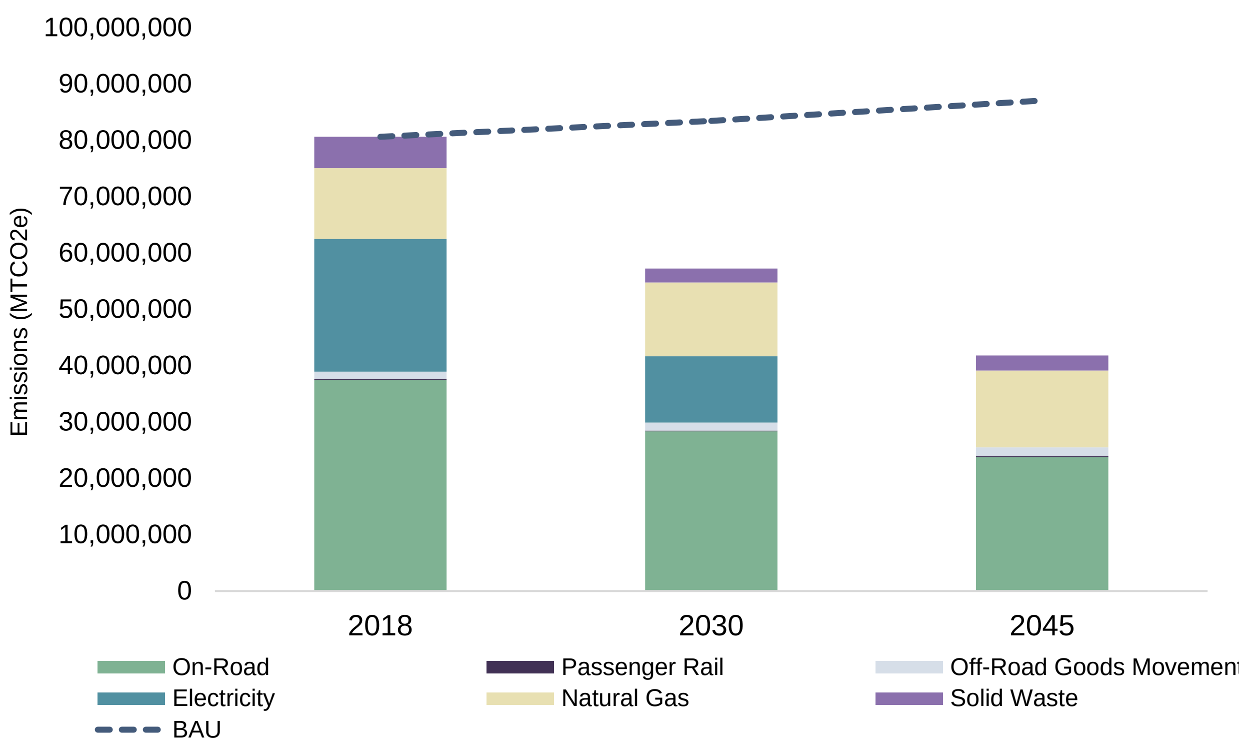

Figure B.6
MSA Inventory, BAU Forecast, and Adjusted BAU Forecast Emissions by Sector

Attachment A: Fehr & Peers Vehicle Miles Traveled Analysis Methods Memo

Memorandum

Date: January 15, 2024

To: Breanna Sewell, Brian Schuster and Jeff Caton, ESA

From: Sarah Brandenberg

Subject: Summary of Data Sources and Methods for Los Angeles and Orange Counties Priority Climate Action Plan Vehicle Miles Traveled Inventory

LA23-3485

Fehr & Peers has developed an inventory of the vehicle miles traveled (VMT) in Los Angeles and Orange Counties in support of the Priority Climate Action Plan. This memorandum presents a summary of the data sources used to develop the inventory and details related to the modeling methods.

Overview and Data Sources

VMT estimates for large urban areas are commonly developed using regional travel demand models. These models are developed and periodically updated, calibrated, and validated for use in long range infrastructure planning, environmental impact assessments, and air quality conformity analyses by local and regional agencies. Trip-based travel forecasting models generate (output) daily vehicle trips for each traffic analysis zone (TAZ) across various trip purposes based on inputs such as the transportation network and socioeconomic data such as population, households, and employment. The Southern California Association of Governments (SCAG) maintains a regional travel demand model that uses a four-step process to forecast vehicle trips based on the data inputs. The VMT estimates for the Priority Climate Action Plan utilized data inputs and outputs from the SCAG regional travel demand model including:

- Vehicle trips by type: including cars, light trucks, medium duty trucks, heavy duty trucks, and transit (bus) vehicles
- Vehicle trip lengths by trip purpose
- Vehicle trip origins and destinations

The source of the VMT data is the 2016 SCAG Regional Travel Demand Model that includes the six-county area of SCAG member agencies. This version of the SCAG model, adopted in 2016 as part of the *2016-2040 Regional Transportation Plan/Sustainable Communities Strategy* (RTP/SCS), has a base year of 2012 and horizon year of 2040. For horizon year 2040, SCAG provides alternative model scenarios, including Scenario 1 "Baseline" and Scenario 3 "Plan". The Baseline scenario assumes business as usual conditions, including social economic growth, as well as other policy assumptions, without the implementation of the RTP while the Plan scenario reflects full implementation of the RTP. For the VMT inventory, the 2040 model year based on modeling Scenario 1 – Baseline was utilized as the starting point.

In coordination with SCAG staff, changes were made to the 2016 SCAG model inputs to reflect more recent Work from Home (WfH) assumptions. The 2016 SCAG model was updated to reflect the WfH inputs shown in **Table 1**. The WfH assumptions provided by SCAG were used to develop an estimate of WfH conditions in 2040 for each household income range included in the 2016 SCAG model. The 2040 SCAG model was then updated to reflect these WfH assumptions for use in the VMT inventory estimates.

Table 1: Work from Home Assumptions

Household Income	2030 Plan	2045 Plan
<$25K	18.96834271	21.80160891
$25k-$50k	17.14649455	19.00753699
$50k-$75k	18.92601067	20.68506458
$75k-$100k	20.48932009	22.09414118
$100k-$125k	23.07250052	24.76953085
$125k-$150k	27.50583452	29.74214601
$150k-$200k	30.68002609	33.15135902
>$200k	37.17895991	39.89071906

Source: Southern California Association of Governments WfH assumptions for 2020 SCAG model.

VMT was estimated utilizing the methods described in the following section for all cities within Los Angeles and Orange Counties and for the unincorporated areas.

Methodology

There are a variety of methods that can be used to model data that capture different relationships between the length of the trip, where the trip starts and ends, and how that mileage is captured and assigned to jurisdictions for the purpose of analyzing VMT. For both methods described below, VMT was calculated at the local level by TAZ or roadway link and aggregated to the city level or into the counties.

The Full Accounting Method, also known as the Origin-Destination Method, accounts for VMT depending on where the trip starts and ends. This method tracks (and "fully accounts" for) all the vehicle trips being generated by a geographic area (i.e., a city) across the entire regional network, and allows for the isolation of different types of VMT as follows.

- Internal-internal (II) VMT: Includes all trips that begin and end entirely within the geographic area of study.
- One-half of internal-external (IX) VMT: Includes one-half of trips with an origin within the geographic area of study and a destination outside of this area. This assumes that the geographic area shares half the responsibility for trips traveling to other areas.
- One-half of external-internal (XI) VMT: Includes one-half of trips with an origin outside of the geographic area of study and a destination within this area. Similar to the IX trips, the geographic area shares the responsibility of trips traveling from other areas.
- External-external (XX) VMT: Trips through the geographic area of study are not included. This approach is consistent with the concept used for the IX and XI trips. Therefore, the XX VMT would be assigned to other areas that are generating the trips.

The Full Accounting Method was utilized to develop the VMT estimates assigned to each city and to the unincorporated areas because it fully accounts for the amount of regional travel generated by each city, not just the travel occurring on that city's roadways. VMT data was estimated separately for passenger/light duty vehicles and trucks for each city and for the unincorporated areas of Los Angeles and Orange counties.

The Boundary Method is another way to measure VMT that estimates all the travel that takes place within a specific geographic area (for example, within the County boundaries) and truncates the mileage of each trip to only the distance traveled within that border. Under this method, each County accounts for all VMT occurring on their particular roadways, including all through trips that neither start nor end in the jurisdiction. This is done by selecting the roadway links within the SCAG model by County. VMT is then calculated based on the link volumes and link lengths within each area.

The Boundary Method was utilized to provide an estimate of all VMT occurring within each County. Since emissions vary by type of vehicle and by speed of travel, VMT was calculated separately for passenger/light duty vehicles, trucks, and transit (buses), and then categorized by speed bins (in 5 MPH increments) by time of day and provided for both counties.

For both sets of data, VMT estimates were provided for the Years 2018, 2030, and 2045. The 2016 SCAG models reflecting the base year of 2012 and horizon year of 2040 were used to develop a straight-line interpolation to provide VMT forecasts for the Priority Climate Action Plan base year of 2018 and horizon years of 2030 and 2045.

Appendix C

GHG Reduction Measure Quantification Methods

APPENDIX C
GHG Reduction Measure Quantification Methods

C.1 Purpose

The purpose of this Appendix is to describe the assumptions, sources, and emissions reduction calculations for the GHG reduction measures listed below.

- **Section C.2: Greenhouse Gas Reduction Measures** This section describes the calculation methods for estimating local GHG emission reductions for the PCAP measures. “Local” emission reductions are defined as those which occur beyond State regulations accounted for in the Adjusted BAU forecasts described in Appendix B. The quantified measures include:
  - T1: Decarbonize Goods Movement
  - T2: Decarbonize Passenger Transport
  - T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs
  - T4: Reduce VMT Through Sustainable Land Use
  - T5: Expand the Active Transportation Network
  - T6: Expand the Transit Network and Increase Ridership
  - T7: Optimize Traffic Flow to Reduce Idle Time
  - E1: Decarbonize Existing Buildings
  - E2: Decarbonize New Buildings
  - E3: Decarbonize Industrial Processes
  - E4: Increase Renewable Energy Generation and Storage
  - E5: Improve Energy Efficiency and Resiliency Through Grid Modernization
  - E6: Improve Energy Efficiency Through Building Upgrades
  - E7: Improve Energy Efficiency Through Urban Greening
  - E8: Reduce Fugitive Emission and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations
  - SW1: Increase Organics Diversion
  - SW3: Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential
- **Section C.3: State vs. Local Contribution to Greenhouse Gas Reductions** This section describes how State and Local contributions were identified and apportioned for the GHG reduction measures.

C.2 Greenhouse Gas Reduction Measures

Transportation

Measure T1: Decarbonize Goods Movement

TABLE C.1 MEASURE T1 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	1,397,816	2,578,404
Orange	301,840	566,030
Total	1,699,656	3,144,434

MTCO2e = metric tons of carbon dioxide equivalent

Description

Implement and incentivize the decarbonization of goods movement activities by increasing the zero-emission vehicle (ZEV) market share of heavy-duty, on-road vehicles and off-road equipment fleets.

Performance Goals

Measure T1 aims to reduce GHG emissions associated with the on-road goods movement vehicle fleet by 40 percent by 2030 and 100 percent by 2045; reduce GHG emissions associated with port cargo-handling equipment by 100 percent by 2030; and to reduce GHG emissions associated with non-port off-road goods movement equipment by 70 percent by 2030 and 100 percent by 2045.

Modeling Approach

GHG emissions reductions from on-road goods movement fleet decarbonization was estimated using the total truck Adjusted BAU emissions for each County as the baseline. Goods movement vehicles were identified using EMFAC2021 vehicle types to determine which vehicle types are used primarily for goods movement purposes based on the vehicles' weight classes and descriptions. The percentage of carbon dioxide emissions attributed to goods movement vehicle types in EMFAC2021 was then applied to the total Adjusted BAU truck emissions to determine the goods movement share of emissions by County. The performance goal percent reductions in emissions for each target year were then applied to the goods movement emissions inventory to estimate the on-road emissions reductions from T1.

GHG emissions reductions from port cargo-handling equipment (CHE) were estimated using inventory data from the Port of Los Angeles (POLA) and Port of Long Beach (POLB). BAU and adjusted BAU emissions for CHE were forecasted using a growth factor for both target years derived from CARB's OFFROAD2021 tool, which provides emissions and fuel use projections for off-road equipment by sector. Emissions reductions were estimated by applying a percentage reduction to the adjusted BAU port CHE emissions by County for each target year.

GHG emissions reductions from non-port CHE were estimated using fuel output from OFFROAD2021 and includes rail CHE and transportation refrigeration units (TRUs). Emissions for the inventory and target years were calculated by multiplying the total gallons of diesel by a standard CO2e emission factor from the Climate Registry. Emissions reductions were estimated by applying the performance goal percent reductions to the adjusted BAU non-port CHE emissions by County for each target year, as disclosed above.

Assumptions

- On-road goods movement vehicle types include the following EMFAC2021 vehicle categories: T6 CAIRP Class 4, T6 CAIRP Class 5, T6 CAIRP Class 6, T6 CAIRP Class 7, T6 Instate Delivery Class 4, T6 Instate Delivery Class 5, T6 Instate Delivery Class 6, T6 Instate Delivery Class 7, T6 Instate Other Class 4, T6 Instate Other Class 5, T6 Instate Other Class 6, T6 Instate Other Class 7, T6 Instate Tractor Class 6, T6 Instate Tractor Class 7, T6 OOS Class 4, T6 OOS Class 5, T6 OOS Class 6, T6 OOS Class 7, T6TS, T7 CAIRP Class 8, T7 NNOOS Class 8, T7 NOOS Class 8, T7 POAK Class 8, T7 POLA Class 8, T7 Single Other Class 8, T7 Tractor Class 8, T7IS, LHD2, and half of LHD1

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory
- CARB, OFFROAD 2021. Link: https://arb.ca.gov/emfac/offroad/.
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
- POLA, 2019. Inventory of Air Emissions – 2018. Link: https://kentico.portoflosangeles.org/getmedia/0e10199c-173e-4c70-9d1d-c87b9f3738b1/2018_Air_Emissions_Inventory.
- POLB, 2019. Air Emissions Inventory – 2018. Link: https://polb.com/environment/air/#emissions-inventory.

Measure T2: Decarbonize Passenger Transport

TABLE C.2 MEASURE T2 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	3,469,770	12,772,564
Orange	1,090,621	4,113,246
Total	4,560,391	16,885,810

MTCO2e = metric tons of carbon dioxide equivalent

Description

Increase the ZEV market share for on-road passenger vehicles and passenger buses.

Performance Goals

Measure T2 aims to reduce GHG emissions associated with buses by 50 percent by 2030 and 100 percent by 2045; and electrify passenger vehicles by 30 percent by 2030 and 90 percent by 2045.

Modeling Approach

GHG emissions reductions from on-road passenger vehicle decarbonization was estimated using the total passenger vehicle Adjusted BAU emissions for each County as the baseline. The performance goal percent reductions in emissions for each target year were then applied to the passenger vehicle emissions inventory to estimate the passenger vehicle emissions reductions from T2. This measure also assumes that decarbonization of passenger vehicles would lead to an increase in electricity use which is estimated by applying an electric vehicle (EV) fuel efficiency factor (in kWh per mile) to the electrified percentage of passenger vehicle VMT for each target year. The fuel efficiency factor is derived from CARB's EMFAC2021 model. The GHG emissions from the increase in electricity use for each target year was then calculated using weighted average electricity emission factors for each County (as described in Appendix B). Net emissions reductions were calculated as the difference between the reduction in passenger vehicle gasoline and diesel tailpipe emissions and the increase in indirect electricity emissions from EV charging.

GHG emissions reductions from buses were estimated using the total bus Adjusted BAU emissions for each County as the baseline. The performance goal percent reductions in emissions for each target year were then applied to the bus emissions inventory to estimate the bus emissions reductions from T2.

Assumptions

- Passenger vehicles include the following EMFAC2021 vehicle types: LDA, LDT1, LDT2, MCY, and MDV
- Buses include the following EMFAC2021 vehicle types: OBUS, SBUS, and UBUS

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory
- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid

- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf

Measure T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs

TABLE C.3 MEASURE T3 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	1,002,768	1,238,110
Orange	309,453	317,638
Total	1,312,222	1,555,747

MTCO2e = metric tons of carbon dioxide equivalent

Description

Increase the ZEV market share for on-road medium- and heavy-duty vehicles.

Performance Goals

Measure T3 aims to transition medium- and heavy-duty vehicles to ZEVs by 50 percent by 2030 and 90 percent by 2045.

Modeling Approach

GHG emissions reductions from medium- and heavy-duty vehicle decarbonization was estimated using the total trucks adjusted BAU emissions for each County as the baseline. The performance goal percent reductions in emissions for each target year were then applied to the truck emissions inventory to estimate the truck emissions reductions from T3. This measure also assumes that decarbonization of trucks would lead to an increase in electricity use which is estimated by applying an EV fuel efficiency factor (in kWh per mile) to the electrified percentage of truck VMT for each target year. The fuel efficiency factor is derived from CARB's EMFAC2021 model. The GHG emissions from the increase in electricity use for each target year were then calculated using weighted average electricity emission factors for each County (as described in Appendix B). Net emissions reductions were calculated as the difference between the reduction in truck emissions and the increase in electricity from EV adoption.

Assumptions

- Trucks include the following EMFAC2021 vehicle types: LHDT1, LHDT2, MHDT, and HHDT.
- Buses include the following EMFAC2021 vehicle types: OBUS, SBUS, and UBUS

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_ 2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf

Measure T4: Reduce VMT Through Sustainable Land Use

Table C.4 Measure T4 GHG Emissions Reductions

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	1,388,779	3,779,209
Orange	513,958	1,127,443
Total	1,902,737	4,906,652

MTCO2e = metric tons of carbon dioxide equivalent

Description

Reduce VMT by constructing transit-oriented, mixed-use, and infill development and increasing housing and job density in high quality transit areas.

Performance Goals

Measure T4 aims to reduce per capita passenger vehicle VMT from 2018 levels by 10 percent by 2030 and 20 percent by 2045.

Modeling Approach

GHG emissions reductions from on-road passenger vehicle per capita VMT reductions were estimated using the total passenger vehicle VMT for each County. The total VMT was divided by the total population for the 2018 baseline year to derive the VMT per capita by County. The performance goal percent reductions in VMT per capita for each target year were then applied to the baseline passenger vehicle VMT per capita. The resultant VMT per capita was multiplied by the projected population of each County for each target year to estimate the total VMT by target year. The total VMT was then multiplied by a passenger vehicle GHG emission factor (in grams per mile) for each future year to calculate the emissions under measure T4. The T4 emissions were then subtracted from the Adjusted BAU emissions for each target year to calculate the emission reductions by County.

Assumptions

- Passenger vehicles include the following EMFAC2021 vehicle types: LDA, LDT1, LDT2, MCY, and MDV
- Reduced passenger vehicle VMT is replaced with alternative modes of transportation which produce zero GHG emissions per mile traveled.

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory
- Fehr & Peers, 2023. VMT by County and Socioeconomic Data.

Measure T5: Expand the Active Transportation Network

Table C.5 Measure T5 GHG Emissions Reductions

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	1,048,766	1,898,018
Orange	327,562	646,570
Total	1,376,328	2,544,588

MTCO2e = metric tons of carbon dioxide equivalent

Description

Expand active transportation infrastructure, including bicycle and pedestrian networks and micro-mobility options (e.g., e-bikes, scooters, electric golf carts, etc.), to encourage and support zero-carbon transportation options.

Performance Goals

Measure T5 aims to increase active transportation mode share by 5 percent by 2030 and 10 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure T5 were estimated using the total passenger vehicle Adjusted BAU emissions for each County as the baseline. The performance goal percent reductions in VMT for each target year were then applied to the passenger vehicle emissions inventory to estimate the passenger vehicle emissions reductions from T5. VMT reduction percentages were provided by Fehr & Peers (see Attachment A).

Assumptions

- Passenger vehicles include the following EMFAC2021 vehicle types: LDA, LDT1, LDT2, MCY, and MDV
- Active transportation modes produce zero GHG emissions.

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory
- Fehr & Peers, 2024. VMT Reduction Estimates for Transportation Strategies for Los Angeles and Orange Counties Regional Climate Action Plan Vehicle Miles Traveled Inventory

Measure T6: Expand the Transit Network and Increase Ridership

TABLE C.6 MEASURE T6 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	132,246	239,333
Orange	17,621	31,785
Total	149,866	271,119

MTCO2e = metric tons of carbon dioxide equivalent

Description

Expand transit services and accessibility to reach the majority of residents and workers.

Performance Goals

Measure T6 aims to increase transit ridership by 10 percent by 2030 and 20 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure T6 were estimated using the total passenger vehicle Adjusted BAU emissions for each County as the baseline. The performance goal percent reductions in VMT for each target year were then applied to the passenger vehicle emissions inventory to estimate the passenger vehicle emissions reductions from T6. VMT reduction percentages were provided by Fehr & Peers (see Attachment A)

Assumptions

- Passenger vehicles include the following EMFAC2021 vehicle types: LDA, LDT1, LDT2, MCY, and MDV
- Transit vehicles produce zero tailpipe GHG emissions.

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory

- Fehr & Peers, 2024. VMT Reduction Estimates for Transportation Strategies for Los Angeles and Orange Counties Regional Climate Action Plan Vehicle Miles Traveled Inventory

Measure T7: Optimize Traffic Flow to Reduce Idle Time

TABLE C.7 MEASURE T7 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	13,665	29,548
Orange	3,137	6,041
Total	16,802	35,589

MTCO2e = metric tons of carbon dioxide equivalent

Description

Retrofit and enhance traffic infrastructure to improve traffic flows and reduce vehicle idle times.

Performance Goals

Measure T7 aims to reduce GHG emissions associated with vehicle idle time on major arterials below 2018 levels by 10 percent by 2030 and 20 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure T7 were estimated using the total idling emissions from EMFAC2021's emissions inventory for each County as the baseline. The idling emissions are calculated as the sum of CO2, CH4, and N2O emissions from EMFAC2021's IDLEX category, which applies to the LHDT1, LHDT2, MHDT, HHDT, OBUS, and SBUS EMFAC vehicle types. The percentage of total idling emissions attributable to major arterial roads was derived from public road data aggregated by Caltrans, which is approximately 39.7 percent Statewide. The performance goal percent reductions in idling emissions for each target year were then applied to the idling emissions inventory to estimate the reductions from Measure T7.

Assumptions

- Total idling emissions are covered by EMFAC2021's IDLEX emissions inventory for the LHDT1, LHDT2, MHDT, HHDT, OBUS, and SBUS EMFAC vehicle types.
- Idling emissions are only reduced on major arterial roadways as defined by Caltrans.

Data Sources

- Caltrans, 2020. California 2019 Public Road Data – Statistical Information Derived from the Highway Performance Monitoring System. Link: https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/california-public-road-data/prd-2019-a11y.pdf
- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory

Energy

Measure E1: Decarbonize Existing Buildings

TABLE C.8 MEASURE E1 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	310,503	5,978,139
Orange	99,898	2,106,729
Total	410,402	8,084,868

MTCO2e = metric tons of carbon dioxide equivalent

Description

Implement building performance standards and fuel switching to decarbonize existing buildings and reduce the GHG intensity of existing building operations.

Performance Goals

Measure E1 aims to decarbonize 25 percent of existing residential building stock and 15 percent of existing commercial by 2030 and decarbonize 80 percent of existing residential building stock and 60 percent of existing commercial by 2045.

Modeling Approach

GHG emissions reductions from Measure E1 were estimated using the activity data (electricity and natural gas) and GHG emissions for existing residential and nonresidential land uses as a baseline. The baseline year for existing development is assumed to be 2025. In other words, Measure E1 would apply to the built environment through the end of 2025. Electricity use was used as a proxy for building decarbonization (i.e., it was assumed that decarbonization means switching from fossil natural gas to zero-carbon electricity). To calculate the reduction in natural gas use and increase in electricity use under Measure E1, natural gas use in for residential and commercial buildings was converted to electricity use by multiplying the number of therms consumed by the performance goal electrification percentages for each building type (residential and commercial) for each target year. The resultant displaced natural gas was converted to electricity using a standard conversion factor of 29.3 kWh per therm.[1] GHG emissions after implementation of Measure E1 were then calculated using weighted average electricity emission factors by County to estimate the GHG reductions produced by Measure E1 (as described in Appendix B). GHG emissions for natural gas savings were calculated using the emission factors of 0.00531 $MTCO_2e$ per therm for residential and commercial buildings.

1 UC Irvine Physics and Astronomy. 2021. Energy Units and Conversions. Link: https://www.physics.uci.edu/~silverma/units.html. Accessed November 2021.

Assumptions

- Electricity use is a proxy for building decarbonization (i.e., decarbonization means switching from fossil natural gas to zero-carbon electricity).
- There is no efficiency loss when converting natural gas to electricity (in other words, electric appliances and natural gas appliances are equally energy efficient, on balance).
- Existing development represents emissions and activity data in 2025.

Data Sources

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018SCE PCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_ 2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/ power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf

Measure E2: Decarbonize New Buildings

TABLE C.9 MEASURE E2 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	25,716	573,370
Orange	5,432	111,983
Total	31,148	685,354

MTCO2e = metric tons of carbon dioxide equivalent

Description

Require new buildings to achieve zero GHG emissions in building operations.

Performance Goals

Measure E2 aims to decarbonize all applicable new residential and commercial buildings by 90 percent by 2030 and 100 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure E2 were estimated using Adjusted BAU activity data (electricity and natural gas) and GHG emissions for new residential and commercial land uses as a baseline. New residential and commercial energy use was calculated by taking the difference between the target year activity data and the existing year activity data by land use designation (e.g., subtracting the 2030 electricity use by the 2025 electricity use for residential and commercial land uses). Electricity use was used as a proxy for building decarbonization (i.e., it was assumed that decarbonization means switching from fossil natural gas to zero-carbon electricity). To calculate the reduction in natural gas use and increase in electricity use under Measure E2, natural gas use in residential and commercial buildings was converted to electricity use by multiplying the number of therms consumed by the performance goal electrification percentages for each building type (residential and commercial) for each target year. The resultant displaced natural gas was converted to electricity using a standard conversion factor of 29.3 kWh per therm.[2] GHG emissions after implementation of Measure E2 were then calculated using the same weighted average electricity emission factors implemented under Measure E1 to estimate the GHG reductions produced by Measure E2 (as described in Appendix B). Electrification of new development starts in 2025 and emissions reductions in each of the target years are calculated as cumulative reductions; for example, total annual GHG emissions reductions in 2030 account for all new building electrification for the years 2025 through 2030.

Assumptions

- Electricity use is a proxy for building decarbonization (i.e., decarbonization means switching from fossil natural gas to zero-carbon electricity).
- There is no efficiency loss when converting natural gas to electricity (in other words, electric appliances and natural gas appliances are equally energy efficient, on balance).
- Decarbonization of new development begins in 2025.
- Annual GHG emissions reductions for each target year (2030 and 2045) reflect all buildings electrified in all previous years (e.g., all buildings electrified from 2025–2030 contribute to annual emissions reductions in 2030).

Data Sources

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_ 2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan

2 UC Irvine Physics and Astronomy. 2021. Energy Units and Conversions. Available: https://www.physics.uci.edu/~silverma/units.html. Accessed November 2021.

- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
- UC Irvine Physics and Astronomy, Energy Units and Conversions Link: https://www.physics.uci.edu/~silverma/units.html

Measure E3: Decarbonize Industrial Processes

TABLE C.10 MEASURE E3 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	20,819	991,518
Orange	13,425	679,476
Total	34,244	1,670,994

MTCO2e = metric tons of carbon dioxide equivalent

Description

Decarbonize and retrofit industrial processes by adopting zero GHG emission technologies, improving energy efficiency, and transitioning to carbon-free and renewable energy sources.

Performance Goals

Measure E3 aims to decarbonize industrial energy use 10 percent by 2030 and 80 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure E3 were estimated using Adjusted BAU activity data (electricity and natural gas) and GHG emissions for new industrial land uses as a baseline. New industrial energy use was calculated by taking the difference between the target year activity data and the existing year activity data by land use designation (e.g., subtracting the 2030 electricity use by the 2025 electricity use for industrial land uses). Electricity use was used as a proxy for building decarbonization (i.e., it was assumed that decarbonization means switching from fossil natural gas to zero-carbon electricity). To calculate the reduction in natural gas use and increase in electricity use under Measure E2, natural gas use in industrial buildings was converted to electricity use by multiplying the number of therms consumed by the performance goal electrification percentages for industrial buildings for each target year. The resultant displaced natural gas was converted to electricity using a standard conversion factor of 29.3 kWh per therm.[3] GHG emissions after implementation of Measure E3 were then calculated

[3] UC Irvine Physics and Astronomy. 2021. Energy Units and Conversions. Available: https://www.physics.uci.edu/~silverma/units.html. Accessed November 2021.

using the same weighted average electricity emission factors implemented under Measure E1 to estimate the GHG reductions produced by Measure E3. GHG emissions for natural gas savings were calculated using the emission factor of 0.00532 $MTCO_2e$ per therm for industrial buildings. Electrification of new development starts in 2025 and emissions reductions in each of the target years are calculated as cumulative reductions; for example, total annual GHG emissions reductions in 2030 account for all new building electrification for the years 2025 through 2030.

Assumptions

- Electricity use is a proxy for building decarbonization (i.e., decarbonization means switching from fossil natural gas to zero-carbon electricity).
- There is no efficiency loss when converting natural gas to electricity (in other words, electric appliances and natural gas appliances are equally energy efficient, on balance).
- Decarbonization of new development begins in 2025.
- Annual GHG emissions reductions for each target year (2030 and 2045) reflect all buildings electrified in all previous years (e.g., all buildings electrified from 2025–2030 contribute to annual emissions reductions in 2030).

Data Sources

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_ 2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/ power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors. Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
- UC Irvine Physics and Astronomy, Energy Units and Conversions. Link: https://www.physics.uci.edu/~silverma/units.html

Measure E4: Increase Renewable Energy Generation and Storage

TABLE C.11 MEASURE E4 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	6,520,748	0
Orange	2,302,665	0
Total	8,823,413	0

MTCO2e = metric tons of carbon dioxide equivalent

Description

Expand energy storage and local renewable energy generation.

Performance Goals

Measure E4 aims to increase energy use provided by carbon-free and renewable energy sources 75 percent by 2030 and 100 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure E4 were estimated using Adjusted BAU activity data (electricity) and GHG emissions for residential and commercial land uses as a baseline. The emissions reductions for Measure E4 were calculated by applying the performance goal percent reductions to total electricity emissions in each target year by County. Emission reductions in 2045 are zero because California's grid is legally mandated to reach 100% carbon-free electricity generation sources by 2045 under the Renewables Portfolio Standard (SB 100).

Assumptions

- All grid-supplied electricity is carbon-free by 2045.

Data Sources

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label

- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
- California Public Utilities Commission, Renewables Portfolio Standard. Link: https://www.cpuc.ca.gov/rps/

Measure E5: Improve Grid Efficiency and Resiliency Through Grid Modernization

Table C.12 Measure E5 GHG Emissions Reductions

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	826,512	0
Orange	293,224	0
Total	1,119,736	0

MTCO2e = metric tons of carbon dioxide equivalent

Description

Expand energy storage and microgrids.

Performance Goals

Measure E5 aims to reduce electricity consumption compared to 2018 levels by 10 percent by 2030 and 20 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure E5 were estimated using Adjusted BAU activity data (electricity) and GHG emissions for residential and non-residential land uses as a baseline. The emissions reductions for Measure E5 were calculated by applying the performance goal percent reductions to total electricity emissions in each target year by County. Emission reductions in 2045 are zero because California's grid is legally mandated to reach 100% carbon-free electricity generation sources by 2045 under the Renewables Portfolio Standard (SB 100).

Assumptions

- All grid-supplied electricity is carbon-free by 2045.

Data Sources

- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf

- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
- California Public Utilities Commission, Renewables Portfolio Standard. Link: https://www.cpuc.ca.gov/rps/

Measure E6: Improve Energy Efficiency Through Building Upgrades

TABLE C.13 MEASURE E6 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	3,659,992	4,575,512
Orange	1,372,681	1,858,679
Total	5,032,672	6,434,191

MTCO2e = metric tons of carbon dioxide equivalent

Description

Retrofit existing building stock to improve energy efficiency.

Performance Goals

Measure E6 aims to reduce energy use compared to 2025 levels by 20 percent for residential buildings, 15 percent for industrial buildings, and 25 percent for commercial buildings by 2030, and 50 percent for residential, industrial, and commercial buildings by 2045.

Modeling Approach

GHG emissions reductions from Measure E6 were estimated using the activity data (electricity and natural gas) and Adjusted BAU GHG emissions for existing residential and nonresidential land uses. The baseline year for existing development is assumed to be 2025. In other words, Measure E6 would apply to the built environment through the end of 2025. Electricity and natural gas savings resulting from implementation of Measure E6 were then calculated by multiplying the baseline year emissions (electricity and natural gas) by the performance goal percent improvements in total energy use for each target year under Measure E6 implementation. GHG emissions after implementation of Measure E6 were then calculated using the weighted average electricity emission factors implemented under Measure E1 to estimate the GHG reductions produced by Measure E6. GHG emissions for natural gas savings were calculated using the emission factors of 0.00531 $MTCO_2e$ per therm for residential and commercial buildings and 0.00532 $MTCO_2e$ per therm for industrial buildings.

Assumptions

- Existing building stock represents the built environment through the year 2025.

Data Sources

- CARB, EMFAC2021. Link: https://arb.ca.gov/emfac/emissions-inventory
- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf

Measure E7: Improve Energy Efficiency Through Urban Greening

TABLE C.14 MEASURE E7 GHG EMISSIONS REDUCTIONS

Region	Annual Emissions Reductions (MTCO2e)	
	2030	2045
MSA	5,240	10,480

MTCO2e = metric tons of carbon dioxide equivalent

Description

Reduce energy consumption in urban environments through the strategic planting of shade trees.

Performance Goals

Measure E7 aims to reduce energy consumption by planting 200,000 new shade trees by 2030 and 400,000 new shade trees by 2045.

Modeling Approach

This measure is regional and is not broken out by individual counties. Emissions reductions from Measure E7 are calculated by assuming that a certain number of shade trees are planted in the MSA by each target year, as indicated in the measure's performance goal above. The number of shade trees planted is partially based on the planned number of shade trees to be planted under LA County's 2045 Climate Action Plan. A sequestration factor of 26.2 kg CO2e per tree planted was multiplied by the total number of trees planted by each target year to get the respective emissions reductions.

Assumptions

- Trees are mature and at full sequestration potential upon planting.

Data Sources

- McPherson, E.G.; Kendall, A.; Albers, S. 2015. Million Trees Los Angeles: Carbon dioxide sink or source? In M. Johnston; G. Perceival, eds. Proceedings of the Urban Trees Research Conference "Trees, People and the Built Environment II." Edgbaston, UK: University of Birmingham: 7-19.

Measure E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations

TABLE C.15 MEASURE E8 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	1,053,264	989,536
Orange	663,369	678,117
Total	1,716,633	1,667,653

MTCO2e = metric tons of carbon dioxide equivalent

Description

Develop strategies and policies to decommission oil and gas operations and increase carbon removal.

Performance Goals

Measure E8 aims to reduce gas and oil operations by 40 percent by 2030 and 80 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure E8 were estimated using Adjusted BAU activity data (electricity and natural gas) and GHG emissions for industrial land uses as a baseline. The emissions reductions for Measure E8 were calculated by applying a percent reduction to total electricity and natural gas emissions in each target year by County. By 2045, all emissions reductions are a result of decreased natural gas because California's grid is expected to reach 100% renewable energy by 2045 under the Renewables Portfolio Standard.

Assumptions

- Assumes carbon-free electricity by 2045.

Data Sources

- California Public Utilities Commission, Renewables Portfolio Standard. Link: https://www.cpuc.ca.gov/rps/

Solid Waste

Measure SW1: Increase Organics Diversion

TABLE C.16 MEASURE SW1 GHG EMISSIONS REDUCTIONS

County	Annual Emissions Reductions (MTCO2e)	
	2030	2045
Los Angeles	1,596,158	1,932,852
Orange	507,733	603,995
Total	2,103,890	2,536,847

MTCO2e = metric tons of carbon dioxide equivalent

Description

Increase diversion of organics from landfills generated from residential, industrial, and commercial sources through ordinances, service improvements, education and outreach, and promotion of product stewardship.

Performance Goals

Measure SW1 aims to divert organic waste from landfills generated from residential and commercial sources by 85 percent by 2030 and 95 percent by 2045; and recover edible food that would have otherwise been sent to landfill by 50 percent by 2030 and 75 percent by 2045.

Modeling Approach

GHG emissions reductions from Measure SW1 were estimated using Adjusted BAU waste emissions as a baseline. The emissions reductions for Measure SW1 were calculated by applying the performance goal percent reductions to total organics waste emissions in each target year by County.

Assumptions

- Adjusted BAU accounts for reductions from SB 1383.
- All solid waste emissions are from organic waste disposal in landfills.
- For each ton of solid waste not placed in a landfill, 0.44 $MTCO_2e$ is saved (based on the Adjusted BAU forecast for the waste sector; see Appendix A).

Data Sources

- CalRecycle, SB 1383. Link: https://calrecycle.ca.gov/organics/slcp/

Measure SW2: Recover and Reuse Materials

Description

Reduce waste generation, conserve resources, and promote circular economy practices by expanding the recovery and reuse of materials.

Performance Goals

Measure SW2 aims to increase diversion of recoverable, reusable, and recyclable materials from landfill by 80 percent by 2030 and 95 percent by 2045.

Modeling Approach

Measure SW2 is not quantified. Measure W2 addresses non-organics, which do not have GHG reduction potential. Measure SW3: Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential.

Measure SW3: Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential

TABLE C.17 MEASURE SW3 GHG EMISSIONS REDUCTIONS

Region	Annual Emissions Reductions (MTCO2e)	
	2030	2045
MSA	244,169	0

MTCO2e = metric tons of carbon dioxide equivalent

Description

Expand waste management practices and implement waste-to-energy and energy conversion technologies.

Performance Goals

Measure SW3 aims to install waste-to-energy (WTE) generation capacity by 200 megawatts (MW) by 2030 and 400 MW by 2045.

Modeling Approach

GHG emissions reductions from Measure SW3 were estimated based on using WTE facilities to generate clean electricity from waste biproducts. The electricity generated by WTE facilities is calculated by multiplying the performance goal capacity (in MW) of WTE facilities for each target year by the assumed annual hours of operation (8,760 hours) and by a usage factor of 0.91. The resultant electricity usage is multiplied by an weighted average electricity emission factors for the MSA to determine the amount of displaced electricity emissions in each target year. Emission reductions in 2045 are zero because California's grid is legally mandated to reach 100% carbon-free electricity generation sources by 2045 under the Renewables Portfolio Standard.

Assumptions

- Assumes WTE facilities operate 24 hours per day, 7 days per week, and 365 days annually, which equates to 8,760 hours.
- Assumes a usage factor of 0.91 (i.e., a WTE facility is operating at 91% its full capacity at any given point.)
- All grid-supplied electricity is carbon-free by 2045.

Data Sources

- California Public Utilities Commission, Renewables Portfolio Standard. Link: https://www.cpuc.ca.gov/rps/
- SCE Emission Factor. Link: https://www.sce.com/sites/default/files/inline-files/2018 SCEPCL.pdf
- Clean Power Alliance Emission Factor. Link: https://www.energy.ca.gov/sites/default/files/2020-01/2018_PCL_Clean_Power_Alliance.pdf
- SDG&E Emission Factor. Link: https://csr.sempra.com/wp-content/uploads/sempra_csr_2022_rgb.pdf
- Anaheim Public Utility Emission Factor. Link: https://www.anaheim.net/DocumentCenter/View/20943/2018-Integrated-Resource-Plan
- EPA, eGRID. Link: https://www.epa.gov/egrid
- CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label
- The Climate Registry, 2023 Default Emission Factors .Link: https://theclimateregistry.org/wp-content/uploads/2023/06/2023-Default-Emission-Factors-Final-1.pdf
- Waste-to-Energy Process Model. Available: https://mswdst.rti.org/docs/WTE_Model_OCR.pdf

C.3 State vs. Local Contribution to Greenhouse Gas Reductions

Overview

State contributions represent GHG emission reductions achieved through State of California regulations and policy. State contributions represent the difference between the BAU and the Adjusted BAU scenario and derive from actions such as the RPS, Title 24 Building Energy Efficiency Standards, and Pavley Vehicle Standards. State actions are described in detail in Appendix B, *GHG Inventory and Forecast Methods.* Local contributions represent GHG emission reductions achieved by the priority measures beyond state policy; i.e., beyond the Adjusted BAU scenario.

For each measure in **Table C-18** and **Table C-19**, below, state and local contributions are shown to delineate the reductions from each and highlight the aggressive action taken by the State to reduce GHG emissions. The local contributions build on and go beyond State policy; however, in some cases there are diminishing returns from local emission reduction contributions due to State actions such as RPS. For example, the local contributions from Measure E4 are zero in 2045 because Statewide electricity is required to be 100 percent carbon-free by 2045 under RPS. In other cases, local contributions represent all the emissions reductions associated with a measure. Measures T4 through T7 represent strategies that currently have no Statewide legislation considered in the Adjusted BAU scenario. State contributions are essentially the difference between the Adjusted BAU and BAU scenarios specific to each measure, and any additional reductions exceeding the Adjusted BAU are attributed to the local contribution. Table C.18 presents measure-level emission reductions for Los Angeles county by state and local contributions. Table C.19 presents measure-level emission reductions for Orange county by state and local contributions.

TABLE C.18. LOS ANGELES COUNTY REDUCTIONS BY STATE AND LOCAL CONTRIBUTION

Sector / Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
Transportation						
T1: Decarbonize Goods Movement	674,411	1,397,816	**2,072,227**	1,522,584	2,578,404	**4,100,988**
T2: Decarbonize Passenger Transport	5,629,908	3,469,770	**9,099,679**	7,802,695	12,772,564	**20,575,259**
T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs	793,917	1,002,768	**1,796,685**	1,683,156	1,238,110	**2,921,265**
T4: Reduce VMT Through Sustainable Land Use	0	1,388,779	**1,388,779**	0	3,779,209	**3,779,209**
T5: Expand the Active Transportation Network	0	1,048,766	**1,048,766**	0	1,898,018	**1,898,018**
T6: Expand the Transit Network and Increase Ridership	0	132,246	**132,246**	0	239,333	**239,333**
T7: Optimize Traffic Flow to Reduce Idle Time	0	16,802	**16,802**	0	35,589	**35,589**
Energy						
E1: Decarbonize Existing Buildings	145,277	310,503	**455,780**	145,277	5,978,139	**6,123,416**
E2: Decarbonize New Buildings	103,769	25,716	**129,485**	485,906	573,370	**1,059,277**
E3: Decarbonize Industrial Processes	1,695,731	20,819	**1,716,550**	3,446,257	991,518	**4,437,775**
E4: Increase Renewable Energy Generation and Storage	11,284,370	6,520,748	**17,805,118**	21,881,237	0	**21,881,237**
E5: Improve Energy Efficiency and Resiliency Through Grid Modernization	11,284,370	826,512	**12,110,883**	21,881,237	0	**21,881,237**

Sector / Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
E6: Improve Energy Efficiency Through Building Upgrades	6,750,070	3,659,992	**10,410,062**	6,750,070	4,575,512	**11,325,582**
E7: Improve Energy Efficiency Through Urban Greening	Regional Measure					
E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations	1,695,731	1,053,264	**2,748,995**	3,446,257	989,536	**4,435,793**
Solid Waste						
SW1: Increase Organics Diversion	2,628,966	1,596,158	**4,225,123**	2,848,414	1,932,852	**4,781,266**
SW2: Recover and Reuse Materials	Not Quantified					
SW3: Increase Waste-to-Energy and Conversion Technology Potential	Regional Measure					

Source: ESA, 2024
Abbreviations: metric tons of carbon dioxide equivalent (MTCO2e); not quantified (NQ)
Note: State = GHG emission reductions based on adopted State of California regulations. Local = GHG emission reductions based on the identified measures in this PCAP.

TABLE C.19. ORANGE COUNTY REDUCTIONS BY STATE AND LOCAL CONTRIBUTION

Sector / Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
Transportation						
T1: Decarbonize Goods Movement	176,507	301,840	**478,347**	466,193	566,030	**1,032,223**
T2: Decarbonize Passenger Transport	1,966,677	1,090,621	**3,057,298**	2,634,861	4,113,246	**6,748,107**
T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs	209,352	309,453	**518,805**	555,119	317,638	**872,756**
T4: Reduce VMT Through Sustainable Land Use	0	513,958	**513,958**	0	1,127,443	**1,127,443**
T5: Expand the Active Transportation Network	0	327,562	**327,562**	0	646,570	**646,570**
T6: Expand the Transit Network and Increase Ridership	0	17,621	**17,621**	0	31,785	**31,785**
T7: Optimize Traffic Flow to Reduce Idle Time	0	3,137	**3,137**	0	6,041	**6,041**

Sector / Measure	Annual GHG Emissions Reductions ($MTCO_2e$)					
	2030			2045		
	State	Local	Total	State	Local	Total
Energy						
E1: Decarbonize Existing Buildings	41,791	99,898	**141,689**	41,791	2,106,729	**2,148,520**
E2: Decarbonize New Buildings	29,851	5,432	**35,283**	114,139	111,983	**226,122**
E3: Decarbonize Industrial Processes	682,652	13,425	**696,077**	1,705,786	679,476	**2,385,262**
E4: Increase Renewable Energy Generation and Storage	2,474,725	2,302,665	**4,777,390**	6,012,357	0	**6,012,357**
E5: Improve Energy Efficiency and Resiliency Through Grid Modernization	2,474,725	293,224	**2,767,949**	6,012,357	0	**6,012,357**
E6: Improve Energy Efficiency Through Building Upgrades	1,498,230	1,372,681	**2,870,910**	1,498,230	1,858,679	**3,356,908**
E7: Improve Energy Efficiency Through Urban Greening	Regional Measure					
E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations	682,652	663,369	**1,346,021**	1,705,786	678,117	**2,383,904**
Solid Waste						
SW1: Increase Organics Diversion	836,266	507,733	**1,343,998**	890,098	603,995	**1,494,093**
SW2: Recover and Reuse Materials	Not Quantified					
SW3: Increase Waste-to-Energy and Conversion Technology Potential	Regional Measure					

Source: ESA, 2024
Abbreviations: metric tons of carbon dioxide equivalent (MTCO2e); not quantified (NQ)
Note: State = GHG emission reductions based on adopted State of California regulations. Local = GHG emission reductions based on the identified measures in this PCAP.

Attachment A: Fehr & Peers Vehicle Miles Traveled Reduction Methods Memo

FEHR PEERS

Memorandum

Date: February 9, 2024

To: Breanna Sewell, Brian Schuster and Jeff Caton, ESA

From: Sarah Brandenberg

Subject: VMT Reduction Estimates for Transportation Strategies for Los Angeles and Orange Counties Regional Climate Action Plan Vehicle Miles Traveled Inventory

LA23-3485

Fehr & Peers has developed vehicle miles traveled (VMT) reduction estimates for two transportation strategies in support of the Regional Climate Action Plan for Los Angeles and Orange Counties. This memorandum provides an overview of the transportation strategies and presents a summary of the methodology applied and resulting VMT reduction estimates.

Transportation Strategies

The current phase of the Regional Climate Action Plan has the following two transportation strategies in which VMT reduction estimates were quantified.

- T5 – Expand the Active Transportation Network
  - Achieve 5 percent higher active transportation mode share by 2030
  - Achieve 10 percent higher active transportation mode share by 2045
- T6 – Expand the Transit Network and Increase Ridership
  - Increase transit ridership by 10 percent by 2030
  - Increase transit ridership by 20 percent by 2045

The methodology to estimate the VMT reduction from each of these strategies is summarized below.

Methodology

The VMT estimates for the Regional Climate Action Plan were developed using the Southern California Association of Governments (SCAG) regional travel demand model. The 2016 SCAG

Regional Travel Demand Model has a base year of 2012 and horizon year of 2040. For horizon year 2040, SCAG provides alternative model scenarios, including Scenario 1 "Baseline" and Scenario 3 "Plan". The Baseline scenario assumes business as usual conditions, including socio-economic growth, as well as other policy assumptions, without the implementation of the RTP while the Plan scenario reflects full implementation of the RTP. For the VMT inventory, the 2040 model year based on modeling Scenario 1 – Baseline was utilized as the starting point and work from home assumptions were updated based on data provided by SCAG.

To estimate the VMT reduction for transportation strategy T5, the 2040 SCAG model vehicle-trip and VMT outputs were modified as follows:

- The number of auto person trips was reduced for Los Angeles and Orange Counties for peak and off-peak periods to reflect a mode share increase of 10 percent for walk/bike person trips in comparison to base year conditions. This approach assumes that the mode share change does not affect the total person trips generated in each County.
- Using the SCAG model trip tables, all origin-destination (OD) pairs with non-zero walk/bike trips were extracted. The mode shift from auto person trips to walk/bike trips was assumed to only occur within the OD pairs that already have walk/bike travel to have consistency in the distances traveled between auto and walk/bike trips.
- Using the OD pairs with non-zero walk/bike trips, the number of auto person trips were calculated based on the vehicle trips for those OD pairs after applying vehicle occupancies. The vehicle trip tables were then updated to reflect the total vehicle trips of those OD pairs.
- Using the updated vehicle trip tables, OD VMT was calculated for Los Angeles and Orange Counties.
- The updated VMT estimates with the increase in mode share for walk/bike trips was compared to the original 2040 VMT estimate that reflects business as usual conditions to determine the percent reduction in VMT. VMT reduction estimates for the Years 2030 and 2045 were developed using a straight-line interpolation between the 2012 base year model and 2040 forecasted year with the implementation of strategy T5.

A similar methodology was applied to estimate the VMT reduction for transportations strategy T6 as summarized below.

- The number of auto person trips was reduced for Los Angeles and Orange Counties for peak and off-peak periods to reflect a 20 percent increase in transit ridership in 2040 in comparison to business-as-usual conditions using the 2040 SCAG model.
- The number of auto person trips reflecting the transit ridership increase were calculated based on the vehicle trips after applying vehicle occupancies. The vehicle trip tables were then updated to reflect the total vehicle trips in Los Angeles and Orange Counties.

- Using the updated vehicle trip tables, OD VMT was calculated for Los Angeles and Orange Counties.
- The updated VMT estimates with the transit ridership increase was compared to the original 2040 VMT estimate that reflects business as usual conditions to determine the percent reduction in VMT. VMT reduction estimates for the Years 2030 and 2045 were developed using a straight-line interpolation between the 2012 base year model and 2040 forecasted year with the implementation of strategy T6.

VMT Reduction Estimates

Table 1 summarizes the VMT reductions in Los Angeles and Orange Counties resulting from the implementation of T5 and T6. As shown, the increase in mode share with the implementation of T5 would result in approximately a 6% reduction in VMT in Year 2030 and 13% reduction in VMT in Year 2045 in both Counties. With the implementation of T6, the VMT reduction would be approximately twice as high in Los Angeles County in comparison to Orange County since transit ridership is higher in Los Angeles. The VMT reduction would range from 0.3 to 0.8 percent in Year 2030 and 0.7 to 1.6 percent in Year 2045.

Table 1: VMT Reduction Estimates with Implementation of T5 and T6

VMT Decrease	Year 2030	Year 2045
T5: Expand the Active Transportation Network		
Los Angeles County	-6.1%	-12.9%
Orange County	-5.7%	-13.5%
T6: Expand the Transit Network and Increase Ridership		
Los Angeles County	-0.8%	-1.6%
Orange County	-0.3%	-0.7%

Note: VMT reduction estimates apply to auto/light-duty vehicles.
Source: 2016 SCAG model and Fehr & Peers.

Appendix D

GHG Quantification Guidance

APPENDIX D
GHG Quantification Guidance

D.1 Purpose

The purpose of Appendix D, *GHG Quantification Guidance*, is to provide guidance and methods for calculating GHG emission reductions from individual and specific GHG reduction measures, actions, strategies, and policies, to support the CPRG implementation grant application process. This Appendix includes relevant background information, recommended calculation methods, and a list of guidance documents, resources, and emission calculation tools. The following sections detail which GHGs to assess, how to quantify emissions reductions for each type of measure, and which guidance documents are relevant to each PCAP measure and strategy.

D.2 Quantification Overview

Greenhouse Gases

When quantifying GHG reductions for individual actions or strategies, best practice is to include as many of the Kyoto Protocol's six greenhouse gases (GHGs) as feasible. These are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). At minimum, CO_2, CH_4, and N_2O should be included. For each GHG, **Table 1** shows the chemical formula, the typical lifetime of the compound in the atmosphere, and the Global Warming Potential (GWP). GWP is a measure of warming impact relative to CO_2; consequently, gases with a high GWP can have a very large impact, even when only a small amount is generated.

TABLE D1. GHGS COVERED BY THE KYOTO PROTOCOL: LIFETIME AND GLOBAL WARMING POTENTIALS

GHG	Chemical Formula	Lifetime (years)	GWP (100-year)
Carbon Dioxide	CO2		1
Methane	CH4	12	28
Nitrous Oxide	N2O	121	265
Hydrofluorocarbons	HFCs	<1-242	4-12,400
Perfluorocarbons	PFCs	<1-50,000	6,630-11,100
Sulfur Hexafluoride	SF6	3,200	23,500

Source: IPCC, 2013

Calculating GHG Emissions Reductions

The process for calculating GHG emissions from sources and emission reductions from measures and strategies generally involves activity data (e.g., fuel consumption) rather than direct measurements of emissions at the source. Activity data paired with standard source-specific emission factors are used to calculate total emissions or emissions reductions from each source, using the following general equation:

Activity Data x Emission Factor = GHG emissions

For example, say an entity located in Southern California requires annual electricity use of 500,000 kilowatt-hours (kWh) in 2018. The entity is implementing an energy efficiency measure to reduce energy consumption by 20 percent, which equals 100,000 kWh (500,000 kWh * 20% = 100,000 kwh). EPA's Emissions & Generation Resource Integrated Database (eGRID) provides information on the air quality attributes of almost all the electric power generated in the United States by year. The entity is located in the 'California' eGRID subregion (CAMX), where the CO_2e emissions intensity for consumed electricity in 2018 is 498.7 pounds per kWh. CO_2e emissions are typically expressed in metric tons (MT). The unit conversion from pounds to metrics tons is 2,204.62 pounds per MT. Thus, total annual $MTCO_2e$ emission reductions from reducing energy consumption by 100,000 kWh are:

$$100{,}000 \text{ kWh} \times 498.7 \text{ lbs } CO_2e/\text{kWh} \div 2{,}204.62 \text{ lbs/MT} = 22{,}621 \text{ MT}CO_2e$$

Emissions calculation accuracy is improved by using utility-specific emission factors which are typically published by the utilities or are available via the California Energy Commission's (CEC) Power Content Labels.[1] Emission factors may also be sourced from other scientifically vetted sources including the United States Environmental Protection Agency (EPA), The Climate Registry (TCR), the Bureau of Transportation Statistics (BTS), the United States Department of Energy (DOE), and others. See Appendix A for the emission factors used for the MSA's GHG inventory and forecasts.

Order of Implementation for Reduction Measures

To avoid double counting GHG emissions reductions between measures that might overlap a particular emissions source, it is important to account for overlapping effects of different measures and strategies.

For example, assume Strategy E4.5 (Participate in a CCA) is implemented before other measures to reduce energy usage or generate renewable energy at the building itself. E4.5 addresses the actual electricity emission factors and CPA participation rates, which are then applied to the remaining building energy and water measures. In addition, the starting activity data (i.e., electricity and natural gas consumption) or "baseline" activity data upon which each subsequent measure is applied are affected by measure order. For example, grid electricity savings from solar production under Strategy E4.1 (Install On-Site Renewable Energy) should be subtracted from the adjusted BAU electricity activity data for the relevant building sector, and

[1] CEC, Power Content Label. Link: https://www.energy.ca.gov/programs-and-topics/programs/power-source-disclosure-program/power-content-label.

the resulting remaining electricity usage is used as the new “baseline” activity data for the next measure, Strategy E6.1 (Improve Energy Efficiency of Existing Buildings). After E6.1is implemented, the new “baseline” activity data are recalculated and used as the new “baseline” total electricity usage for Measure E1 (Decarbonize Existing Buildings). Here is an example calculation to illustrate:

1. Adjusted BAU baseline electricity usage = 500,000 kWh.
2. Implementation of ES2 reduces the carbon intensity of grid supplied electricity by 50% from 498.7 lbs CO2e/kWh to 249.4 lbs CO2e/kWh. Emission reductions for ES2 are: 500,000 kWh x (498.7 lbs CO2e/kWh -249.4 lbs CO2e/kWh) ÷ 2,204.62 lbs/MT = 56,552 MTCO2e.
3. Implementation of ES3 would generate 100,000 kWh of renewable energy through rooftop solar PV installations. Emission reductions for ES3 are then: **100,000 kWh x** 249.4 **lbs CO2e/kWh ÷ 2,204.62 lbs/MT =** 11,310 **MTCO2e**.
4. The new “baseline” electricity use after implementation of ES3 is therefore 500,000 kWh - 100,000 kWh = 400,000 kWh.
5. Implementation of E4 reduces remaining electricity consumption by 20% = 400,000 kWh * 20% = 80,000 kWh. Emission reductions for E4 are then: 80,000 kWh x 249.4 lbs CO2e/kWh ÷ 2,204.62 lbs/MT = 9,048 MTCO2e.
6. The total emission reductions for measures ES2, ES3, and E4 combined is then: 56,552 MTCO2e + 11,310 MTCO2e + 9,048 MTCO2e = 76,910 MTCO2e.

For calculation purposes, we recommend that the following calculation order for energy measures:

1. Participate in increased renewable offerings from a utility or CCA
2. Increase Renewable Energy Production
3. Improve Energy Efficiency of Existing Buildings
4. Decarbonize Existing Buildings
5. Decarbonize All-Electric New Development

Note that Measure E2 (Decarbonize New Development) is independent of the other measures because it exclusively applies to new development and therefore does not use the same baseline activity data as the other measures.

D.3 Guidance Documents and Resources

The following is a list of general guidance documents, resources, and calculation tools that can be used to estimate GHG emission reductions for individual measures, actions, and strategies.

General

GEN-1 CAPCOA GHG Handbook
GEN-2 Quantifying Energy Savings and Greenhouse Gas (GHG) Reductions | US EPA

GEN-3 CPRG Tools and Technical Assistance - GHG Reduction Measures - Resources and Tools | US EPA
GEN-4 GLIMPSE – A computational framework for supporting state-level environmental and energy planning | US EPA
GEN-5 AVoided Emissions and geneRation Tool (AVERT) | US EPA
GEN-6 Non-CO2 Greenhouse Gas Emission Projections & Mitigation | US EPA
GEN-7 Port Emissions Inventory Guidance | US EPA
GEN-8 Carbon Sequestration | CARB
GEN-9 Carbon Capture and Sequestration Protocol | CARB
GEN-10 Carbon Dioxide Emissions Coefficients | US EIA
GEN-11 Frequently Asked Questions | US EIA
GEN-12 Simplified GHG Emissions Calculator | US EPA

Electricity Generation

EG-1 Energy and Environment Guide to Action | US EPA: best practices
EG-2 OLEM's RE-Powering America's Land | US EPA
EG-3 AVoided Emissions and geneRation Tool (AVERT) | US EPA
EG-4 Energy Savings and Impacts Scenario Tool (ESIST) | US EPA
EG-5 Guidebook for Energy Efficiency Evaluation, Measurement, and Verification (epa.gov)
EG-6 Ports Initiative | US EPA
EG-7 Technical Resources for Ports | US EPA
EG-8 Guidance on Control Strategies for State and Local Agencies | US EPA
EG-9 Shore Power Emissions Calculator | US EPA
EG-10 NREL PVWatts Calculator

Transportation

TRAN-1 State and Local Transportation Resources | US EPA
TRAN-2 MOVES and Mobile Source Emissions Research | US EPA
TRAN-3 U.S. National Blueprint for Transportation Decarbonization | US EPA
TRAN-4 Green Vehicle Guide | US EPA
TRAN-5 The EPA Automotive Trends Report | US EPA
TRAN-6 Fuel Economy
TRAN-7 EMFAC2021
TRAN-8 OFFROAD2021
TRAN-9 Argonne National Lab AFLEET Tool
TRAN-10 Vehicle Idle Reduction Savings Worksheet | Argonne
TRAN-11 IdleBox: Idle Reduction Education and Outreach | Clean Cities
TRAN-12 Idle Reduction | AFDC
TRAN-13 Diesel Emissions Quantifier (DEQ)
TRAN-14 Reducing Rail Emissions in California

Commercial & Residential Building Energy

BE-1 Policymakers | ENERGY STAR
BE-2 Benchmarking and Building Performance Standards Policy Toolkit | US EPA

BE-3 Residential New Construction Program Requirements | ENERGY STAR
BE-4 ENERGY STAR Home Upgrade | ENERGY STAR
BE-5 Clean Energy Financing Toolkit for Decisionmakers | US EPA
BE-6 Zero Net Energy Buildings Hub | DOE
BE-7 Advanced Energy Retrofit Guides
BE-8 ENERGY STAR Building Upgrade Manual

Industry

IND-1 Industrial Energy Management | ENERGY STAR
IND-2 Get Involved - Become an ENERGY STAR Industrial Partner | ENERGY STAR
IND-3 ENERGY STAR Challenge for Industry | ENERGY STAR
IND-4 ENERGY STAR plant certification | ENERGY STAR
IND-5 How to Apply for Plant Certification | ENERGY STAR
IND-6 emerging_trends_in_supply_chain_emissions_engagement.pdf (epa.gov)
IND-7 Methane Challenge Program | US EPA

Agriculture / Natural & Working Lands

AG-1 Air Monitoring at Agricultural Operations | US EPA
AG-2 Types of Composting and Understanding the Process | US EPA
AG-3 Reducing the Impact of Wasted Food by Feeding the Soil and Composting | US EPA
AG-4 Anaerobic Digestion (AD) | US EPA
AG-5 Tree Planting Calculator | i-Tree
AG-6 Urban Forest Protocol | Climate Action Reserve
AG-7 Quantification Methodology for Urban and Community Forestry Program | CARB

Waste & Materials Management

SW-1 Energy Efficiency for Water Utilities | US EPA
SW-2 Landfill Methane Outreach Program (LMOP) | US EPA
SW-3 Waste Reduction Model (WARM) | US EPA
SW-4 Recycled Content (ReCon) Tool | US EPA
SW-5 Circular Economy | US EPA
SW-6 Sustainable Materials Management | US EPA
SW-7 Sustainable Management of Food | US EPA
SW-8 Sustainable Materials Management Prioritization Tools | US EPA
SW-9 Anaerobic Digester/Biogas System Operator Guidebook | US EPA
SW-10 How does Anaerobic Digestion Work? | US EPA
SW-11 AgSTAR Library of Tools | US EPA
SW-12 Biomass Explained | US EIA

Carbon Intensity of Local Electricity Providers

CI-1 CEC Power Content Labels
CI-2 EPA, eGRID CAMX

D.4 Standard Units and Conversion Factors

Unit Conversions		
1 Metric Ton (MT)	=	2,204.62 pounds (lbs)
1 MT	=	1,000,000 grams (g)
1 MT	=	1,000 kilograms (kg)
1 lb	=	454 g
1 megawatt-hour (MWh)	=	1,000 kilowatt-hours (kWh)
1 megawatt (MW)	=	1,000 kilowatts (KW)
1 kWh	=	3,412.14 British thermal units (Btu)
1 MW	=	1,341 horsepower (hp)
1 therm	=	100,000 Btu
1 therm	=	100 cubic feet (cf)
1 cf	=	1,039 Btu
1 million Btu (MMBtu)	=	1,000,000 Btu
1 barrel of oil	=	42 gallons

D.5 PCAP Reduction Measures and Strategies

This section summarizes each PCAP reduction measure and strategy, identifies relevant activity data and emission factors needed to complete emission reduction calculations, and provides guidance and reference material to aid in quantifying emission reductions.

Measure Types

The following section describes the different types of measures and general methods for quantifying GHG emissions reductions for each type. Each PCAP measure and strategy falls within one of the following measure types. The tables below include data needs, relevant emission factors and constants, guidance documents and references, and helpful notes for how to quantify GHG emission reductions for each individual measure and their associated reduction strategies. Guidance documents and references are identified by their code (e.g. TRAN-2) in each table and refer back to Section D.3.

Transportation

VMT Reduction

VMT reduction measures achieve GHG reductions through project design elements or programs that result in fewer vehicle trips and/or shorter vehicle trips, thereby reducing VMT and vehicle fuel combustion (gasoline and diesel). For example, providing transit-oriented development locates projects in compact, walkable areas that have easy access to public transit, ideally in a location with a mix of uses, including housing, retail offices, and community facilities. Project residents, employees, and visitors have easy access to high-quality public transit, thereby encouraging transit ridership and reducing the number of single-occupancy vehicle trips, VMT, and associated GHG emissions from vehicle fuel combustion. VMT reduction measures typically require a baseline level of VMT and GHG emissions before implementing any reductions. Baseline GHG emissions are calculated by multiplying VMT (activity) by an on-road vehicle emission factor (typically expressed in grams CO2e per mile). To calculate the reduction in VMT, first apply the percent reduction in VMT attributable to the project to the baseline VMT. Then multiply the same on-road vehicle emission factor used for the baseline GHG emissions to the resulting VMT reduction to calculate the GHG emissions reductions associated with the measure.

Fuel Switching

Fuel switching refers to the act of replacing one fuel type with another fuel type with lower GHG intensity. This could mean replacing a diesel vehicle fleet with an electric vehicle fleet. All non-renewable vehicle fuels have associated GHG emission factors which are usually expressed in grams CO2e per unit of volume or per mile (or grams CO_2, CH_4, and N_2O). If switching to electric vehicles, fuel switching measures also require the carbon intensity of electricity provided, which is typically expressed in pounds CO2e per kWh (lbs CO2e/kWh). When implementing a fuel switching measure, first calculate the baseline emissions from the existing vehicle fleet by multiplying the emission factor (grams CO2e per mile or gallon) by the activity data (VMT or gallons consumed). If fuel usage or VMT are not available, average fuel economy (miles per gallon) and average annual mileage per vehicle can be used to derive total fuel usage or VMT. After determining the baseline emissions, first identify the number of vehicles being replaced by an alternative technology (e.g., EVs or green hydrogen). Then calculate the activity data (VMT or fuel use) for the alternative-fuel vehicles and multiply the activity data by the relevant emission factor for the selected alternative fuel. The emissions reductions are the difference between the baseline emissions and the alternative technology emissions.

Fueling Station Installation

The installation of fueling stations supports the adoption of electric and hydrogen-fueled vehicles and, therefore, results in GHG emissions reductions. Calculating the emissions reductions from fueling stations is a two-step process involving estimating the number of stations and fuel use associated with each station and then estimating the displaced conventional vehicle VMT as a result of fueling station installation. For example, installing an EV charger would generate electricity and, in turn, generate emissions. The electricity generated is estimated using the kilowatt (KW) rating of a charger and hours of use per year. The emissions are calculated as the electricity generated multiplied by the carbon intensity of the electricity provider. Electricity use can also be used to estimate the amount of VMT displaced by multiplying the electricity use by the fuel efficiency of an electric vehicle (expressed in miles per kWh). Then multiply by an emission factor for vehicles (g CO2e per mile) to calculate the emissions savings. The net emissions reductions are the displaced VMT emissions reductions minus the emissions generated from electricity use.

Mode shift

A mode shift encourages the use of one form of transportation over another. This typically involves shifting from single-occupancy vehicles to alternative forms of transit, including walking, biking, and public transit. Mode shift measures are similar to VMT Reduction measures and are calculated using a mode shift factor and/or a VMT reduction associated with switching from a single-occupancy vehicle to a more efficient form of transit.

Reduce Idle Time

Reducing idling time is typically achieved through traffic signal synchronization or installation of high occupancy vehicle lane/express lanes. Idling emissions can be calculated using an idling rate (expressed in gallons per hour) and an assumption on hours of idling per year. The baseline total gallons of fuel spent idling annually is calculated by multiplying the idling rate by the hours of idling time. To calculate fuel reductions form reduced idling time, adjust the idling rate and/or hours of idling time per year and recalculate the fuel usage. Subtract the recalculated fuel use from the baseline fuel use and then multiply the difference by the emission factor for whichever fuel is being used (typically expressed in pounds CO2e per gallon).

Energy

Decarbonization

Decarbonization is a form of fuel switching that usually involves replacing natural gas-powered appliances with electric equivalents. Electricity is generally more efficient than natural gas and has a lower carbon intensity (approaching or equal to zero). To calculate emissions reductions from electrification, first determine the fuel consumption of a natural gas appliance and its electric equivalent. Then calculate emissions associated with each source using the carbon intensities of natural gas and electricity. The emissions reduction is the difference between the emissions resulting from a natural gas appliance and its electric equivalent. Typical appliances that are electrified include water heaters; gas ranges; heating, ventilation, and air conditioning (HVAC); clothes dryers; and pool heating.

Reduction in the Carbon Intensity of Energy

Carbon intensity of energy refers to the amount of CO2e released per unit of energy consumed. Lowering the carbon intensity of energy reduces emissions. This can be achieved by sourcing a cleaner mix of electricity from a utility provider (including a CCA) or by installing renewable energy generation infrastructure such as solar photovoltaic panels or wind turbines. The carbon intensity of electricity varies depending on the utility provider. Retail utility providers in California are required to procure an increasingly cleaner energy portfolio under the State's Renewables Portfolio Standard. State law requires that eligible renewable energy resources and zero-carbon resources must supply 90 percent of all retail sales of electricity to California end-use customers by 2035, 95 percent by 2040, 100 percent by 2045, and 100 percent of electricity procured to serve all state agencies by 2035 (Senate Bill 1020). To calculate reductions from lower carbon intensity electricity, first multiply the electricity use by the baseline carbon intensity (typically expressed in pounds CO2e per kWh or MWh) to estimate baseline emissions. Then multiply the same baseline electricity use by the lower carbon intensity value and subtract this from the baseline emissions to estimate the emissions reductions from using less carbon-intensive fuel sources.

Energy Reduction and Energy Efficiency

Energy reduction and energy efficiency measures reduce the quantity of energy (typically electricity and/or natural gas) consumed in buildings. To estimate emissions reductions, first identify the amount of energy saved that is associated with operation of higher energy efficiency buildings. Then multiply the reduction in electricity and/or natural gas by the carbon intensity of the respective energy source to calculate emissions reductions.

Carbon Sequestration from Tree Planting

Trees capture carbon from the atmosphere and store it in their trunks and branches. The amount of carbon a tree can capture depends on its species, size, age, growth rate, and health. The amount of carbon sequestered is typically expressed in terms of CO2e captured per year per tree. To estimate emissions reductions, multiply the number of trees planted by a sequestration factor. Carbon sequestration could also mean embedding the carbon in a structure that will hold the emissions and keep them out of the atmosphere. Common forms of carbon sequestration include carbon capture and storage (CCS) or direct air capture (DAC). CCS is typically used for large point emission sources such as a power plant to capture carbon being released at the source. DAC is capable of capturing carbon already in the atmosphere. Sequestration occurs through biological, chemical, or physical processes.

Solid Waste

Waste Diversion

Solid waste diversion refers to the process of diverting and redirecting waste from landfills. Organic waste decomposes in landfills and produces methane that escapes into the atmosphere. Emissions reductions from solid waste diversion are calculated by first identifying the waste characterization and tonnage of the waste stream. Then identify the amount of solid waste diverted from landfill by organic waste type. Then multiply the tonnage of each organic material type by its respective emission factor. Total emissions reductions are the sum of emission reductions for each diverted waste type.

Waste-to-Energy

Waste-to-Energy (WTE) technology converts landfill gas from decaying organics in landfills into usable energy through landfill gas combustion. Converting waste to energy through incineration, gasification, or pyrolysis is a trash management strategy reduces GHG emissions in two ways: 1) by reducing methane generated by the organic feedstock in landfills; and 2) by replacing traditional fossil energy sources (such as diesel or natural gas) with biogenic fuels produced in the WTE process (such as renewable biodiesel or biomethane). To estimate emissions reductions associated with electricity produced by a WTE facility, first multiply the capacity (in KW or MW) of the WTE facility by the hours of operation per year and by a usage factor to estimate the electricity generated annually. Then multiply the electricity by the carbon intensity of electricity supplied by the local utility provider to calculate emission reductions. Electricity generated by WTE facilities us assumed to displace electricity that would otherwise be generated through traditional means at utility power plants (e.g., natural gas combustion). A similar process can be used to estimate other energy types produced by WTE facilities, such as renewable biodiesel or biomethane.

Measure T1: Decarbonize Goods Movement

Description

Implement and incentivize the decarbonization of goods movement activities by increasing the zero-emission vehicle (ZEV) market share of heavy-duty, on-road vehicles and off-road equipment fleets.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T1.1— Replace fossil fuel-powered vehicles, rail, and equipment with zero emission vehicles (ZEV). [ZEV registrations]	Fuel Switching	Number of vehicles being converted to ZEV	Conventionally fueled vehicle emission factor (g CO2e per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	GEN-1: Measure T-28 TRAN-7 CI-2 TRAN-13	EMFAC2021 provides emission factors and fuel/electricity use when ran in “inventory” mode that can be used to derive emission factors. eGRID’s CAMX carbon intensity factor is the regional factor for California.
T1.2— Install electric vehicle (EV) charging stations/infrastructure, including for offroad equipment and harbor craft. [EVCS installed]	Fueling Station Installation	Fuel type of existing equipment Hours of equipment operation	Carbon intensity of fossil-fueled equipment (g CO2e per horsepower-hour)	GEN-1: Measure T-13 GEN-7 TRAN-8 TRAN-9	AFLEET calculates emissions reductions from EV charging installations based on charger rating.
T1.3— Install hydrogen fueling infrastructure, including for off-road equipment and harbor craft. [hydrogen fueling stations installed]	Fueling Station Installation	Number of fueling stations		GEN-1: Measure T-50 TRAN-9	AFLEET assumes fueling stations for light duty vehicles only. However, it may be useful for gathering data on hydrogen fueling station assumptions.
T1.4— Install ship to shore power infrastructure. [terminals retrofitted with shore power]	Fuel Switching	Vessel type Engine tier Annual vessel calls Hotel hours per vessel call	None needed if using Shore Power Emissions Calculator.	GEN-1: Measure T-49 EG-6 EG-7 EG-10	Shore Power Emissions Calculator calculates net emissions reductions from implementing shore power units.
T1.5— Upgrade electric grid to support ZEV charging infrastructure. [EV-ready parking spaces]	Fueling Station Installation	# of chargers installed at site Total vehicles accessing the site per day	Conventionally fueled vehicle emission factor (g CO2e per mile) Energy efficiency of EVs (kWh per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	GEN-1: Measure T-13 GEN-1: Measure E-9 EG-5 TRAN-7 CI-2	

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T1.6— Expand rail infrastructure and low- and zero-emissions locomotives to support the decarbonization of goods movement. [low-emission locomotives; zero-emission locomotives]	Fuel Switching	Fuel type of existing locomotives Fuel use of existing locomotives	Conventionally fueled locomotive emission factor (g CO2e per mile) Alternatively fueled locomotive emission factor (g or kWh CO2e per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	TRAN-13 TRAN-14	

Measure T2: Decarbonize Passenger Transport

Description

Increase the ZEV market share for on-road passenger vehicles and passenger buses, including school buses.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T2.1— Replace fossil fuel-powered passenger vehicles with ZEVs and install necessary EV infrastructure. [ZEV registrations]	Fuel Switching	Number of vehicles being converted to ZEV	Conventionally fueled vehicle emission factor (g CO2e per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	GEN-1: Measure T-28 TRAN-7 CI-2 TRAN-13	EMFAC2021 provides emission factors and fuel/electricity use when ran in “inventory” mode that can be used to derive emission factors. eGRID’s CAMX carbon intensity factor is the regional factor for California.
T2.2— Replace fossil fuel-powered buses with ZEVs and install necessary EV infrastructure. [ZEV registrations]	Fuel Switching	Number of vehicles being converted to ZEV	Conventionally fueled vehicle emission factor (g CO2e per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	GEN-1: Measure T-28 TRAN-7 CI-2 TRAN-13	EMFAC2021 provides emission factors and fuel/electricity use when ran in “inventory” mode that can be used to derive emission factors. eGRID’s CAMX carbon intensity factor is the regional factor for California.
T2.3— Install publicly accessible EV chargers. [public and shared private EVCS installed]	Fueling Station Installation	Number of fueling stations Type of fueling stations		GEN-1: Measure T-13 TRAN-8 TRAN-9	AFLEET tool has options for level 2 and DC fast chargers in addition to hydrogen fueling stations.
T2.4— Install publicly accessible hydrogen fueling infrastructure. [hydrogen fueling stations installed]	Fueling Station Installation	Number of fueling stations Type of fueling stations		GEN-1: Measure T-50 TRAN-9	AFLEET tool has options for level 2 and DC fast chargers in addition to hydrogen fueling stations.

Measure T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs

Description

Increase the ZEV market share for on-road medium- and heavy-duty vehicles.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T3.1— Replace fossil fuel-powered medium- and heavy-duty vehicles with ZEVs. [ZEV registrations]	Fuel Switching	Number of vehicles being converted to ZEV	Conventionally fueled vehicle emission factor (g CO2e per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	GEN-1: Measure T-28 TRAN-7 CI-2 TRAN-13	EMFAC2021 provides emission factors and fuel/electricity use when ran in "inventory" mode that can be used to derive emission factors. eGRID's CAMX carbon intensity factor is the regional factor for California.
T3.2— Install EV charging stations. [EVCS installed]	Fueling Station Installation	Number of vehicles being converted to ZEV	Conventionally fueled vehicle emission factor (g CO2e per mile) Carbon intensity of local electricity provider (lb CO2e per MWh)	GEN-1: Measure T-28 TRAN-7 CI-2 TRAN-13	EMFAC2021 provides emission factors and fuel/electricity use when ran in "inventory" mode that can be used to derive emission factors. eGRID's CAMX carbon intensity factor is the regional factor for California.
T3.3— Install hydrogen fueling infrastructure. [hydrogen fueling stations installed]	Fueling Station Installation	Number of fueling stations Type of fueling stations		GEN-1: Measure T-50 TRAN-9	AFLEET tool has options for level 2 and DC fast chargers in addition to hydrogen fueling stations.

Measure T4: Reduce VMT Through Sustainable Land Use

Description

Reduce VMT by constructing transit-oriented, mixed-use, and infill development and increasing housing and high-quality transit near high job density areas.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T4.1— Increase housing and job density along transit corridors, such as high-quality transit areas (HQTA). [jobs per acre; dwelling units or population per acre]	VMT Reduction	Residential or job density of project development (du or jobs per acre)	Density of typical development Elasticity of VMT	GEN-1: Measure T-1 GEN-1: Measure T-2 GEN-1: Measure T-35	See CAPOA guidance for details on method.
T4.2— Construct infill and mixed-use development. [jobs per acre; dwelling units or population per acre]	VMT Reduction	None	Transit mode share in region Ratio of transit mode share for transit-oriented development area with measure Auto mode share in region	GEN-1: Measure T-3 GEN-1: Measure T-29-A GEN-1: Measure T-29-B	See CAPOA guidance for details on method.
T4.3— Establish flexible parking requirements through zoning changes or new development regulations that can result in reduced parking. [parking spaces per land use type]	VMT Reduction	Parking demand (spaces) Parking supply (spaces) % of VMT generated by residents	% of household VMT that is commute based % reduction in commute mode share	GEN-1: Measure T-14 GEN-1: Measure T-15	

Measure T5: Expand the Active Transportation Network

Description

Expand active transportation infrastructure and vehicles, including bicycle and pedestrian networks and micro-mobility options (e.g., e-bikes, scooters, electric golf carts, etc.), to encourage and support zero-carbon transportation options.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T5.1— Enhance pedestrian infrastructure in areas of development that support active transportation by expanding sidewalks and protected multi-use trails. [miles of sidewalks; miles of multi-use trails]	VMT Reduction	Existing sidewalk length in study area Sidewalk length in study area with strategy	Elasticity of VMT	GEN-1: Measure T-17 GEN-1: Measure T-35	See CAPOA guidance for details on method.
T5.2— Improve the connectivity of the bicycle network by expanding bicycle facilities and infrastructure. [miles of bike lanes and bikeways]	VMT Reduction	% of plan/community VMT on parallel roadway Active transportation adjustment factor Miles of bikeway Credits for key destinations near project Growth factor	Bicycle trip lengths and mode share Vehicle mode share Bicycle trip length	GEN-1: Measure T-9 GEN-1: Measure T-18A GEN-1: Measure T-18B GEN-1: Measure T-19 GEN-1: Measure T-36	See CAPOA guidance for details on method.
T5.3— Support the integration of micro-mobility and first-mile/last-mile travel options, such as e-bikes and scooters, through subsidies and community awareness. [e-bikes and scooters in operation]	VMT Reduction/Mode Shift	% of residences in plan/community with/without access to micro-mobility program	Daily micro-mobility trips per person Vehicle to micro-mobility substitution rate Average micro-mobility trip length Daily vehicle trips per person Regional Average trip length	GEN-1: Measure T-20 GEN-1: Measure T-21 TRAN-9 TRAN-13	

Measure T6: Expand the Transit Network and Increase Ridership

Description

Expand transit services, infrastructure, and accessibility to reach the majority of residents and workers.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T6.1— Expand transit coverage by incorporating new ZEV buses and increasing the service and frequency of bus and rail systems. [ZEVs in transit fleet; transit service hours; transit service miles; miles of transit-only lanes]	VMT Reduction	Total transit service miles or hours in plan/community before and after expansion Transit mode share in plan/community	Elasticity of transit demand Mode shift factor Ratio of vehicle trip reduction to VMT	GEN-1: Measure T-24 GEN-1: Measure T-25 GEN-1: Measure T-28	See CAPOA guidance for details on method.
T6.2— Provide information, outreach, and incentives to community members to encourage transit use. [ridership]	VMT Reduction	Residences in plan/community before/after strategy implementation	% of targeted residences that participate % vehicle trip reduction by participating residences Adjustment factor	GEN-1: Measure T-22 GEN-1: Measure T-37	See CAPOA guidance for details on method.
T6.3— Improve connectivity and transit efficiency through development of bus rapid transit (BRT) systems. [BRT service hours; BRT service miles]	Mode Shift	Increase in transit frequency or miles	Elasticity of transit ridership with respect to frequency of service Transit mode share Vehicle mode share Mode shift factor	GEN-1: Measure T-25	
T6.3— Expand rail infrastructure and low- and zero-emissions locomotives to support the decarbonization of passenger rail. [low-emission locomotives; zero-emission locomotives]	Fuel Switching	Fuel type of existing locomotives Fuel use of existing locomotives	Conventionally fueled locomotive emission factor (g CO_2e per mile) Alternatively fueled locomotive emission factor (g or kWh CO_2e per mile) Carbon intensity of local electricity provider (lbs CO_2e per MWh)	TRAN-13 TRAN-14	

Measure T7: Optimize Traffic Flow to Reduce Idle Time

Description

Retrofit and enhance traffic infrastructure to improve traffic flows and reduce idle times.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
T7.1— Implement traffic signal synchronization on arterial roads. [roadway miles with traffic signal synchronization; intersections with traffic signal synchronization]	Idling Time Reduction	Idling rate (gal per hour) Idling time (hours per year)	Emission factor of fuel type (lb CO2e per gal)	GEN-1: Measure T-34 TRAN-7 TRAN-10 TRAN-11 TRAN-12	EMFAC2021 provides idling emission rates for specific vehicle types
T7.2— Replace lanes and roadway adjacent infrastructure with high-occupancy vehicle (HOV) / express lanes and active transportation lanes. [miles of HOV / express lanes; miles of active transportation lanes]	Idling Time Reduction	Idling rate (gal per hour) Idling time (hours per year)	Emission factor of fuel type (lb CO2e per gal)	TRAN-7 TRAN-10 TRAN-11 TRAN-12	EMFAC2021 provides idling emission rates for specific vehicle types

Measure E1: Decarbonize Existing Buildings

Description

Implement building performance standards and fuel switching to decarbonize existing buildings and reduce the GHG intensity of existing building operations.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E1.1— Adopt Building Performance Standards and reach code requirements in existing buildings. [adoption of reach codes; buildings retrofitted]	Decarbonization	Quantified under E1.2 and E1.4			
E1.2— Replace natural gas equipment and appliances with electric and zero-GHG alternatives. [appliances replaced]	Decarbonization	Building type Number of dwelling units or size of commercial building	Electricity Demand Forecast Zone Existing fuel consumption Additional electricity use for equivalent electrified end uses with strategy Carbon intensity of natural gas and electricity	GEN-1: Measure E-12 GEN-2 GEN-4 BE-2 BE-4	EPA's GLIMPSE and NREL's SLOPE tools may be useful
E1.3—Establish financial incentives for private and public building owners to invest in energy-efficient retrofitting. [buildings retrofitted]	Decarbonization	Quantified under E1.2 and E1.4			
E1.4— Decommission and replace outdated refrigeration equipment and properly dispose of high-GWP refrigerants. [equipment retrofitted]	Decarbonization	Total alternative refrigerant charge size (kg) Annual leak rate of equipment with alternative refrigerant	HFC refrigerant charge size (kg) Annual leak rates of existing equipment GWP of HFC refrigerant and alternative refrigerant	GEN-1: Measure R-1 GEN-1: Measure R-7 GEN-12	The Simplified GHG Emissions Calculator has a module for refrigerants

Measure E2: Decarbonize New Buildings

Description

Require new buildings to achieve zero GHG emissions in building operations.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E2.1— Adopt an ordinance requiring all applicable new buildings to be zero-GHG emission. [adoption of reach codes; buildings constructed]	Decarbonization	Building type Number of dwelling units or size of commercial building	Electricity Demand Forecast Zone Existing fuel consumption Additional electricity use for equivalent electrified end uses with strategy Carbon intensity of natural gas and electricity	GEN-1: Measure E-1 GEN-1: Measure E-14 GEN-1: Measure E-15 GEN-2 GEN-4	EPA's GLIMPSE and NREL's SLOPE tools may be useful
E2.2— Adopt a zero net energy (ZNE) ordinance for all new buildings. [adoption of reach codes; buildings constructed]	Decarbonization	N/A	Percent reduction in GHG emissions from building	GEN-1: Measure E-15 BE-2 BE-3 BE-6	Assumes a zero net energy buildings would reduce emissions to zero.

Measure E3: Decarbonize Industrial Processes

Description

Decarbonize and retrofit industrial processes by adopting zero GHG emission technologies, improving energy efficiency, and transitioning to carbon-free and renewable energy sources.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E3.1— Retrofit industrial processes and equipment with electric- or hybrid-powered equipment. [number of retrofits]	Decarbonization	Fuel type of existing equipment Hours of equipment operation Carbon intensity of fossil-fueled equipment	Horsepower of equipment Carbon intensity of local electricity provider % fuel reduction of hybrid equipment compared to conventional equipment	GEN-1: Measure C-1 TRAN-8 IND-1	OFFROAD2021 has fuel use and emission factors for specific types of off-road equipment.
E3.2— Encourage and support on-site installation and use of zero-GHG and renewable energy generation systems. [kW of solar capacity installed]	Carbon Intensity of Energy	Electricity provided by PV system with measure (kWh per year) Total electricity demand (kWh per year)	Carbon intensity of local electricity provider	GEN-1: Measure E-9B GEN-1: Measure E-10 GEN-2 IND-1	NREL's SLOPE tool may be useful solar calculations.

Measure E4: Increase Renewable Energy Generation and Storage

Description

Accelerate use of renewable energy by expanding renewable electricity generation, participating in renewable electricity services, and maximizing electricity storage.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E4.1—Install onsite zero-GHG and renewable electricity generation and storage systems throughout the MSA. [kW of solar capacity installed]	Carbon Intensity of Energy	Electricity provided by PV system with measure (kWh per year) Total electricity demand (kWh per year)	Carbon intensity of local electricity provider	GEN-1: Measure E-9A GEN-1: Measure E-9B GEN-1: Measure E-10 GEN-2 CI-1 EG-10	NREL's SLOPE tool may be useful solar calculations.
E4.2— Establish financial incentives for residents and businesses to install renewable electricity generation and storage equipment. [value of financial incentives awarded; kW of solar capacity installed]	Quantified under E4.1				
E4.3—Streamline permitting processes for installation of onsite zero-GHG and renewable electricity generation and storage systems. [kW of renewable energy capacity installed]	Quantified under E4.1				
E4.4—Establish incentives for municipalities to streamline permitting processes for installation of onsite zero-GHG and renewable electricity generation and storage systems. [kW of renewable energy capacity installed]	Quantified under E4.1				
E4.5— Encourage residents and businesses to participate in renewable offerings through utilities and community choice aggregates (CCA). [CCA participation rate; utility renewable participation rate]	Carbon Intensity of Energy	Electricity use (kWh)	Carbon intensity of local electricity provider Carbon intensity of power supply with green power	GEN-1: Measure E-10 GEN-2 CI-1	Check for local CCAs in your region. Some utilities offer electricity rate options with higher renewable energy mixes.
E4.6— Leverage funding for public schools to retrofit buildings with electricity storage and renewable electricity generation. [building retrofits; kW of renewable electricity capacity installed]	Carbon Intensity of Electricity	Electricity provided by PV system with measure (kWh per year) Total electricity demand (kWh per year)	Carbon intensity of local electricity provider	GEN-1: Measure E-9A GEN-1: Measure E-9B GEN-1: Measure E-10 GEN-2 CI-1 EG-10	

Measure E5: Improve Grid Efficiency and Resiliency Through Grid Modernization

Description

Improve energy efficiency and grid resiliency by expanding regional energy storage, developing microgrids, and using other grid modernization technologies, such as peak shaving, demand management, and net energy metering.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E5.1— Identify and prioritize solar and microgrid backup power projects at critical facilities. [kW of solar capacity installed; number and capacity of microgrid systems installed; estimated energy savings]	Carbon Intensity of Energy	Electricity provided by PV system with measure (kWh per year) Total electricity demand (kWh per year)	Carbon intensity of local electricity provider	GEN-1: Measure E-9B GEN-1: Measure E-23 GEN-2	NREL's SLOPE tool may be useful solar calculations.
E5.2— Conduct feasibility studies to identify priority areas for building- and community-scale microgrids and alternative technologies such as fuel cells and grid paralleling, to support demand management, peak shaving, and load shifting to increase grid resilience. [priority areas identified; facilities upgraded]	Energy Reduction	Facilities upgraded Baseline energy use Projected energy use with strategy	Carbon intensity of local electricity provider	BE-2 BE-4 BE-7 BE-8	
E5.3— Leverage funding for public facilities to address grid modernization and improved resiliency. [facilities upgraded]	Energy Reduction	Facilities upgraded Baseline energy use Projected energy use with strategy	Carbon intensity of local electricity provider	BE-2 BE-4 BE-7 BE-8	

Measure E6: Improve Energy Efficiency Through Building Upgrades

Description

Retrofit existing building stock to improve energy efficiency.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E6.1— Incentivize retrofits for energy-efficient appliances and building envelope improvements. [buildings retrofitted; estimated energy savings]	Carbon Intensity of Energy	Building type ENERGY STAR appliance(s) installed	Electricity demand forecast zone % reduction in electricity for ENERGY STAR appliance compared to conventional appliance % of total building electricity by appliance	GEN-1: Measure E-2 GEN-2 BE-2 BE-4	NREL's SLOPE and EPA's ESIST tools may be helpful.
E6.2— Incentivize installation of smart meters. [smart meters installed]	Energy Reduction	Facilities upgraded Baseline energy use Projected energy use with strategy	Carbon intensity of local electricity provider	BE-2 BE-4 BE-7 BE-8	
E6.3—Establish financial incentives for private and public building owners to invest in energy-efficient retrofitting. [buildings retrofitted]	Quantified under E6.1				

Measure E7: Improve Energy Efficiency Through Urban Greening

Description

Reduce energy consumption in urban environments through the strategic planting of shade trees and vegetation and the use of cooling surfaces.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E7.1— Expand shade tree planting on private, City, School District, and County property and in the public right-of-way. [trees planted]	Carbon Sequestration	Location Tree species Tree mortality over projected lifetime Tree condition and diameter Distance to nearest building Direction of tree from building Building vintage	Carbon intensity of local electricity provider Carbon intensity of natural gas	GEN-1: Measure N-2 AG-5 AG-6 AG-7	
E7.2— Create and implement equitable Urban Forest Management Plans that prioritize: (1) tree- and parks-poor communities; (2) climate- and watershed-appropriate and drought/pest-resistant vegetation; (3) appropriate watering, maintenance, and disposal practices; (4) provision of shade; and (5) biodiversity. [trees planted; drought-tolerant vegetation planted]	Quantified under E7.1				
E7.3— Promote cool roofs and pavement, green roofs, vertical gardens, reflective materials, and other materials that help reduce the urban heat island effect. [area of cool materials installed; buildings with cool roofs; buildings with vertical gardens]	Energy Reduction	Building type Climate zone Orientation Area of installation Albedo of surface Coverage	Carbon intensity of local electricity provider Carbon intensity of natural gas Change in electricity use with cool roof Solar availability	GEN-1: Measure E4	

Measure E8: Reduce Fugitive Emission and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations

Description

Develop strategies and policies to decommission oil and gas operations and increase carbon removal.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
E8.1— Develop sunset strategies for all oil and gas operations that prioritize disproportionately affected communities. [oil wells decommissioned; gas operations ended]	Carbon Intensity of Energy/Energy Reduction	Gallons, barrels, or cubic feet of fuel produced at facility.	Carbon intensity of fuel type	GEN-10 GEN-11	Emissions reductions are calculated as the reduction in fuel use from sunset strategy multiplied by the carbon intensity of the fuel
E8.2— Develop a policy that requires the examination of all active, idle, and abandoned oil wells for fugitive emissions of GHG. [number of oil wells examined; amount of GHGs emitted (estimated or measured)]	Quantified under E.8-1				
E8.3— Develop a carbon removal strategy that considers direct air capture (DAC) and carbon capture and sequestration (CCS). [capacity of DAC systems installed; capacity of CCS systems installed]	Carbon Sequestration	Amount of carbon capable of being sequestered	N/A	GEN-1: Measure M-1 GEN-8 GEN-9	
E8.4— Create training opportunities to help the fossil fuel workforce transition to clean energy jobs. [clean energy jobs created]	Not quantified.				

Measure SW1: Increase Organics Diversion

Description

Increase diversion of organic wastes from landfills that is generated from residential, industrial, and commercial sources, and livestock through ordinances, service improvements, education and outreach, and promotion of product stewardship.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
SW1.1— Add new or expand existing regional composting facilities. [composting facilities constructed; organics processing capacity]	Quantified under SW1.4				
SW1.2— Increase availability of public organics bins. [organic bins in use]	Quantified under SW1.4				
SW1.3— Increase frequency of organic waste pickups. [organic waste pickups; quantify of organic waste collected]	Quantified under SW1.4				
SW1.4— Implement food recovery programs. [tons of food recovered]	Diversion	Population	Residential and non-residential disposal rates by location or business type % of material in waste stream Material type	GEN-1: Measure S-2 SW-3 SW-4 SW-5 SW-7	CAPCOA provides relevant inputs that can be used in the WARM model.
SW1.5— Implement composting programs. [tons of organics composted]	Diversion	Population	Residential and non-residential disposal rates by location or business type % of material in waste stream Material type	GEN-1: Measure S-2 SW-3 SW-4 SW-5 SW-7	CAPCOA provides relevant inputs that can be used in the WARM model.
SW1.6— Divert tree trimming debris to local mulch recycling programs. [tons of material diverted]	Diversion	Population	Residential and non-residential disposal rates by location or business type % of material in waste stream Material type	GEN-1: Measure S-2 SW-3 SW-4 SW-5 SW-7	CAPCOA provides relevant inputs that can be used in the WARM model.

Measure SW2: Recover and Reuse Materials

Description

Reduce waste generation, conserve resources, and promote circular economy practices by expanding the recovery, recycling, and reuse of materials.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
SW2.1— Educate the public on proper disposal sorting. [waste generation rates; waste disposal rates]	Not quantified.				
SW2.2— Establish construction and demolition (C&D) diversion requirements beyond state requirements. [C&D waste disposal rates]	Not quantified.				
SW2.3— Increase frequency of recycling pickups and/or increase cost of waste bins. [recycling pickups; quantify recycling material collected]	Not quantified.				
SW2.4— Implement a textile recovery program. [textiles recovered]	Not quantified.				
SW2.5—Replace single use items with multi-use recyclable materials. [recycling rate; diversion rate]	Not quantified.				
SW2.6— Invest in local reuse and repurposing companies. [waste disposal rate; diversion rate]	Not quantified.				

Measure SW3: Increase Waste-to-Energy (WTE) and Conversion Technology (CT) Potential

Description

Expand waste management practices and implement waste-to-energy and energy conversion technologies.

Reduction Strategies	Measure Type	Activity Data/User Inputs	Emission Factors/Constants	Guidance Document Sources	Notes
SW3.1— Increase landfill gas capture and build waste-to-energy systems in local solid waste and landfill facilities. [quantity of landfill gas captured; capacity of WTE facilities constructed; energy generated at WTE facilities]	Waste-to-Energy	KW rating of WTE facility Hours of operation annually Usage factor	Carbon intensity of local electricity provider	GEN-1: Measure E-17 SW-2 SW-3 SW-12	
SW3.2— Explore the feasibility of regional anaerobic digestion and conversion technology facilities. [anaerobic digestion facilities; biogas generated; digestate generated]	Waste-to-Energy	KW rating of anaerobic digester OR biogas recovered Hours of operation annually Usage factor	Carbon intensity of local electricity provider Carbon intensity of biogas	AG-4 SW-9 SW-10 SW-11	

Appendix E

Potential Activities Under PCAP Measures

APPENDIX E
Potential Activities Under PCAP Measures

The table below lists potential activities and actions that fall under each PCAP reduction measure.

Table E-1. Potential Activities

Transportation Measures
T1: Decarbonize Goods Movement • Purchase or lease ZEV goods movement vehicles and equipment to replace fossil fuel-powered vehicles. • Policies for fleet efficiency or GHG standards for new agency or port vehicles. • Install battery systems for vehicles with onboard equipment (such as boom tucks) to decrease truck idling while equipment is used. • Use Global Positioning Systems (GPS) and integrated software to control fleet vehicles, reduce misuse and increase efficiency through trip planning and location information. • Electric vehicle (EV) Charging infrastructure at goods movement facilities: o Combined charging systems: DC fast charging (DCFC) systems with a combined charging cable type. Combined charging systems are compatible with almost all LD and MHD ZEVs on the market today (with the major exception of Tesla vehicles, unless a personal adaptor is used). Combined charging systems range from 50kW-350kW, depending on the system and use needs. o Megawatt charging systems – developing technology that will provide fast charging for class 6, 7, and 8 commercial vehicles (MHD trucks), including goods movement long haul trucks that frequent the highway corridors of the region. These systems can charge a single vehicle with the maximum system power output or multiple vehicles at once, with the system's power divided among the users. • Hydrogen fueling stations at goods movement facilities • Ship to shore power infrastructure at goods movement facilities • Purchase of goods movement zero-emission vehicles (ZEVs) o Funding of incentive programs for fleet electrification and decarbonization • Pilot vehicle & equipment studies for electric and hydrogen vehicle technology implementation • Electrification of warehouse cargo-handling equipment • Energy storage and grid resilience o Commercial solar and battery storage expansion • Building Performance Standards for existing goods movement facilities and reach code requirements for major retrofits and renovations that require alternative fueling infrastructure for medium- and heavy-duty vehicles. • Streamline permitting of ZEV charging and fueling infrastructure for medium- and heavy-duty vehicles. • First mile/last mile improvements • Address barriers impeding the transformation of the last mile freight market

Transportation Measures

T2: Decarbonize Passenger Transport

- Replacement of fossil fuel-powered on-road passenger vehicles with ZEVs
- Replacement of fossil fuel-powered on-road buses with ZEVs
- Policies for fleet efficiency or GHG standards for new buses.
- EV Charging infrastructure at necessary on-road passenger vehicle and passenger bus locations
- Program planning and siting of electric vehicle charging stations (EVCS)
    - Identify appropriate locations and site hosts.
    - Outreach and engagement to ensure that sites are appropriate and effective.
    - Coordinate with local and regional planning efforts related to ZEV infrastructure.
    - Leverage, where possible, EV readiness planning that has been previously completed for the region by CVAG, SCAG, and WRCOG.
- EVCS Purchases
    - DC fast chargers along highway corridors to support regional travelers.
    - Level 2 chargers to support community, multi-family residential, and local opportunity charging.
- EVCS Deployment
    - Install EVCS: design, construction, construction management
    - Provide needed electrical infrastructure upgrades
- EVCS Operation
    - Support station operations and payments.
    - Ensure that stations are functional.
    - Provide customer service to end users.
    - Periodic charger software upgrades.
- EVCS Maintenance
    - Ensure stations are maintained and repaired promptly.
    - Ensure correct connector standards are maintained.
    - Ensure technicians are trained in appropriate technologies and needed skills.
- Program Administration
- Hydrogen fueling infrastructure at necessary on-road passenger vehicle and passenger bus locations
- Energy storage and grid resilience

T3: Transition Medium- and Heavy-Duty Vehicles to ZEVs

- Purchase or lease ZEV medium and heavy-duty vehicles to replace fossil fuel-powered vehicles.
- EV Charging and hydrogen fueling infrastructure at critical medium- and heavy-duty vehicle locations:
    - Combined charging systems: DC fast charging (DCFC) systems with a combined charging cable type. Combined charging systems are compatible with almost all LD and MHD ZEVs on the market today (with the major exception of Tesla vehicles, unless a personal adaptor is used). Combined charging systems range from 50kW-350kW, depending on the system and use needs.
    - Megawatt charging systems – developing technology that will provide fast charging for class 6, 7, and 8 commercial vehicles (MHD trucks), including goods movement long haul trucks that frequent the highway corridors of the region. These systems can charge a single vehicle with the maximum system power output or multiple vehicles at once, with the system's power divided among the users
- Program planning and siting of electric vehicle charging stations (EVCS)
    - Identify appropriate locations and site hosts.
    - Outreach and engagement to ensure that sites are appropriate and effective.
    - Coordinate with local and regional planning efforts related to ZEV infrastructure.
    - Leverage, where possible, EV readiness planning that has been previously completed for the region by CVAG, SCAG, and WRCOG.

Transportation Measures

- EVCS Purchases
  - DC fast chargers along highway corridors to support regional travelers.
  - Level 2 chargers to support community, multi-family residential, and local opportunity charging.
- EVCS Deployment
  - Install EVCS: design, construction, construction management
  - Provide needed electrical infrastructure upgrades
- EVCS Operation
  - Support station operations and payments.
  - Ensure that stations are functional.
  - Provide customer service to end users.
  - Periodic charger software upgrades.
- EVCS Maintenance
  - Ensure stations are maintained and repaired promptly.
  - Ensure correct connector standards are maintained.
  - Ensure technicians are trained in appropriate technologies and needed skills
- Streamline permitting of ZEV charging and fueling infrastructure for medium- and heavy-duty vehicles.
- Energy storage and grid resilience

T4: Reduce VMT Through Sustainable Land Use

- Increase residential density
  - Develop increased housing density of dwelling units (du) compared to the average residential density in the U.S
- Increase job density
  - Develop higher density of jobs compared to the average job density in the U.S
- Provide transit-oriented development
  - Build in compact, walkable areas that have easy access to public transit, ideally in a location with a mix of uses, including housing, retail offices, and community facilities
- Locate and develop in high destination accessibility areas
  - Development in an area with high accessibility to destinations where the number of jobs or other attractions (e.g., schools, supermarkets, and health care services) are reachable within a given travel time or travel distance
- Improve destination accessibility in underserved areas
  - Constructing job centers or other attractions (e.g., schools, supermarkets, and health care services) for residents in underserved areas (e.g., food deserts)
- Streamline the entitlement process for development of high quality residential construction in older and infill areas through updates to the housing element of the general plan or the zoning code, including taking full advantage of opportunities to streamline the California Environmental Quality Act (CEQA) review for infill development
- Develop general plan policies that integrate diverse land uses – including housing, employment and community services – at appropriate densities to help reduce automobile travel and promote walking, bicycling and other opportunities for physical activities

T5: Expand the Active Transportation Network

- Evaluation of local public pedestrian and bicycle infrastructure in existing communities and neighborhoods
- Design and redesign standards for streets and sidewalks for multi-modal mobility and access
- Urban non-motorized zones
  - Convert a percentage of its roadway miles to transit malls, linear parks, or other non-motorized zones
- Construct and improve bike facilities

Transportation Measures
o Construct or improve a single bicycle lane facility (only Class I, II, or IV) that connects to a larger existing bikeway network • Construct and improve bike boulevards o Construct or improve single bicycle boulevard that connects to a larger existing bikeway network • Expand bikeway networks o Increase the length of a city or community bikeway network with markings and signage on appropriately sized roads • Evaluate a bicycle master plan to guide bikeway policies and development standards to make bicycling safer, more convenient and enjoyable for all bicyclists. • Create and distribute bike maps and “safe routes to school” maps to community members through collaborating with local businesses, service organizations and schools. • End of trip bicycles facilities o Install and maintain end-of-trip facilities at major transportation hubs
T6: Expand the Transit Network and Increase Ridership • Transition of fossil fuel-powered buses with ZEVs and cleaner-fuel vehicles • EV Charging infrastructure at necessary transit network locations • Extend transit network coverage and hours of operation o Expand the local transit network by either adding or modifying existing transit service or extending the operation hours to enhance the service near neighborhood destinations • Increase transit service frequency o Reduce waiting and overall travel time by increasing transit frequency on one or more transit lines serving the community • Design and redesign standards for streets and sidewalks to be designed for multi-modal mobility and transit access • Partnership and incentives for community transit use • Provide community based-travel planning o Target residences in the plan/community with community-based travel planning (CBTP). CBTP is a residential based approach to outreach that provides households with customized information, incentives, and support to encourage the use of transportation alternatives in place of single occupancy vehicles. • Pilot a study for a non-motorized connectivity plan (complete streets) to create a path and roadway network and make sure that bicycle paths and pedestrian walkways connect to neighborhood destinations, schools, parks, rail stations and essential services • First and last mile TNC incentives o First-last mile partnership between a municipality/transit agency and a transportation network company (TNC) for a subsidy for shared TNC rides to or from the local transit station within a certain geographic area
T7: Optimize Traffic Flow to Reduce Idle Time • Traffic signal synchronization at arterial roads o Evaluation of traffic signals and management at major arterial roads • Evaluate vehicle idle reduction savings from fleet manager and vehicle owners • Implement Intelligent Transportation Systems (ITS) for surveillance and traffic control, such as synchronized signals, transit and emergency signal priority, and other traffic flow management techniques as appropriate, to improve traffic flow and reduce vehicle idling. • Provide vehicle idle reduction education and outreach • Adopt idle reduction technologies o Auxiliary Power systems o Air Heaters

Transportation Measures

  - Automatic Power Management Systems
  - Waste-heat Recovery Systems
- Replacement of lanes and roadway adjacent infrastructure with high-occupancy vehicles (HOVs) express lanes and active transportation lanes
  - Identify opportunities for infrastructure improvements such as High Occupancy Toll (HOT) lanes and dedicated bus rapid transit right-of-ways and coordinate with regional and state agencies when appropriate.
- Provide traffic calming measures
  - Traffic calming features may include, but are not limited to, marked crosswalks, count-down signal timers, curb extensions, speed tables, raised crosswalks, raised intersections, median islands, tight corner radii, roundabouts or mini-circles, on-street parking, planter strips with street trees, chicanes/chokers, and others.

Energy Measures

E1: Decarbonize Existing Buildings

- Adopt a renewable energy financing program, such as through a PACE (Property Assessed Clean Energy) financing district, to help homeowners, multi-family dwellings and businesses install solar photovoltaic and hot water systems on existing residential and commercial buildings
- Adopt policy or program that offers incentives, such as streamlined permitting system or fee waivers, to encourage installation of photovoltaic systems on existing residential and commercial buildings.
- Perform energy efficiency performance audits for specific types of residential and commercial remodeling projects.
- Install electric ranges in place of gas ranges for residential and commercial buildings
- Evaluate benchmarking and building performance standards for existing residential and commercial buildings
  - Funding of incentive programs for building energy retrofits and appliances, including but not limited to motion sensors, photocells, and multi-level switches to control room lighting system, compact fluorescents, overhead fluorescent lights or light-emitting diodes (LEDs)
  - ENERGY STAR home upgrades and installation of ENERGY STAR-certified appliances that exceed the energy efficiency of conventional appliances.
- Use of alternative refrigerants instead of high-GWP refrigerants
  - Replace high-GWP refrigerants with lower-GWP refrigerants (e.g., natural refrigerants such as CO2, ammonia [NH3], and hydrocarbons, or next generation low-GWP synthetic refrigerants like hydrofluoroolefin-1234yf) in refrigeration and A/C equipment.
- Reduce disposal emissions
  - Disposal of refrigeration and A/C equipment at the end of its lifetime. Safe disposal requirements are included in U.S. EPA regulations (40 C.F.R. 82(F)) under Section 608 of the Clean Air Act, as well as under California's Refrigerant Management Program.

E2: Decarbonize New Buildings

- Residential buildings: Establishing a direct install program that complements the statewide California Energy Commission's (CEC) Equitable Building Decarbonization Program, and provides funding for decarbonization retrofits to low- and moderate-income households such as, but not limited to:
  - Heat pumps for space heating and cooling
  - Heat pump for water heater, unitary and central
  - Duct testing/sealing, new ducts, returns, and registers
  - Occupant controlled smart thermostats
  - ENERGY STAR certified appliance replacements
  - Air sealing, insulation, and solar window film
  - Low-flow showerheads and faucets
  - Induction range or cooktops

Energy Measures
o Electric clothes dryers o LED bulbs and fixtures o Attic fan installation o Thermal bridging removal o Efficient pool pump installation o Installing awnings or black out UV window shades o Planting strategically placed trees to provide shade to the facility or residence o Solar and battery storage installation • New commercial developments to include electric vehicle charging stations in parking lots or garages. • Building Performance Standards for new residential and commercial buildings and reach code requirements for major retrofits and renovations that require alternative fueling infrastructure for passenger, medium- and heavy-duty vehicles • Adopt policy or program that offers incentives, such as streamlined permitting system or fee waivers, to encourage installation of photovoltaic systems on new residential and commercial buildings. • New homes, buildings or remodels to exceed the minimum requirements of California's Green Building Standards Code (also known as CalGreen). Options to exceed the standard include CALGreen's built-in tiers and/or certification under Build It Green's Green Point Rated system, LEED®, or an alternative certification program • Require buildings to exceed Title 24, Part 6, the State's Building Standard Code which establishes energy efficiency requirements for residential and non-residential new construction and major remodels • Organize a sustainable building task force that includes representatives from various fields within the building industry and other groups to evaluate the feasibility of incorporating green building techniques that exceed the state standards into all new building and retrofit projects in the community
E3: Decarbonize Industrial Processes • Electrification or hybrid-power of warehouse cargo-handling equipment • Energy storage and grid resilience o Industrial solar and battery storage expansion • Establish onsite renewable energy systems for solar power o Electricity to be generated from onsite PV systems, displacing the electricity demand that would ordinarily be supplied by the local electricity provider • Install battery systems for vehicles with onboard equipment (such as boom tucks) to decrease truck idling while equipment is used. • Building Performance Standards for existing industrial facilities and reach code requirements for major retrofits and renovations that require alternative fueling infrastructure for medium- and heavy-duty vehicles. • Program planning and siting of EVCS o Identify appropriate locations and site hosts. o Outreach and engagement to ensure that sites are appropriate and effective. o Coordinate with local and regional planning efforts related to ZEV infrastructure. o Leverage, where possible, EV readiness planning that has been previously completed for the region by CVAG, SCAG, and WRCOG. • EVCS Purchases o DC fast chargers along highway corridors to support regional travelers. o Level 2 chargers to support community, multi-family residential, and local opportunity charging. • EVCS Deployment o Install EVCS: design, construction, construction management o Provide needed electrical infrastructure upgrades • EVCS Operation

Energy Measures
- Support station operations and payments.   - Ensure that stations are functional.   - Provide customer service to end users.   - Periodic charger software upgrades.   - EVCS Maintenance   - Ensure stations are maintained and repaired promptly.   - Ensure correct connector standards are maintained.   - Ensure technicians are trained in appropriate technologies and needed skills.   - Pilot vehicle & equipment studies for electric and hydrogen vehicle technology implementation   - Streamline permitting of ZEV charging and fueling infrastructure for medium- and heavy-duty vehicles.   - Evaluate industrial energy management and operations of facilities
E4: Increase Renewable Energy Generation and Storage   - Regional energy storage and grid resilience   - Onsite renewable energy generation systems   - Funding of incentive programs for energy storage and renewable energy generation   - Streamlining permitting processes for installation of renewable energy generation systems   - Establish onsite renewable energy for generic and solar power systems   - Electricity to be generated from onsite PV systems, displacing the electricity demand that would ordinarily be supplied by the local electricity provider   - Purchase solar photovoltaic systems or enter into power purchase agreements (PPA) to meet all or part of the electrical energy requirements of buildings and critical facilities   - Streamlining permitting system or fee waivers, to encourage installation of photovoltaic systems on new or existing residential and commercial buildings.   - Procure electricity from lower carbon intensity power supply   - Procuring electricity with a lower carbon intensity than the primary product offered by the local provider (often an investor-owned utility)
E5: Improve Energy Efficiency and Resiliency Through Grid Modernization   - Regional energy storage and grid resilience   - Solar and battery storage expansion   - Funding of incentive programs for public facilities   - Establish onsite renewable energy systems for solar power   - Electricity to be generated from onsite PV systems, displacing the electricity demand that would ordinarily be supplied by the local electricity provider   - Conduct and evaluate alternative energy technologies in building- and community-scale microgrids   - The microgrid manager (e.g., local energy management system) can balance generation from non-controllable renewable power sources, such as solar, with distributed, controllable generation, such as natural gas-fueled combustion turbines. They can also use energy storage and the batteries in electric vehicles to balance energy distribution and usage within the microgrid.   - Purchase solar photovoltaic systems or enter into power purchase agreements (PPA) to meet all or part of the electrical energy requirements of buildings and critical facilities   - Streamlining permitting system or fee waivers, to encourage installation of photovoltaic systems on new or existing residential and commercial buildings.
E6: Improve Energy Efficiency Through Building Upgrades   Adopt a policy that requires new buildings to exceed the minimum requirements of California’s Green Building Standards Code (also known as CalGreen). Options to exceed the standard include CALGreen’s built-in tiers and/or certification under Build It Green’s Green Point Rated system, LEED®, or an alternative certification program.

Energy Measures

- Require buildings to exceed Title 24, Part 6, the State's Building Standard Code which establishes energy efficiency requirements for residential and non-residential new construction and major remodels.
- Provide information to homeowners and businesses about available utility rebates for new residences and commercial buildings that exceed California's Title 24 energy code by 15 percent.
- Provide incentives, such as expedited review/permit processing, to encourage green building.
- Private and public building energy efficient retrofits
    - Funding of incentive programs for building energy retrofits and appliances, including but not limited to motion sensors, photocells, and multi-level switches to control room lighting system, compact fluorescents, overhead fluorescent lights or light-emitting diodes (LEDs)
    - ENERGY STAR home upgrades and installation of ENERGY STAR-certified appliances that exceed the energy efficiency of conventional appliances.

E7: Improve Energy Efficiency Through Urban Greening

- Adopting a tree ordinance to protect urban forests, including protection for specific individual trees or tree species important to the community.
- Create an agency-sponsored tree planting program that offers free shade and other trees to residents, businesses, schools and non-profits, as well as education about the care and benefits from trees. Collaborate with the local utility if it has a tree planting program to help get the word out
    - Establish an Equitable Urban Forest Management Plan
    - Planting of shade trees and vegetation surfaces
    - Comprehensive application for Private, City, District, and County property
- Participate in regional tree planting efforts to mobilize and encourage the community to plant trees.
- Heat island effect reduction
    - Use of cool roofs and pavement, green roofs, vertical gardens, and reflective materials

E8: Reduce Fugitive Emissions and Reliance on Fossil Fuels by Sunsetting Oil and Gas Operations

- Evaluation of all oil and gas operations
    - Establishing a strategy that addresses the environmental risk of subsidence, reserving funds for the municipal and state underfunded abandonment liability, and filling in revenue gaps which impact critical equity, youth, public health and safety programs and local infrastructure projects
    - Examination of all active, idle, and abandoned oil wells
- Promote and transition new labor opportunities for fossil fuel workforce into clean energy workforce
- Establish a Carbon Sequestration Project
    - Address options of short- to medium-term solutions of carbon removal

Solid Waste Measures

SW1: Increase Organics Diversion

- Evaluation of facilities and operations
    - Expansion of existing regional composting facilities
    - Increased capacities for organics processing
- Established food recovery and composting programs
    - Funding of incentive programs for food recovery and composting
- Public organic waste bin expansion
- Evaluate agency facilities and operations to identify opportunities to increase material recovery and beneficial use of organic material.
- Distribute or post materials illustrating best practices for organics collection and composting.
- Establish a program to use the maximum amount of organic waste possible that is generated within the jurisdiction to produce compost for use on agency parks and landscaping.
- Create a vermicomposting (worm-bin) program with a complementary educational component at agency facilities, such as county detention centers and city jails.

Solid Waste Measures

- Approve siting of composting facility within jurisdiction.
- Distribute an annual newsletter highlighting agency and community waste reduction programs and accomplishments.

SW2: Recover and Reuse Materials

- Distribution of illustrations and material for best practices on proper disposal sorting
- Implement a comprehensive waste reduction and recycling program in agency offices and facilities.
- Create and facilitate an agency employee education program highlighting waste reduction and recycling best practices.
- Reuse or redistribute to community non-profit groups office items such as supplies, computer, furniture and cell phones in order to divert items from the landfill.
- Evaluate current community recycling infrastructure relative to future population growth and waste generation.
- Partnership with other public agency offices located within the jurisdiction for green procurement, waste reduction and recycling at those facilities
- All agency demolition projects to incorporate de-construction/construction and demolition waste recycling or recovery practices.
- Institute or extending recycling services
    - Address ways to reduce the volume of landfilled waste

SW3: Increase Waste-to-Energy and Conversion Technology Potential

- Energy storage and grid resilience
- Establish methane recovery in landfills
    - Capture and treatment of landfill gas (LFG) emitted from decomposition of organic waste in landfills.
- Evaluation of waste-to-energy facilities and anaerobic digestion systems and capacities
- For jurisdictions that own or operate landfills, recover and use the maximum feasible amount of methane gas from the landfill to produce electricity, fuel co-generation facilities, and/or produce compressed natural gas for use in alternative fuel vehicles.
- For jurisdictions that host landfills owned by private companies or other public agencies, enter into partnerships or agreements with agencies or companies that own or operate landfills to ensure that the maximum feasible amount of methane is recovered for waste-to-energy or other renewable energy projects
- Install digesters and other technologies at solid waste facilities to produce methane and other bio-fuels.
- Install fuel cells to generate power for solid waste plants.
- Evaluate opportunities to convert agency organic waste into biofuels to use in agency vehicles.

Source: ESA 2024

Appendix F

LIDAC Identification

APPENDIX F
LIDAC Identification

F.1 CEJST LIDACs

Provided below is a list of US Census tracts identified as LIDACs through the CEJST.

TABLE F-1. LOS ANGELES COUNTY CEJST LIDACS

Los Angeles County Census Tracts							
6037500500	6037213100	6037232600	6037402301	6037575300	6037192520	6037231800	6037402101
6037122410	6037219800	6037434004	6037134520	6037575401	6037192610	6037232300	6037404902
6037123103	6037224310	6037920033	6037553701	6037575500	6037195600	6037235100	6037405203
6037120020	6037224420	6037910603	6037553901	6037206010	6037199400	6037237710	6037541801
6037120300	6037117530	6037930200	6037555104	6037535200	6037199800	6037240020	6037542200
6037121210	6037119310	6037540000	6037570204	6037535300	6037201504	6037241110	6037542402
6037123410	6037119400	6037540902	6037183101	6037535702	6037204820	6037535606	6037542700
6037125320	6037113421	6037541500	6037185310	6037535803	6037134904	6037534202	6037543903
6037128210	6037231600	6037542401	6037186401	6037535901	6037532102	6037534900	6037550000
6037128220	6037224410	6037543201	6037190700	6037541603	6037201503	6037535102	6037134720
6037123601	6037226420	6037543602	6037190902	6037541604	6037207400	6037535701	6037190100
6037123510	6037228710	6037227010	6037191110	6037542501	6037208903	6037536000	6037404801
6037123520	6037232500	6037228310	6037191500	6037543502	6037209200	6037536102	6037405002
6037123700	6037117520	6037228800	6037192420	6037552200	6037210010	6037536200	6037407001
6037124102	6037109500	6037229410	6037190901	6037294200	6037211420	6037553503	6037480804
6037125310	6037111301	6037231900	6037191203	6037294510	6037212203	6037554105	6037480102
6037127210	6037119340	6037232120	6037191610	6037301701	6037212610	6037554203	6037480302
6037131020	6037120400	6037297110	6037191810	6037302104	6037218120	6037554204	6037481001
6037482301	6037123203	6037575202	6037190802	6037480902	6037218500	6037183820	6037481500
6037482401	6037127400	6037600201	6037191301	6037480903	6037221210	6037197500	6037481604
6037482600	6037275102	6037600912	6037191302	6037481002	6037221302	6037201302	6037481711
6037480011	6037275500	6037601402	6037201601	6037481102	6037224200	6037408133	6037482101
6037481712	6037134201	6037601502	6037206032	6037201200	6037480101	6037408211	6037482201
6037481713	6037310701	6037602103	6037207101	6037201501	6037221120	6037408303	6037482202
6037482303	6037294110	6037602106	6037207102	6037201700	6037222500	6037408623	6037482503

Los Angeles County Census Tracts							
6037482304	6037301203	6037602900	6037207103	6037203300	6037224020	6037408704	6037500402
6037221401	6037310703	6037403200	6037207301	6037208610	6037224320	6037430102	6037101210
6037221602	6037575901	6037403303	6037433102	6037208620	6037227020	6037431700	6037408705
6037221402	6037920037	6037119800	6037433304	6037209102	6037228720	6037432700	6037408800
6037221601	6037900804	6037120010	6037433305	6037900602	6037229200	6037433902	6037123204
6037234502	6037551201	6037122200	6037433101	6037481202	6037231300	6037434001	6037123205
6037222002	6037900704	6037122420	6037433306	6037481800	6037231710	6037603301	6037238310
6037226001	6037910502	6037408722	6037433307	6037482001	6037232700	6037603302	6037240010
6037226002	6037120107	6037533202	6037433503	6037482002	6037236202	6037221110	6037240600
6037234901	6037120108	6037534404	6037433504	6037482522	6037237720	6037117407	6037240700
6037234902	6037121102	6037208902	6037434003	6037500600	6037240500	6037117408	6037242100
6037236203	6037302505	6037208904	6037220000	6037543100	6037240900	6037119002	6037297120
6037236204	6037302506	6037209402	6037208720	6037543202	6037530700	6037119201	6037301000
6037237101	6037320201	6037211120	6037211802	6037503703	6037531301	6037119202	6037301602
6037237102	6037132501	6037211320	6037293304	6037404901	6037243000	6037237300	6037302301
6037237201	6037132502	6037213401	6037540901	6037408401	6037238320	6037237500	6037502902
6037237202	6037134001	6037213402	6037541605	6037408402	6037242600	6037199120	6037530101
6037237401	6037134521	6037220100	6037541606	6037910402	6037243100	6037201301	6037530500
6037239201	6037134903	6037221500	6037570402	6037181600	6037124300	6037203600	6037572301
6037239202	6037134002	6037221710	6037405102	6037191420	6037127220	6037204110	6037575102
6037239501	6037134522	6037226410	6037910504	6037408212	6037552602	6037204420	6037195720
6037239502	6037131800	6037228600	6037910605	6037408626	6037554700	6037204600	6037199201
6037239601	6037134306	6037232110	6037910606	6037431800	6037570303	6037204920	6037203200
6037239602	6037532002	6037232200	6037910711	6037402600	6037570603	6037206300	6037203800
6037239701	6037532101	6037239330	6037910712	6037402902	6037576200	6037211310	6037204700
6037239801	6037532604	6037240200	6037555211	6037403000	6037910001	6037212900	6037204810
6037240401	6037530902	6037132900	6037555212	6037404701	6037910002	6037900607	6037601211
6037239702	6037531604	6037133100	6037407002	6037404703	6037910101	6037910706	6037601501
6037239802	6037533105	6037134104	6037212204	6037405101	6037123304	6037502302	6037601801
6037240402	6037533106	6037212305	6037212303	6037405600	6037296600	6037104310	6037602002
6037504101	6037320300	6037301702	6037212306	6037405900	6037186403	6037106403	6037602105
6037530005	6037121222	6037570301	6037213310	6037407400	6037186404	6037106520	6037229100
6037530204	6037121801	6037601212	6037530102	6037408624	6037187102	6037600304	6037482102
6037533402	6037575801	6037106604	6037104610	6037480012	6037190201	6037600303	6037481402
6037531603	6037600902	6037541100	6037910601	6037462500	6037190202	6037602505	6037106114
6037502802	6037601100	6037542800	6037430802	6037293201	6037190401	6037602506	6037242300
6037503104	6037603704	6037553802	6037431900	6037294810	6037190402	6037602507	6037407701
6037531503	6037603900	6037555102	6037113233	6037301502	6037190801	6037602508	6037406200
6037531504	6037407602	6037293307	6037115302	6037301601	6037533804	6037602509	6037408301
6037533001	6037407802	6037294701	6037121900	6037183620	6037533901	6037900605	6037408627
6037533002	6037408003	6037294302	6037900606	6037199110	6037534001	6037900701	6037432202

Los Angeles County Census Tracts							
6037533805	6037408005	6037294421	6037900803	6037191720	6037534403	6037600302	6037432602
6037533806	6037408006	6037296901	6037462100	6037197200	6037534406	6037540400	6037432802
6037432300	6037119341	6037297201	6037203100	6037199900	6037534502	6037107010	6037433601
6037432401	6037119342	6037301206	6037203500	6037576401	6037535101	6037117405	6037572900
6037433200	6037120103	6037208802	6037203720	6037600202	6037535503	6037119320	6037533502
6037575802	6037120104	6037209103	6037204200	6037600400	6037535604	6037120030	6037533503
6037183610	6037120105	6037209104	6037204300	6037600602	6037293302	6037121020	6037533701
6037575402	6037120106	6037211121	6037209300	6037127920	6037195710	6037122000	6037534002
6037601401	6037910713	6037211122	6037209820	6037572400	6037211910	6037123020	6037534102
6037602004	6037910714	6037211201	6037209510	6037572800	6037213201	6037530006	6037535605
6037602403	6037910715	6037553702	6037212304	6037573201	6037204120	6037530202	6037540203
6037603001	6037911001	6037531901	6037530602	6037573300	6037204410	6037530601	6037541002
6037402502	6037920336	6037533107	6037532605	6037218210	6037204910	6037531102	6037541802
6037301204	6037920337	6037533703	6037535502	6037218600	6037205120	6037531602	6037113234
6037542502	6037980008	6037534201	6037540600	6037218900	6037206050	6037531702	6037482402
6037542601	6037242000	6037310702	6037602003	6037219300	6037218800	6037531902	6037533401
6037542602	6037242700	6037541700	6037320202	6037221220	6037480802	6037532200	6037534301
6037543503	6037402801	6037294900	6037115401	6037224010	6037501504	6037532700	6037542000
6037554101	6037404301	6037218110	6037117510	6037224600	6037530203	6037533103	6037502004
6037554801	6037404803	6037226700	6037131010	6037535001	6037530400	6037533203	6037553801
6037480901	6037404903	6037231100	6037408501	6037535002	6037531201	6037533602	6037570501
6037481300	6037190520	6037235201	6037430721	6037536103	6037531202	6037535400	6037570502
6037481603	6037481103	6037531701	6037432901	6037536104	6037531800	6037535607	6037572500
6037481714	6037601302	6037403402	6037603004	6037542103	6037532304	6037301801	6037123104
6037540700	6037602404	6037201110	6037535802	6037542104	6037532606	6037301802	6037127102
6037404702	6037702803	6037209810	6037402501	6037542105	6037532800	6037302003	6037128302
6037404802	6037900806	6037212410	6037404501	6037542106	6037532900	6037302004	6037503202
6037405001	6037201401	6037910501	6037405201	6037543905	6037603102	6037302401	6037267502
6037406602	6037212202	6037292000	6037405202	6037550601	6037552100	6037302503	6037272302
6037407702	6037432500	6037213320	6037407200	6037551101	6037552601	6037302504	6037291110
6037123206	6037433802	6037221810	6037408202	6037552301	6037206200	6037432601	6037291120
6037123301	6037433402	6037222100	6037432000	6037432402	6037121802	6037433302	6037294610
6037534302	6037530302	6037570403	6037432101	6037432801	6037122121	6037433501	6037294620
6037534802	6037123303	6037571703	6037432102	6037132300	6037122122	6037101220	6037294830
6037534804	6037123420	6037571704	6037432201	6037134101	6037124103	6037104105	6037296500
6037128102	6037127300	6037573003	6037433401	6037481201	6037124104	6037540201	6037291220
6037128601	6037127520	6037573004	6037433403	6037482521	6037124105	6037218220	6037294410
6037131701	6037128303	6037576301	6037433700	6037482502	6037124203	6037222200	6037296210
6037131702	6037228220	6037576302	6037433801	6037530801	6037124204	6037228100	6037432902
6037132001	6037228320	6037576903	6037433901	6037530802	6037127103	6037232400	6037433602
6037132002	6037228410	6037212620	6037127910	6037531302	6037127104	6037241300	6037104401

Los Angeles County Census Tracts							
6037132102	6037228420	6037241001	6037232800	6037532302	6037127603	6037211202	6037104500
6037302201	6037228500	6037241002	6037237900	6037532603	6037127604	6037211703	6037107020
6037190301	6037228900	6037241201	6037920026	6037533104	6037127605	6037211704	6037291210
6037197420	6037229420	6037241202	6037601202	6037533201	6037127711	6037211921	6037293202
6037205110	6037231220	6037209403	6037601802	6037533300	6037127606	6037211922	6037576402
6037208000	6037231500	6037209520	6037601900	6037533702	6037127712	6037212101	6037430101
6037209401	6037183220	6037553502	6037570202	6037241400	6037127803	6037212102	6037431400
6037402303	6037185320	6037554403	6037570203	6037242200	6037127804	6037212501	6037533603
6037402304	6037408136	6037570304	6037571701	6037221900	6037127805	6037212701	6037533902
6037402405	6037408141	6037570601	6037461502	6037229300	6037127806	6037212502	6037534203
6037402406	6037408504	6037910403	6037461901	6037236100	6037128101	6037218701	6037534405
6037402803	6037408505	6037207302	6037462001	6037241120	6037980033	6037218702	6037534501
6037402804	6037408631	6037207502	6037462002	6037190510	6037531502	6037219901	6037534700
6037402903	6037408723	6037208301	6037462201	6037192620	6037103102	6037219902	6037535501
6037404201	6037408724	6037208302	6037462301	6037203710	6037531101	6037221303	6037535804
6037404504	6037431501	6037106407	6037480303	6037602104	6037277400	6037221304	6037540202
6037405301	6037980010	6037106408	6037481605	6037132700	6037294120	6037531000	6037540300
6037701100	6037901010	6037106648	6037481606	6037183810	6037294520	6037530004	6037540501
6037195802	6037901209	6037109603	6037501803	6037188100	6037294820	6037530301	6037104703
6037191120	6037602801	6037117201	6037501804	6037191201	6037296220	6037530901	6037104704
6037191410	6037602802	6037115403	6037480304	6037191710	6037302202	6037532001	6037104821
6037197700	6037603801	6037115404	6037575101	6037192700	6037302302	6037532500	6037104822
6037199000	6037603802	6037117101	6037575803	6037406901	6037900703	6037533403	6037106405
6037199700	6037604002	6037554600	6037222600	6037406902	6037910201	6037533501	6037900103
6037201402	6037183103	6037572600	6037533803	6037407501	6037213202	6037533601	6037900104
6037203900	6037183221	6037573002	6037534101	6037407601	6037218300	6037534803	6037900505
6037552800	6037183401	6037571600	6037219010	6037481101	6037218400	6037535603	6037900507
6037553300	6037185203	6037573202	6037219020	6037481401	6037219700	6037535902	6037900508
6037553601	6037186201	6037576403	6037231400	6037481902	6037900102	6037540102	6037900608
6037122120	6037186301	6037576501	6037235202	6037208401	6037900501	6037540502	6037900609
6037123010	6037139302	6037576502	6037237600	6037208402	6037910602	6037541300	6037102105
6037134305	6037183520	6037576901	6037239310	6037208501	6037104201	6037541400	6037104124
6037134710	6037191204	6037600100	6037239320	6037208502	6037104320	6037542900	6037104108
6037402702	6037191620	6037228210	6037240300	6037208801	6037104620	6037211410	6037104203
6037701902	6037191820	6037231210	6037240800	6037601600	6037104701	6037211500	6037104204
6037575201	6037192510	6037231720	6037302103	6037601700	6037104810	6037212420	6037104403
6037212800	6037104404						

Source: CEJST 2023

Table F-2. Orange County CEJST LIDACs

Orange County Census Tracts							
6059011601	6059110402	6059088701	6059074502	6059099703	6059075100	6059087806	6059088905
6059062625	6059110500	6059074806	6059075201	6059099904	6059075202	6059088107	6059099247
6059087803	6059086702	6059075003	6059076103	6059074200	6059074803	6059099702	6059063808
6059088104	6059110201	6059075514	6059001404	6059074408	6059074902	6059099802	6059074102
6059088403	6059086502	6059086406	6059001801	6059074805	6059074005	6059099223	6059074602
6059088602	6059086901	6059087601	6059075002	6059074901	6059074403	6059087300	6059074701
6059088801	6059087101	6059087802	6059001304	6059075004	6059074501	6059086903	6059087801
6059088802	6059088201	6059088502	6059001401	6059099249	6059074801	6059088002	6059087105
6059089003	6059110603	6059088702	6059011720	6059087505	6059087405	6059089001	6059087200
6059089004	6059110606	6059089102	6059001201	6059099203	6059087503	6059087602	6059087403
6059089105	6059001802	6059089104	6059087002	6059074702	6059087902	6059099226	6059088001
6059099222	6059011602	6059089106	6059087404	6059088501	6059099204	6059088601	6059088106
6059099229	6059042312	6059099202	6059087504	6059076204	6059086501	6059074601	6059088402
6059063605	6059021813	6059087106	6059087901	6059076102	6059001202	6059099248	6059088902
6059063702	6059001103	6059086404	6059088301	6059086802	6059074405	6059099250	6059088904
6059110202	6059074407	6059086405	6059088901	6059088203	6059074406	6059099801	6059011101
6059099601	6059074802	6059086601	6059088903	6059088302	6059063701	6059110110	6059099402
6059099903	6059099701	6059099803					

Source: CEJST 2023

F.2 CEJST LIDACs In Close Proximity to GHG Emissions Sources

Geographic data denoting the location of various GHG emissions sources was reviewed as a component of the Reduction Measure Benefit Analysis to determine the Census tracts that are anticipated to benefit from the measures. The tables below show LIDAC Census tracts, identified using the CEJST, that are within 0.5 miles of a relevant emissions source.

Table F-3. Los Angeles County CEJST LIDACs Within 0.5 miles of Goods Movement Corridors

Los Angeles County Census Tracts							
6037122410	6037219800	6037407501	6037183101	6037575401	6037532102	6037573202	6037542200
6037123103	6037224310	6037407601	6037185310	6037575500	6037207400	6037576403	6037542402
6037120020	6037224420	6037481101	6037186401	6037206010	6037209200	6037576901	6037542700
6037120300	6037117530	6037481401	6037190700	6037535200	6037210010	6037600100	6037543903
6037121210	6037119400	6037481902	6037190902	6037535300	6037211420	6037228210	6037550000
6037123410	6037113421	6037208401	6037191110	6037535702	6037218120	6037231720	6037190100
6037125320	6037224410	6037208402	6037191500	6037535803	6037218500	6037231800	6037404801
6037123510	6037226420	6037208501	6037192420	6037535901	6037221210	6037232300	6037405002

Los Angeles County Census Tracts							
6037123700	6037228710	6037208502	6037190901	6037541603	6037221302	6037235100	6037407001
6037124102	6037232500	6037601600	6037191203	6037541604	6037224200	6037237710	6037480102
6037125310	6037117520	6037601700	6037191610	6037542501	6037480101	6037240020	6037481001
6037127210	6037109500	6037232600	6037191810	6037543502	6037221120	6037241110	6037481500
6037482301	6037111301	6037434004	6037190802	6037552200	6037224020	6037535606	6037481604
6037482401	6037120400	6037910603	6037201601	6037294200	6037224320	6037534202	6037481711
6037482600	6037123203	6037930200	6037206032	6037294510	6037227020	6037534900	6037500402
6037480011	6037127400	6037540000	6037207101	6037301701	6037228720	6037535102	6037408705
6037481712	6037275102	6037540902	6037207102	6037302104	6037231710	6037535701	6037408800
6037481713	6037275500	6037541500	6037207103	6037480902	6037232700	6037536000	6037123204
6037482303	6037134201	6037542401	6037207301	6037480903	6037237720	6037536102	6037123205
6037482304	6037310701	6037543201	6037433102	6037481002	6037240500	6037536200	6037238310
6037221401	6037294110	6037543602	6037433304	6037481102	6037240900	6037553503	6037240010
6037221602	6037301203	6037227010	6037433305	6037201501	6037530700	6037554105	6037240600
6037221402	6037310703	6037228800	6037433101	6037201700	6037531301	6037554203	6037240700
6037221601	6037575901	6037229410	6037433306	6037203300	6037243000	6037554204	6037242100
6037226001	6037920037	6037231900	6037433307	6037208610	6037238320	6037183820	6037297120
6037226002	6037900804	6037232120	6037433504	6037208620	6037242600	6037197500	6037301000
6037234901	6037900704	6037297110	6037434003	6037209102	6037243100	6037201302	6037301602
6037234902	6037910502	6037575202	6037220000	6037900602	6037127220	6037408211	6037302301
6037237101	6037121102	6037600912	6037293304	6037481202	6037552602	6037408303	6037502902
6037237102	6037302505	6037601402	6037540901	6037481800	6037554700	6037408623	6037530101
6037237201	6037302506	6037601502	6037541605	6037482001	6037570303	6037408704	6037530500
6037237202	6037320201	6037602103	6037541606	6037482002	6037570603	6037430102	6037572301
6037239201	6037134521	6037602106	6037570402	6037482522	6037910002	6037432700	6037575102
6037239202	6037134903	6037602900	6037405102	6037500600	6037910101	6037434001	6037195720
6037239601	6037134522	6037403200	6037910504	6037543100	6037123304	6037603301	6037199201
6037239602	6037134306	6037403303	6037910605	6037543202	6037296600	6037603302	6037203200
6037239701	6037532002	6037119800	6037910606	6037503703	6037186403	6037221110	6037203800
6037239801	6037532101	6037120010	6037910711	6037404901	6037186404	6037117407	6037204700
6037240401	6037532604	6037122200	6037910712	6037408401	6037187102	6037117408	6037204810
6037239702	6037530902	6037122420	6037555211	6037408402	6037190201	6037119002	6037601211
6037239802	6037531604	6037533202	6037407002	6037910402	6037190202	6037119201	6037601501
6037240402	6037533105	6037534404	6037530102	6037191420	6037190402	6037119202	6037601801
6037504101	6037533106	6037208902	6037104610	6037408212	6037190801	6037237300	6037602002
6037530005	6037320300	6037211320	6037910601	6037408626	6037533804	6037237500	6037602105
6037533402	6037121222	6037221500	6037430802	6037431800	6037533901	6037199120	6037229100
6037531603	6037575801	6037221710	6037431900	6037402600	6037534001	6037201301	6037481402
6037502802	6037600902	6037226410	6037113233	6037402902	6037534403	6037203600	6037106114
6037503104	6037601100	6037232110	6037115302	6037403000	6037534406	6037204110	6037242300
6037531503	6037603900	6037240200	6037121900	6037404701	6037534502	6037204420	6037407701

Los Angeles County Census Tracts							
6037531504	6037407602	6037132900	6037900606	6037404703	6037535101	6037204600	6037406200
6037533001	6037910713	6037133100	6037900803	6037405101	6037535503	6037204920	6037408301
6037533002	6037910714	6037301702	6037462100	6037405600	6037535604	6037900607	6037432202
6037533805	6037910715	6037570301	6037203100	6037407400	6037293302	6037910706	6037432602
6037533806	6037911001	6037601212	6037203500	6037408624	6037195710	6037502302	6037432802
6037432300	6037920336	6037106604	6037203720	6037480012	6037204120	6037104310	6037433601
6037433200	6037920337	6037553802	6037204200	6037462500	6037204410	6037106403	6037572900
6037575802	6037980008	6037555102	6037204300	6037293201	6037204910	6037106520	6037533502
6037183610	6037242000	6037293307	6037209300	6037294810	6037205120	6037600304	6037533503
6037575402	6037242700	6037294701	6037209820	6037301502	6037206050	6037600303	6037533701
6037601401	6037402801	6037294302	6037530602	6037301601	6037218800	6037602508	6037534002
6037602403	6037404301	6037294421	6037532605	6037183620	6037480802	6037602509	6037534102
6037603001	6037404803	6037301206	6037535502	6037191720	6037501504	6037900701	6037535605
6037402502	6037404903	6037209103	6037540600	6037197200	6037530203	6037600302	6037541002
6037301204	6037190520	6037209104	6037320202	6037199900	6037530400	6037540400	6037541802
6037542502	6037481103	6037211121	6037115401	6037576401	6037531201	6037107010	6037113234
6037542601	6037601302	6037211122	6037117510	6037600400	6037531202	6037117405	6037482402
6037542602	6037602404	6037211201	6037408501	6037572400	6037532304	6037120030	6037533401
6037543503	6037702803	6037553702	6037430721	6037572800	6037532606	6037121020	6037534301
6037554801	6037900806	6037531901	6037432901	6037573300	6037532800	6037122000	6037502004
6037480901	6037432500	6037533107	6037603004	6037218210	6037532900	6037123020	6037553801
6037481300	6037433802	6037533703	6037402501	6037218600	6037603102	6037530202	6037570501
6037481603	6037433402	6037534201	6037404501	6037218900	6037552100	6037530601	6037570502
6037481714	6037530302	6037310702	6037405201	6037219300	6037206200	6037531102	6037572500
6037540700	6037123303	6037294900	6037405202	6037221220	6037121802	6037531602	6037127102
6037404702	6037123420	6037218110	6037407200	6037224010	6037122121	6037531702	6037128302
6037404802	6037127300	6037231100	6037408202	6037224600	6037122122	6037531902	6037503202
6037405001	6037127520	6037235201	6037432000	6037535001	6037124104	6037532200	6037267502
6037406602	6037228220	6037403402	6037432102	6037535002	6037124105	6037532700	6037291110
6037407702	6037228410	6037910501	6037432201	6037536103	6037124204	6037533103	6037291120
6037123206	6037228420	6037292000	6037433401	6037536104	6037127103	6037533203	6037294610
6037123301	6037228500	6037221810	6037433403	6037542103	6037127104	6037533602	6037294620
6037534302	6037228900	6037570403	6037433700	6037542104	6037127603	6037535400	6037294830
6037534804	6037229420	6037571703	6037433801	6037542105	6037127604	6037535607	6037296500
6037302201	6037231220	6037571704	6037433901	6037542106	6037127605	6037301801	6037291220
6037190301	6037183220	6037573003	6037232800	6037543905	6037127711	6037301802	6037294410
6037197420	6037185320	6037573004	6037601202	6037550601	6037127606	6037302003	6037296210
6037205110	6037408136	6037576301	6037601802	6037551101	6037127712	6037302004	6037432902
6037208000	6037408141	6037576302	6037570202	6037552301	6037127804	6037302401	6037104401
6037402303	6037408504	6037576903	6037570203	6037432402	6037127805	6037432601	6037104500
6037402304	6037408505	6037241001	6037571701	6037432801	6037127806	6037433302	6037107020

Los Angeles County Census Tracts							
6037402405	6037408631	6037241002	6037461502	6037481201	6037980033	6037104105	6037291210
6037402406	6037408724	6037241201	6037461901	6037530801	6037531502	6037218220	6037293202
6037402804	6037980010	6037241202	6037462001	6037530802	6037531101	6037222200	6037576402
6037402903	6037901209	6037209403	6037462002	6037531302	6037277400	6037228100	6037430101
6037404201	6037602801	6037209520	6037462201	6037532302	6037294120	6037232400	6037533603
6037404504	6037602802	6037553502	6037462301	6037532603	6037294520	6037241300	6037533902
6037405301	6037603801	6037554403	6037481605	6037533104	6037296220	6037211202	6037534203
6037701100	6037603802	6037570304	6037481606	6037533201	6037302202	6037218701	6037534405
6037195802	6037604002	6037570601	6037501803	6037533300	6037302302	6037218702	6037534501
6037191120	6037183103	6037910403	6037501804	6037533702	6037900703	6037219901	6037534700
6037191410	6037185203	6037207302	6037575101	6037241400	6037910201	6037219902	6037535501
6037197700	6037186201	6037207502	6037575803	6037242200	6037218300	6037221303	6037535804
6037199000	6037186301	6037208301	6037533803	6037221900	6037218400	6037221304	6037540300
6037199700	6037139302	6037208302	6037534101	6037229300	6037219700	6037531000	6037540501
6037201402	6037183520	6037106407	6037219010	6037241120	6037900501	6037530301	6037104703
6037203900	6037191204	6037106408	6037235202	6037190510	6037910602	6037532001	6037104704
6037552800	6037191620	6037106648	6037237600	6037192620	6037104201	6037532500	6037104821
6037553300	6037191820	6037109603	6037239310	6037203710	6037104320	6037533403	6037104822
6037553601	6037192510	6037117201	6037239320	6037602104	6037104620	6037533501	6037106405
6037122120	6037192520	6037115403	6037240300	6037183810	6037104701	6037533601	6037102105
6037123010	6037192610	6037115404	6037240800	6037188100	6037104810	6037534803	6037104124
6037134305	6037195600	6037117101	6037302103	6037191201	6037402301	6037535603	6037104108
6037402702	6037199400	6037554600	6037402101	6037191710	6037134520	6037540102	6037104203
6037701902	6037199800	6037572600	6037404902	6037192700	6037553701	6037540502	6037104204
6037575201	6037201504	6037573002	6037405203	6037406901	6037553901	6037541300	6037104403
6037575300	6037204820	6037571600	6037541801	6037406902	6037570204	6037541400	6037104404

Source: CEJST 2023

Table F-4. Orange County CEJST LIDACs Within 0.5 miles of Goods Movement Corridor

Orange County Census Tracts							
6059011601	6059110201	6059087601	6059001404	6059099601	6059075100	6059099802	6059088905
6059062625	6059086502	6059087802	6059001801	6059099703	6059074005	6059087300	6059074602
6059087803	6059086901	6059088502	6059075002	6059099904	6059074403	6059086903	6059087801
6059088104	6059087101	6059088702	6059001304	6059074200	6059074501	6059088002	6059087105
6059088403	6059088201	6059089102	6059001401	6059074408	6059087405	6059089001	6059087200
6059088602	6059110603	6059089106	6059011720	6059075004	6059087503	6059087602	6059087403
6059088801	6059110606	6059087106	6059001201	6059087505	6059087902	6059088601	6059088001
6059088802	6059001802	6059086404	6059087404	6059088501	6059086501	6059099250	6059088106
6059089003	6059011602	6059086405	6059087504	6059076204	6059001202	6059099801	6059088902
6059089004	6059042312	6059086601	6059087901	6059076102	6059074405	6059099903	6059011101

Orange County Census Tracts							
6059099229	6059021813	6059087806	6059088301	6059086802	6059074406	6059110402	6059099402
6059063605	6059001103	6059088107	6059088901	6059075003	6059063701	6059110500	6059099701
6059063702	6059074407	6059099702	6059088903	6059075514	6059074502	6059086702	6059099803
6059086406	6059076103						

Source: CEJST 2023

Table F-5. Los Angeles County CEJST LIDACs Within 0.5 miles of Landfills

Los Angeles County Census Tracts							
6037500500	6037405001	6037500600	6037404901	6037530004	6037532101	6037432500	6037404501
6037530101	6037431400						

Source: CEJST 2023

Table F-6. Los Angeles County CEJST LIDACs Within 0.5 miles of an Industrial Source

Los Angeles County Census Tracts							
6037500500	6037532500	6037600912	6037104620	6037500600	6037191204	6037573202	6037500402
6037121210	6037533403	6037602106	6037104701	6037543100	6037191820	6037576403	6037408705
6037482600	6037540102	6037602900	6037104810	6037543202	6037192520	6037576501	6037123205
6037481712	6037540502	6037403200	6037553701	6037503703	6037192610	6037576502	6037240700
6037482303	6037541300	6037408722	6037553901	6037408401	6037195600	6037576901	6037301602
6037482304	6037541400	6037534404	6037185310	6037408402	6037199800	6037231720	6037302301
6037221401	6037542900	6037208902	6037191203	6037408212	6037201504	6037231800	6037502902
6037221602	6037211500	6037208904	6037191810	6037408626	6037532102	6037235100	6037530101
6037221402	6037212420	6037209402	6037191301	6037404703	6037201503	6037534202	6037572301
6037221601	6037212800	6037211120	6037191302	6037408624	6037207400	6037536000	6037575102
6037222002	6037213100	6037211320	6037201601	6037293201	6037208903	6037536102	6037195720
6037226001	6037219800	6037220100	6037206032	6037294810	6037209200	6037536200	6037203200
6037226002	6037224310	6037221500	6037207101	6037301601	6037210010	6037553503	6037203800
6037504101	6037224420	6037221710	6037207102	6037199110	6037211420	6037197500	6037204700
6037530005	6037119310	6037226410	6037207103	6037199900	6037212203	6037408133	6037204810
6037530204	6037119400	6037212305	6037207301	6037576401	6037218120	6037408211	6037601211
6037502802	6037224410	6037301702	6037208720	6037600202	6037218500	6037408303	6037602002
6037503104	6037226420	6037601212	6037211802	6037600400	6037221210	6037408704	6037242300
6037533805	6037109500	6037541100	6037293304	6037600602	6037221302	6037430102	6037407701
6037533806	6037123203	6037542800	6037540901	6037572400	6037224200	6037431700	6037408627
6037432300	6037127400	6037553802	6037541605	6037572800	6037222500	6037432700	6037572900
6037575802	6037275102	6037293307	6037541606	6037573201	6037224020	6037603302	6037533701
6037575402	6037310701	6037294701	6037570402	6037573300	6037224320	6037117408	6037534002
6037601401	6037294110	6037294302	6037407002	6037218210	6037236202	6037119002	6037534102
6037602403	6037310703	6037294421	6037212204	6037218600	6037240900	6037119201	6037540203

Los Angeles County Census Tracts							
6037603001	6037575901	6037301206	6037212303	6037218900	6037530700	6037119202	6037541002
6037542502	6037551201	6037208802	6037212306	6037219300	6037531301	6037199120	6037482402
6037542601	6037121102	6037209103	6037530102	6037221220	6037242600	6037203600	6037533401
6037542602	6037320201	6037209104	6037104610	6037224010	6037552602	6037204110	6037534301
6037543503	6037532002	6037211121	6037430802	6037224600	6037554700	6037204420	6037542000
6037554801	6037532101	6037211122	6037900606	6037536103	6037576200	6037204600	6037502004
6037540700	6037320300	6037211201	6037203100	6037536104	6037533804	6037206300	6037553801
6037407702	6037121222	6037553702	6037203500	6037542103	6037533901	6037211310	6037503202
6037123206	6037575801	6037531901	6037203720	6037542104	6037534001	6037212900	6037267502
6037534302	6037600902	6037533703	6037204200	6037542106	6037534406	6037502302	6037291110
6037208000	6037601100	6037534201	6037204300	6037543905	6037293302	6037104310	6037291120
6037209401	6037603704	6037310702	6037209300	6037550601	6037195710	6037600304	6037294610
6037701100	6037603900	6037541700	6037209820	6037551101	6037211910	6037600303	6037294620
6037195802	6037407802	6037294900	6037209510	6037552301	6037213201	6037602505	6037294830
6037191410	6037408003	6037218110	6037212304	6037432402	6037204120	6037602508	6037296500
6037197700	6037408006	6037226700	6037320202	6037432801	6037204410	6037602509	6037291220
6037199700	6037920336	6037231100	6037408501	6037482521	6037205120	6037600302	6037294410
6037201402	6037920337	6037235201	6037430721	6037482502	6037206050	6037530006	6037296210
6037203900	6037980008	6037531701	6037603004	6037531302	6037218800	6037530202	6037433602
6037553300	6037242000	6037201110	6037407200	6037532302	6037501504	6037531602	6037104401
6037553601	6037242700	6037212410	6037408202	6037533702	6037530203	6037531702	6037104500
6037575201	6037601302	6037292000	6037433700	6037241400	6037531800	6037531902	6037291210
6037575300	6037602404	6037221810	6037601900	6037242200	6037532304	6037532200	6037293202
6037575401	6037201401	6037222100	6037570202	6037221900	6037603102	6037533602	6037576402
6037575500	6037212202	6037573003	6037570203	6037192620	6037552601	6037302401	6037430101
6037206010	6037433802	6037573004	6037571701	6037203710	6037206200	6037104105	6037533603
6037535200	6037127300	6037576301	6037501804	6037188100	6037124103	6037218220	6037533902
6037541603	6037127520	6037576302	6037575101	6037191201	6037124104	6037222200	6037534203
6037541604	6037228410	6037576903	6037575803	6037191710	6037124105	6037241300	6037534405
6037542501	6037228420	6037212620	6037222600	6037192700	6037980033	6037211202	6037540300
6037552200	6037231220	6037241001	6037533803	6037208401	6037531502	6037211921	6037540501
6037294200	6037408141	6037241002	6037534101	6037208402	6037294120	6037211922	6037104703
6037294510	6037408504	6037241202	6037219010	6037208501	6037294520	6037212101	6037104704
6037301701	6037408505	6037209520	6037219020	6037208502	6037294820	6037212102	6037104821
6037201200	6037408631	6037553502	6037235202	6037208801	6037302302	6037212701	6037104822
6037201501	6037408723	6037570304	6037240800	6037434004	6037910201	6037212502	6037106405
6037201700	6037408724	6037207302	6037541801	6037930200	6037213202	6037218701	6037900508
6037203300	6037980010	6037207502	6037542402	6037540902	6037218300	6037218702	6037104124
6037208610	6037602801	6037208301	6037542700	6037541500	6037218400	6037219901	6037104108
6037208620	6037602802	6037208302	6037543903	6037543201	6037219700	6037219902	6037104203
6037209102	6037603801	6037554600	6037550000	6037543602	6037900102	6037221303	6037104204

Los Angeles County Census Tracts							
6037900602	6037603802	6037572600	6037407001	6037575202	6037104201	6037221304	6037104403
6037482522	6037604002	6037573002	6037482202	6037600201	6037104320	6037530004	6037104404
6037532001							

Source: CEJST 2023

Table F-7. Orange County CEJST LIDACs Within 0.5 miles of an Industrial Source

Orange County Census Tracts							
6059087803	6059110603	6059075003	6059001801	6059099703	6059075100	6059087806	6059087404
6059099229	6059110606	6059086406	6059075002	6059074901	6059087405	6059099702	6059087901
6059063605	6059001802	6059087802	6059001304	6059087505	6059086501	6059110110	6059087403
6059063702	6059011602	6059087106	6059001401	6059076204	6059063701	6059110500	6059088001
6059099601	6059021813	6059086404	6059011720	6059086802	6059001404	6059086502	6059099402
6059099701							

Source: CEJST 2023