SAC METRO AIR DISTRICT

Capital Region Climate Priorities Plan

2024

RAMBOLL ICF CivicSpark powered by CIVICWELL

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Acknowledgements

The *Capital Region Climate Priorities Plan* (Plan) would not have been possible without collaboration between community members, public agencies, tribal partners, community groups, and nonprofit organizations. The Sacramento Metropolitan Air Quality Management District (Sac Metro Air District) is grateful for the participation, support, and cooperation of the following contributors.

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Steering Committee

- City of Auburn
- City of Citrus Heights
- City of Davis
- City of Elk Grove
- City of Folsom
- City of Grass Valley
- City of Rancho Cordova
- City of Roseville
- City of Sacramento
- City of South Lake Tahoe
- City of Woodland
- El Dorado County Air Quality Management District
- El Dorado County
- Nevada County
- Nevada County Transportation Commission
- Placer County Air Pollution Control District
- Placer County
- Placer County Transportation Planning Agency
- Roseville Electric Utility
- Sacramento Area Council of Governments (SACOG)
- Sacramento County
- Sacramento Municipal Utility District (SMUD)
- Sacramento Regional Transit District (SacRT)
- Sutter County
- Town of Truckee
- Yocha Dehe Wintun Nation
- Yolo County
- Yolo-Solano Air Quality Management District
- Yuba County

Special Thanks

The planning team wants to give a special thank you to staff participants from the Outreach Advisory Committee, stakeholder interviewees, Valley Vision, Inc., and all who contributed their invaluable time and effort to this Plan.

Funding

This Plan was funded by the United States Environmental Protection Agency through the Inflation Reduction Act of 2022 and the Climate Pollution Reduction Grants program.

Abbreviations, Acronyms, and Definitions

AB	Assembly Bill
AB 617	Assembly Bill 617 (C. Garcia, Chapter 136, Statutes of 2017) directs the California Air Resources Board and all local Air Districts to protect communities disproportionately impacted by air pollution
BEV	Battery Electric Vehicle
BRT	Bus Rapid Transit
CalEEMod	California Emissions Estimator Model
CalEnviroScreen	California Communities Environmental Health Screening Tool
CalEPA	California Environmental Protection Agency
CAL FIRE	California Department of Forestry and Fire Protection
CALGreen	California Green Building Standards Code (Part 11, Title 24, California Code of Regulations)
Caltrans	California Department of Transportation
CAP	Criteria Air Pollutant
CAPCOA	California Air Pollution Control Officers Association
CAPCOA Handbook	California Air Pollution Control Officers Association Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity
CARB	California Air Resources Board
Carbon Sequestration	The process of capturing and storing carbon dioxide from the atmosphere
Carbon Sink	A process or mechanism, natural or otherwise, that absorbs more carbon from the atmosphere than it releases
CBG	Census Block Group
CBO	Community-Based Organization
CC4A	Clean Cars 4 All
CEC	California Energy Commission
CEJST	Climate and Economic Justice Screening Tool
CEQA	California Environmental Quality Act
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent

CPRG	Climate Pollution Reduction Grants
CTR	Commute Trip Reduction
DOE	Department of Energy
DOT	Department of Transportation
DPM	Diesel Particulate Matter
DWR	California Department of Water Resources
EJ	Environmental Justice
EMFAC	The Emissions Factor Model was developed by the California Air Resources Board to assess emissions from on-road vehicles including passenger cars, trucks, motorcycles, and buses
EPA	Environmental Protection Agency
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
GHG	Greenhouse Gas
GHG Reduction Measure	Any action to reduce risks from climate change by reducing greenhouse gas emissions or removing greenhouse gases from the atmosphere
GWP	Global Warming Potential
HVAC	Heating, Ventilation, and Air Conditioning
IRA	Inflation Reduction Act
Justice40	Federal initiative to ensure that 40 percent of the overall benefits of certain federal investments flow to disadvantaged communities that are marginalized, underserved, and overburdened by pollution
LIDAC	Low Income and Disadvantaged Community
MPO	Metropolitan Planning Organization
MT CO_2e	Metric Tons of Carbon Dioxide Equivalent
MWh	Megawatt Hour
N_2O	Nitrous Oxide
NO_x	Nitrogen Oxides
OAC	Outreach Advisory Committee
ODS	Ozone Depleting Substances
OEHHA	Office of Environmental Health Hazard Assessment
PHEV	Plug-In Hybrid Electric Vehicle
PM	Particulate Matter
RTPA	Regional Transportation Planning Agency

Sac Metro Air District	Sacramento Metropolitan Air Quality Management District
SACOG	Sacramento Area Council of Governments
SacRT	Sacramento Regional Transit District
Sacramento-Roseville CSA	Sacramento-Roseville, California Combined Statistical Area
SB	Senate Bill
SMUD	Sacramento Municipal Utility District
SO_2	Sulfur Dioxide
TDM	Transportation Demand Management
UHI	The Urban Heat Island Effect describes the higher day and night temperatures experienced in urban and suburban areas compared to the temperatures of their natural and rural surroundings
VMT	Vehicle Miles Traveled
ZEV	Zero-Emission Vehicle

Chapter 1. Introduction

The greater Sacramento region is already feeling the effects of climate change resulting from anthropogenic greenhouse gas (GHG) emissions. These effects include more frequent and extreme weather events, including atmospheric rivers and extreme heat, higher flood risk, reduced snowpack, droughts, and wildfires. These events impact the life and livelihoods of Sacramento's residents by deteriorating human health, decreasing the longevity of transportation and electrical infrastructure, and reducing crop yields. Air pollution from wildfires and exposure to more frequent and extreme heat events is threatening public health, especially for those who are most vulnerable including children, older adults, the unhoused, and those with preexisting health conditions such as asthma and chronic lung and heart disease. Recognizing the need for climate action, the United States Environmental Protection Agency's (EPA) Climate Pollution Reduction Grants (CPRG) program aims to create regional and statewide plans to combat the effects of climate change by reducing GHG emissions and associated co-pollutants that compromise air quality.

As a national and global leader in climate research and planning, other states and countries look to California to lead the way in planning for the future. Assembly Bill (AB) 1279, the California Climate Crisis Act of 2022, calls for statewide net-zero GHG emissions by no later than 2045 and directs the California Air Resources Board (CARB) to coordinate with local agencies to reach the target. As the local agency with the primary responsibility to help the capital region reach its air quality and climate goals, the Sacramento Metropolitan Air Quality Management District (Sac Metro Air District), in coordination with local jurisdictions, agencies, and tribal partners, is leading in the development of a regional climate action plan with strategies to reduce GHG emissions and address disproportionate impacts from air pollution exposure on vulnerable communities.

The Sacramento region already deals with significant air quality challenges from transportation emissions which are exacerbated by certain geographical features. These geographic characteristics expose the region to a diverse range of climate risks over its dense urban areas, valley farmland and agricultural fields, rolling foothills, and high Sierra Nevada mountains. Each of these distinct environments has its own set of issues and opportunities. Fortunately, the CPRG program is facilitating a collaborative process that enables several local agencies to identify commonalities in each jurisdiction's respective climate goals and formulate a set of regional priorities that can be scoped and funded to deliver benefits throughout the capital region. These strategies will be shared with others in the country who face similar environmental challenges.

Through this climate action planning process, the Sac Metro Air District engaged residents, local agencies, multiple cities, and seven counties to build the relationships necessary to implement local climate actions. A steering committee (Table 1) consisting of staff from El Dorado, Placer, Nevada, Sacramento, Sutter, Yolo, and Yuba counties, cities within these counties, the Yocha Dehe Wintun Nation, the Sacramento Area Council of Governments (SACOG), the Sacramento Regional Transit District (SacRT), and the Sacramento Municipal Utility District (SMUD) was formed to guide the development of the Sacramento-Roseville, California Combined Statistical Area (Sacramento-Roseville CSA) priority climate action plan. To signify the importance of regional collaboration, on November 9, 2023, more than 50 elected officials from around the region attended a joint meeting of the Boards of Directors for the Sac Metro Air District, SMUD, SacRT, and SACOG where executive approval was given to execute a joint resolution in support of continued collaboration on regional priority projects. Cooperation ensures greater efficiencies and swifter attainment of mutual goals, which leads to improved wellness and quality of life for the region's residents. Regional priorities identified by the Sac Metro Air District Board and its partners relate to mobility and the reduction of vehicle miles traveled (VMT), grid resiliency, infill development, wildfire reduction, biomass energy, hydrogen production, and energy efficiency. The CPRG program is accelerating work to decarbonize the transportation, industry, electric power, and natural and working lands sectors and address environmental injustice by supporting grant recipients in enacting solutions that are community driven.

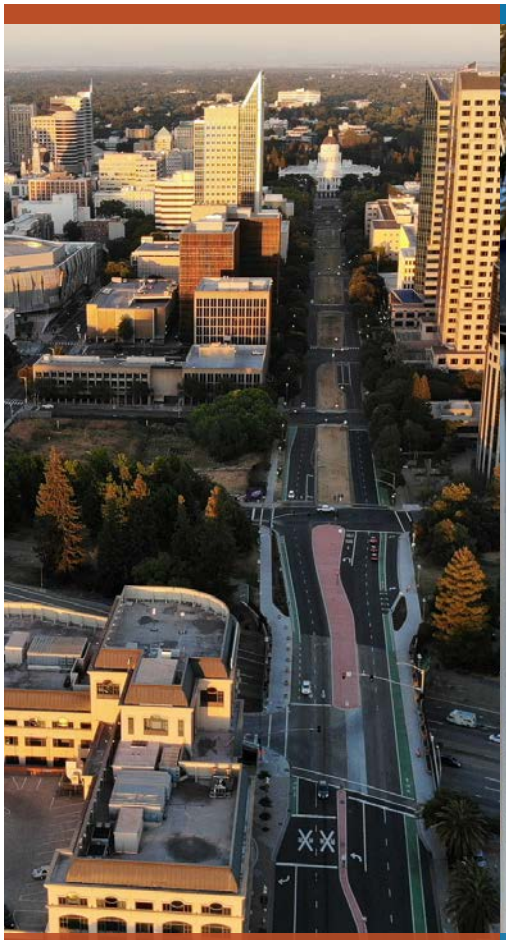
Table 1. Sacramento Region CPRG Steering Committee

SACRAMENTO REGION CPRG STEERING COMMITTEE Lead Agency/Chair – Sac Metro Air District	
City of Auburn	Placer County Air Pollution Control District
City of Citrus Heights	Placer County
City of Davis	Placer County Transportation Planning Agency
City of Elk Grove	Roseville Electric Utility
City of Folsom	Sacramento Area Council of Governments (SACOG)
City of Grass Valley	Sacramento County
City of Rancho Cordova	Sacramento Municipal Utility District (SMUD)
City of Roseville	Sacramento Regional Transit District (SacRT)
City of Sacramento	Sutter County
City of South Lake Tahoe	Town of Truckee
City of Woodland	Yocha Dehe Wintun Nation
El Dorado County Air Quality Management District	Yolo County
El Dorado County	Yolo-Solano Air Quality Management District
Nevada County	Yuba County
Nevada County Transportation Commission	

To engage residents in the planning process, and with help from the CPRG steering committee, the Sac Metro Air District invited community-based organizations (CBOs), nonprofits, and other community groups to participate in an Outreach Advisory Committee (OAC) and influence the creation of an equitable community engagement strategy. Key themes from outreach conducted by the CPRG planning team pertain to equitable implementation of this climate action plan and the importance of continued stakeholder engagement. Staff conducted in-depth interviews with individuals from 17 CBOs, five governmental agencies, and one local university. The Sac Metro Air District distributed a survey based on community priorities that garnered 850 responses. When asked how residents would prioritize the benefits of air pollution reduction in their communities, improving public health and lowering energy bills were among the two greatest priorities. When asked what sources of air pollution most impact their communities, over 50% of respondents selected wildfires and emissions from passenger vehicles and trucks.

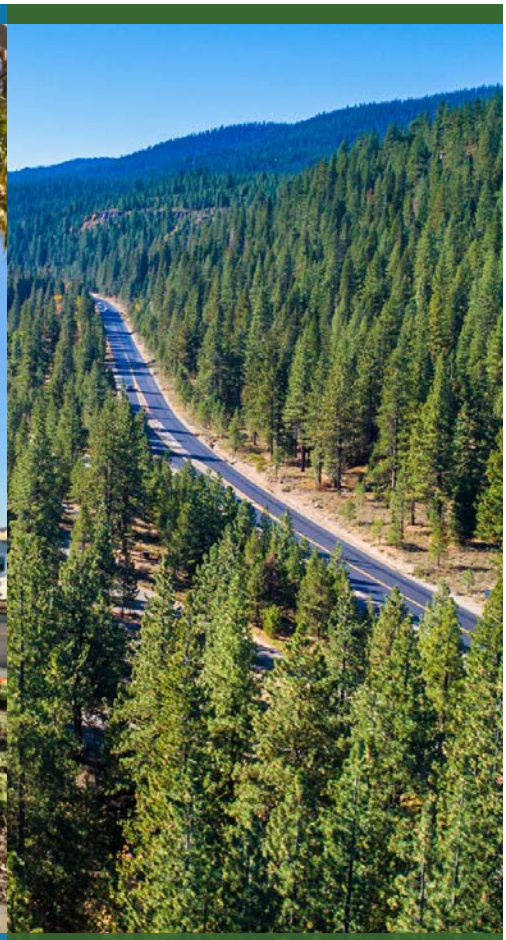
Useful tools that keep planners and decision makers accountable to their communities and aid in meeting local climate goals are the *California Air Pollution Control Officers Association Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity* (CAPCOA Handbook); and the associated California Emissions Estimator Model (CalEEMod). Efforts to develop and implement the CAPCOA Handbook and CalEEMod were led by the Sac Metro Air District on behalf of the air districts of California, and both are considered cutting edge tools. They are planning resources that help decision makers evaluate GHG reduction measures, climate vulnerabilities, and promote equity to support sustainable, resilient, and equitable land use and transportation planning. Some local actions were not quantified within the CAPCOA Handbook, and the CPRG planning team worked to incorporate these actions as quantified measures within the CAPCOA Handbook (CAPCOA Handbook Update) through the development of this climate action plan, ensuring their implementation not only in the capital region, but across California.

The geography, climate risks, and local factors within the seven counties covered by this climate action plan led to the selection of a distinct set of GHG reduction measures. The measures selected for the Capital Region Climate Priorities Plan (Plan) speak to the most concerning set of climate risks in the region and no single climate solution will address the multitude of climate related impacts. The GHG mitigation measures in the Plan are represented within three categories – built environment, transportation, and natural and working lands.



Built Environment

Transportation



Natural and Working Lands

Overview

After reviewing the existing climate action plans in the region and conducting a GHG inventory for all seven counties, the Sac Metro Air District worked with the steering committee and community partners to generate a list of measures for inclusion. This Plan encourages infill development, building electrification and vehicle decarbonization, active modes of transportation, energy resiliency, carbon sequestration, and forest and ecosystem health. Each measure's GHG mitigation potential is provided in metric tons of carbon dioxide equivalent (MT CO_2e) per year for a reduction target year of 2030. The Plan discusses scale of implementation, authority to implement, benefits to vulnerable communities, and funding recommendations for each measure. Implementation of the GHG reduction measures contained within the Plan will move the Sacramento region closer to carbon neutrality by 2030. To meet our emissions reduction goals, Sacramento will continue to advance electric power sector improvements, paying particular attention to renewable energy deployments and battery storage.

In the future, new and strengthened partnerships will allow for continued capacity to apply for funding opportunities to implement necessary energy, built environment, transportation, and natural and working lands measures. New climate actions would require appropriate approvals from environmental review to consultation with community members. To continue Sacramento's push for climate action into the future, from 2024 to 2027 this Plan will be expanded into a more comprehensive Plan update where the measures and the feasibility of individual climate projects and programs will be further explored. Definitive emissions projections and reduction targets will be included in the Plan update to track implementation progress. To benefit partners and community stakeholders, mitigation measures will continue to be explored and new information and environmental best practices will be shared with others in the nation. The updated Plan will contain a communitywide benefits analysis, a continuation plan for ongoing community engagement, and workforce planning analyses. The updated Plan will be provided in 2027.

Additionally, the finalized Plan will be shared via the Sac Metro Air District's public CPRG website[1] on March 1, 2024, for use by cities, towns, counties, tribes, and other agencies throughout the Sacramento-Roseville CSA for citation when applying for competitive CPRG implementation funds in the second phase of the CPRG program. EPA is giving the region an opportunity to apply for future funding to achieve its local climate goals. The investment of future climate funding in a region as multifaceted as Sacramento encourages other regions throughout the nation to strengthen their climate plans and solidify their climate and sustainability goals. In many ways, Sacramento is one of the most culturally and geographically diverse places in the country, and it will continue to be an example to the rest of the country.

REFERENCES

[1] *https://www.airquality.org/residents/climate-change/climate-pollution-reduction-grants*

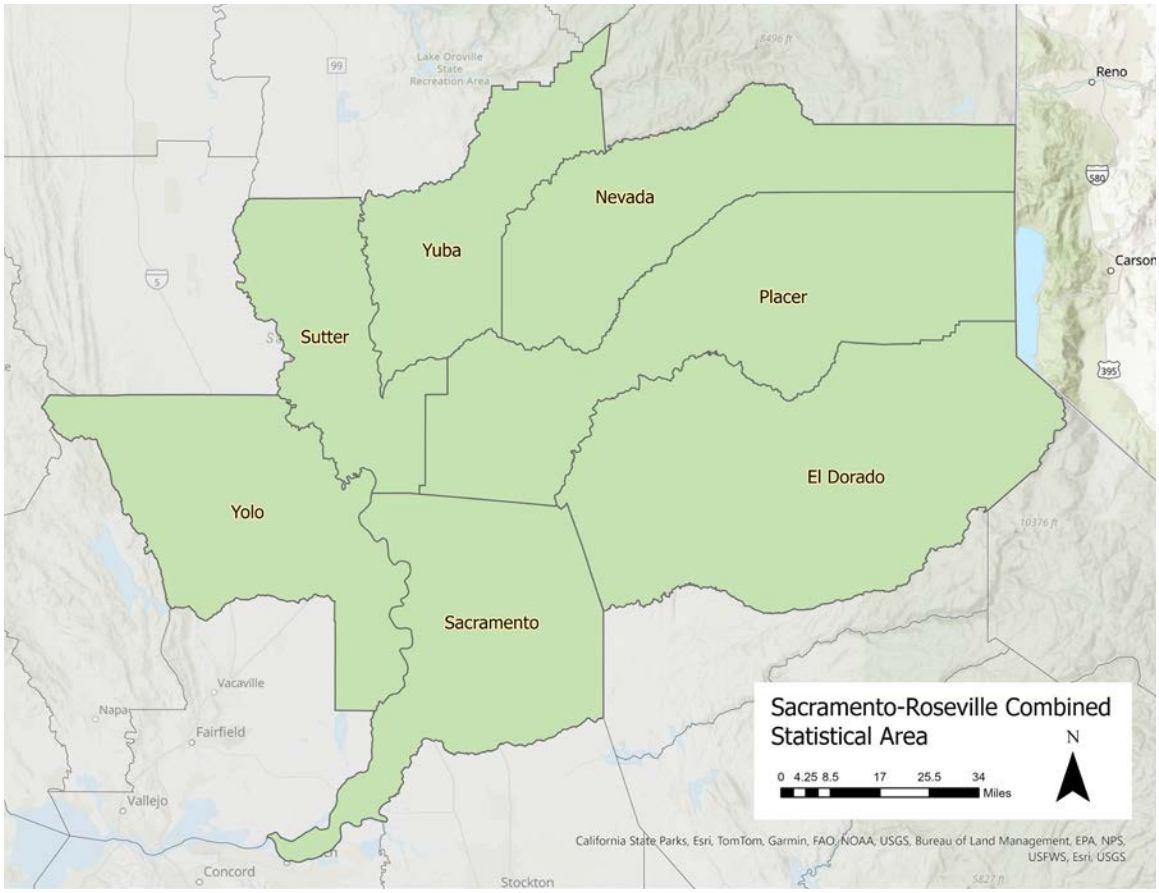
Chapter 2. Greenhouse Gas Emissions Inventory

Developing a Baseline Greenhouse Gas Inventory

A crucial first step in developing a climate action plan is to understand the current state of GHG emissions in the region, including key emissions sources by sector and by geography. GHG inventories help track progress in reducing emissions and achieving targets. This GHG inventory serves as a tool to evaluate emissions by source and economic sector for the region in order to develop and prioritize GHG reduction measures. It will be used as a baseline for comparison when calculating the impact of proposed GHG emissions reduction measures and carbon sinks.

The Sacramento–Roseville CSA emissions inventory was developed with sector, subsector, and county-level details. The Sacramento–Roseville CSA, shown in Figure 1, includes the counties of El Dorado, Nevada, Placer, Sacramento, Sutter, Yolo, and Yuba.

Figure 1. Sacramento-Roseville CSA[1]

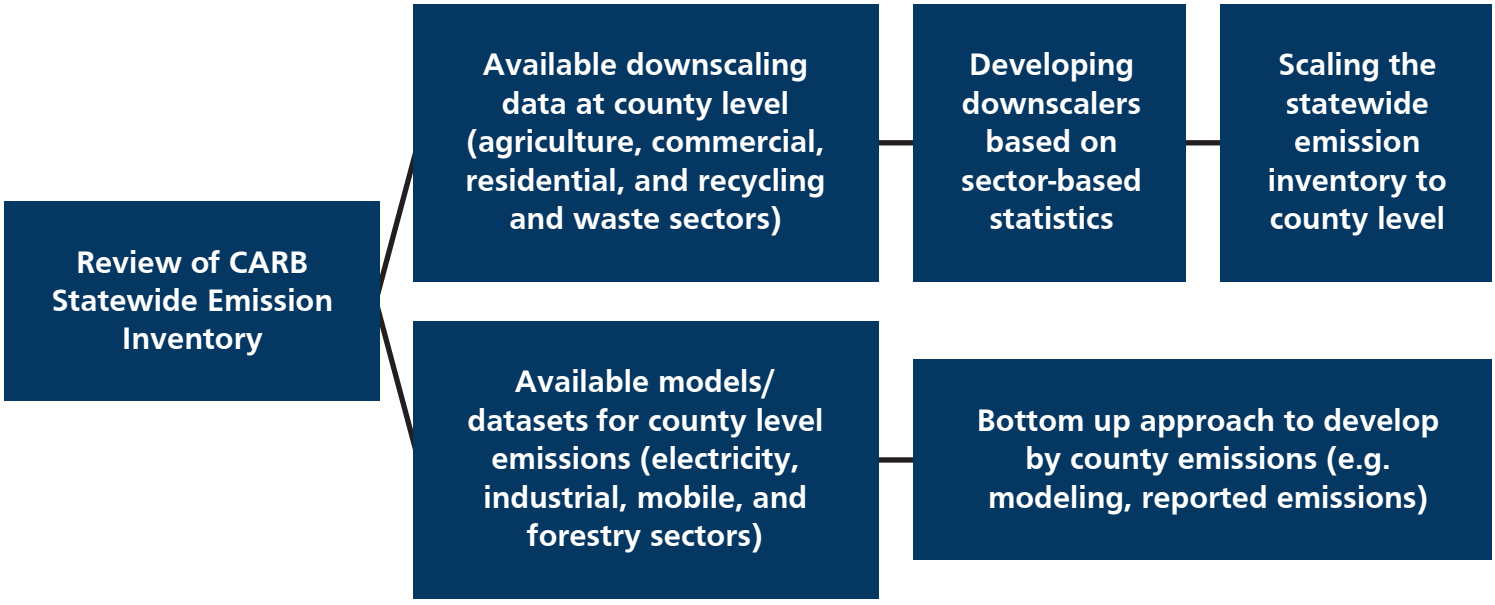


The inventory captures emissions generated by the region's broad range of sources including agriculture and forestry, industrial sectors, the operation of commercial and residential buildings, and from vehicles and machinery including off-road equipment, on-road vehicles, rail, and waterborne sources.

Developing a comprehensive regional inventory using a bottom-up approach is challenging and resource intensive. For the purposes of this Plan, existing emission inventories such as the CARB California Annual Statewide Inventory were leveraged to estimate the emissions for each subsector. For several sectors, relevant analytical data was used to downscale the state emissions to Sacramento–Roseville CSA counties.

Emissions were estimated based on available CARB tools and data, activity data, and emission factors. This methodology was applied to the industrial, electricity and mobile sectors, which includes on-road, off-road, rail and marine sources. For the remaining sectors, emissions were estimated by downscaling from CARB's statewide emissions inventory to Sacramento–Roseville CSA counties based on publicly available sector-specific activity such as natural gas consumption, cropland acreage, population, and landfill tonnage.

Figure 2. Overview of GHG Inventory Approach



Historical year 2019 was selected as the GHG inventory baseline year. To select the inventory year, the CPRG planning team considered available emissions data and the timing of the COVID-19 pandemic. Due to the unique conditions of 2020 as a result of COVID-19, historical year 2020 was not selected as the baseline. The Plan uses 2019 as the GHG inventory baseline year due to an availability of data and the alignment with existing and expected trends that represent business as usual prior to the disruption caused by the COVID-19 pandemic.[2]

Greenhouse Gas Inventory Results

GHG Emissions by Sector

To inform the development of a climate action plan, it is important to understand the key sources of emissions across the region to help prioritize emissions reduction actions and strategies in the future. The complete 2019 GHG emissions inventory for the Sacramento region is summarized in tables and figures below.[3]

Figure 3 displays emissions across the entire Sacramento-Roseville CSA by sector and mobile subsectors. On-road vehicle emissions are the largest sector, contributing 41% of emissions. Industrial is the second largest sector, contributing 25% of emissions, and includes petroleum marketing facilities such as fuel bulk stations, pipeline transportation systems for natural gas, and other types of industrial facilities. Electricity is the third largest sector, contributing 15% of emissions, and includes electricity consumption across all sectors. The next most significant sector is residential, reflecting emissions generated from heating and powering homes across the region.

Figure 3. 2019 Sacramento-Roseville CSA GHG Emissions by Sector and Mobile Subsectors

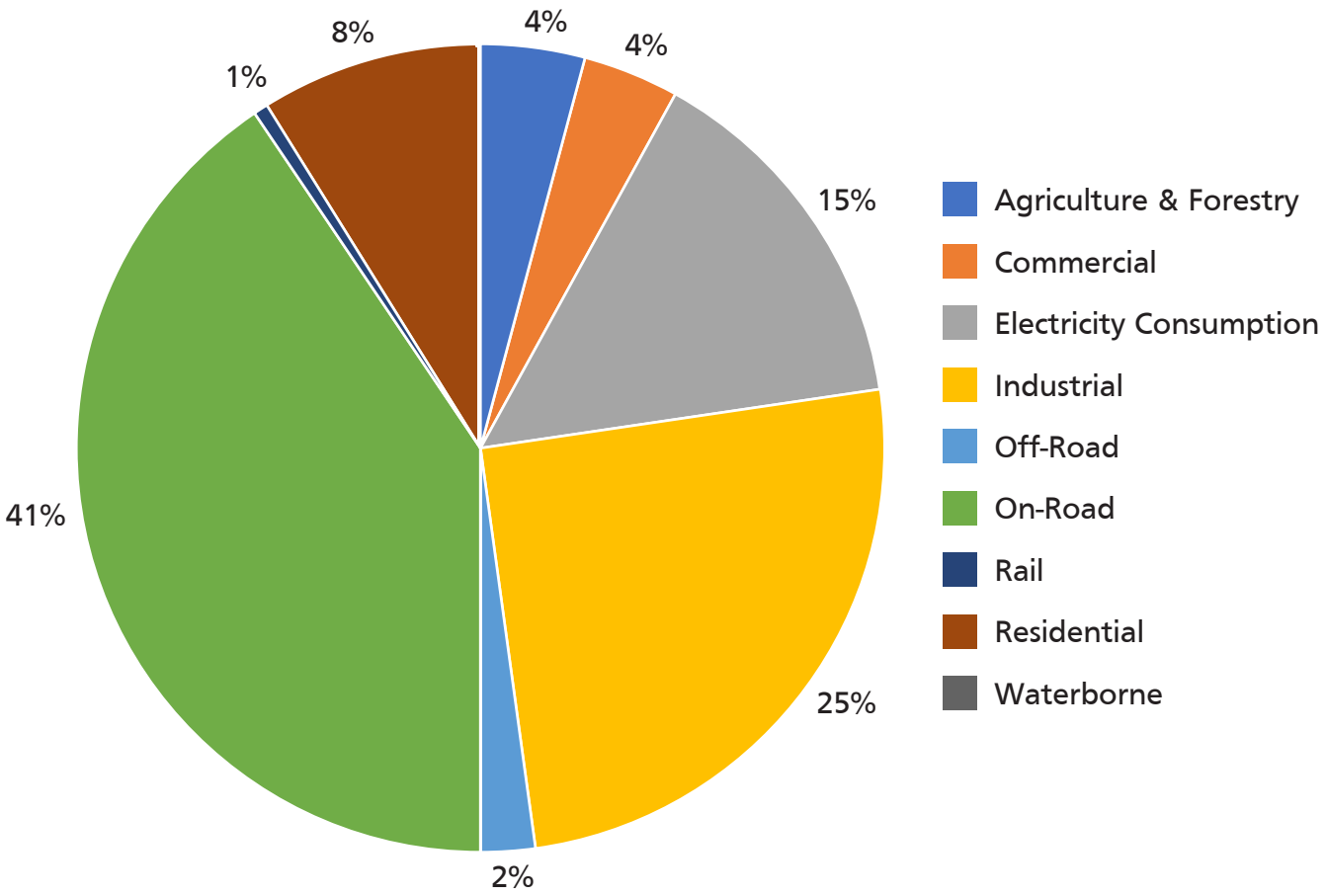


Table 1 below displays the emission breakdown by sector and mobile subsectors. Aircraft activity for the Sacramento-Roseville CSA (e.g., fuel consumption, flight-miles) was not readily available, therefore, aircraft emissions were excluded. The residential and electricity sectors are the second and third largest sources of GHGs in most counties.

Table 1. 2019 Regional Greenhouse Gas Emissions by Sector and Mobile Subsectors

Sector	2019 Regional GHGs (Thousand Metric Tons of CO_2e)	Percentage Breakdown
Mobile (On-Road)	10,713	40.8%
Industrial	6,624	25.2%
Electricity Consumption	3,853	14.7%
Residential	2,232	8.5%
Agriculture & Forestry	1,101	4.2%
Commercial	988	3.8%
Mobile (Off-Road)	547	2.1%
Mobile (Rail)	135	0.5%
Mobile (Waterborne)	79	0.3%

GHG Emissions by Geography

As the most highly populated counties, Sacramento, Yolo, and Placer counties generate the most GHG emissions in the Sacramento-Roseville CSA. Consistent with their lower population size, Yuba and Nevada counties have the smallest emissions. Figure 4 maps emission magnitudes by county, with darker colors indicating greater emission values.

Figure 4. 2019 Sacramento-Roseville CSA GHG Emissions

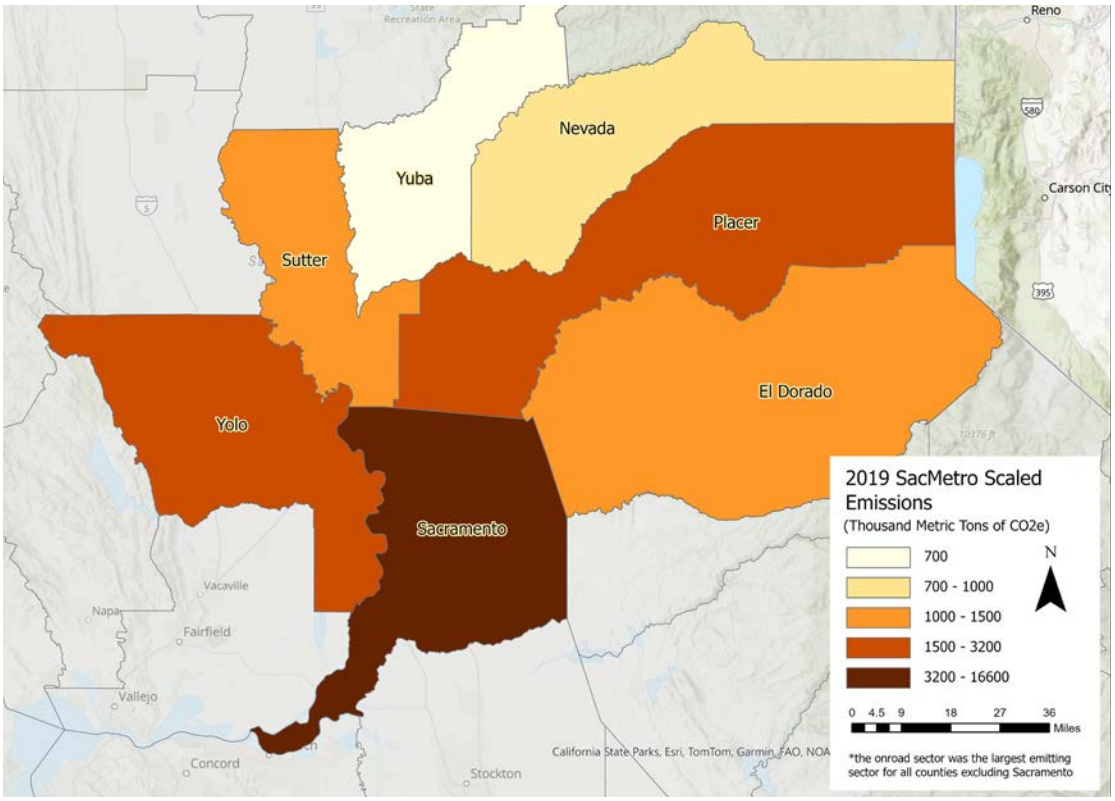


Figure 5 displays the emissions by county, stacked by sector. Across all counties, the mobile source sector was the greatest contributor to overall emissions with the largest contributions from on-road vehicles. However, in Sacramento County the industrial sector's contribution was close to the mobile sector's contribution.

Figure 5. Sacramento-Roseville CSA Annual 2019 GHG Emissions by County and Sector

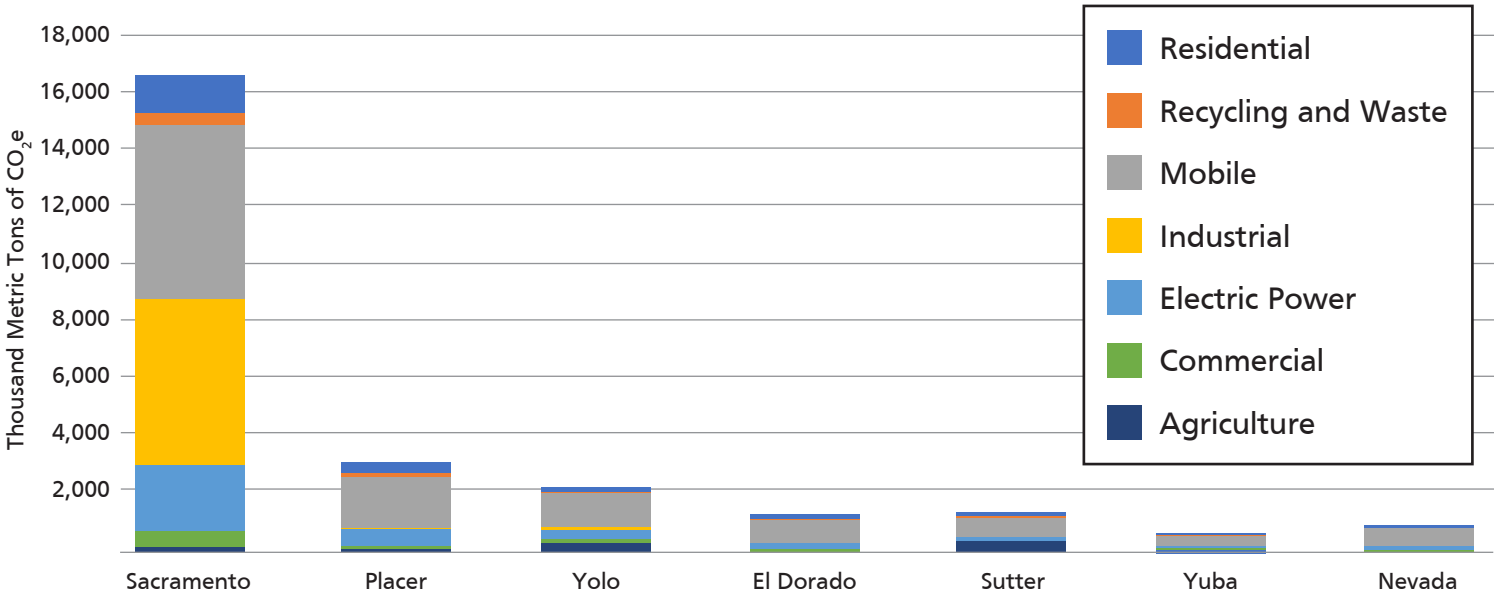


Table 2 displays per capita emissions by county for the entire Sacramento-Roseville CSA. Sutter County has the highest per capita emissions, roughly double the emissions of El Dorado County. Sacramento County has the third highest per capita emissions. Yolo is an agricultural county and has the second highest per capita emissions. While Sacramento County clearly presents the greatest opportunity for emissions reductions, exploring the sources of higher per capita emissions in Sutter and Yolo Counties may present additional opportunities for emissions reductions.

Table 2. 2019 Regional Greenhouse Gas Emissions per Capita

Sector	2019 Regional GHGs (Thousand Metric Tons of CO_2e capita)
Sutter	13.64
Yolo	10.55
Sacramento	10.43
Nevada	9.38
Yuba	8.58
Placer	7.73
El Dorado	6.86
Sacramento-Roseville CSA Average Per Capita Emissions	**9.80**

This 2019 inventory provides a solid basis from which to develop an emissions reduction strategy across sectors and geographies. Guidelines for ongoing emissions tracking and inventory refinement can be found in Appendix A.

Overview by Sector

The next section provides an overview of GHG emissions by sector. Methodologies and details for each sector can be found in Appendix B.

Residential Sector

The residential sector includes emissions generated from space heating, water heating, cooking, and other fuel combustion in residential homes as well as fertilizer usage, and fugitive emissions related to refrigerants and other ozone depleting substances (ODS). The residential sector includes the following subsectors:

- Household Fuel Use: mainly natural gas combustion
- Landscape: residential use of nitrogen fertilizer on turf and other landscaping
- Fugitives of Transmission and Distribution: pipeline system leaks
- ODS: refrigerants, foams, aerosols and fire protection

Emissions in the residential sector are mainly generated by Household Fuel Use (81%) for heating and cooking, and ODS (14%), which result from leaks from refrigerators and air conditioning units. Emissions for each county are displayed by subsector in Figure 6. Emissions per capita for each county are displayed in Figure 7.

Figure 6. 2019 Residential CO_2e[4] Emissions by County and Subsector

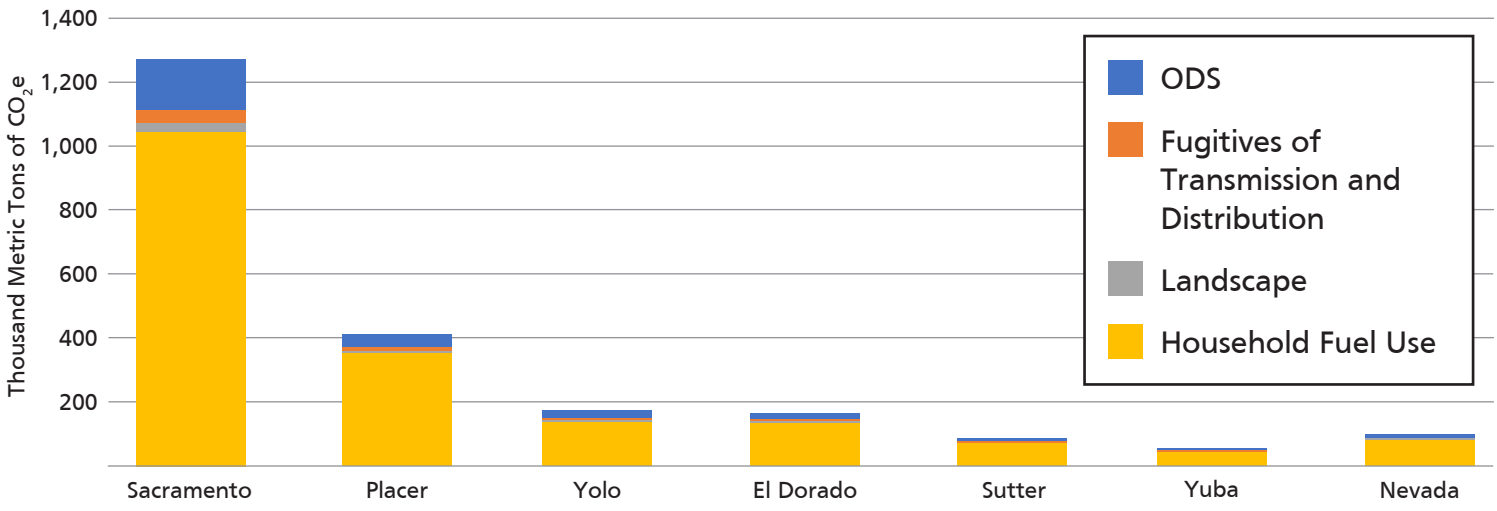
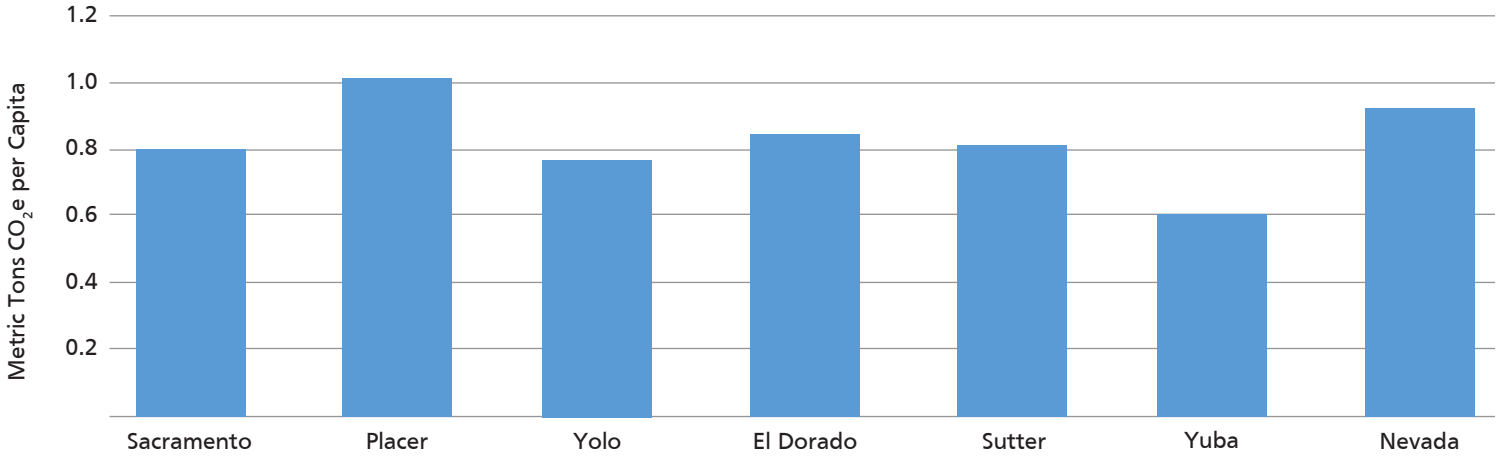


Figure 7. 2019 Residential CO_2e Emissions Per Capita by County



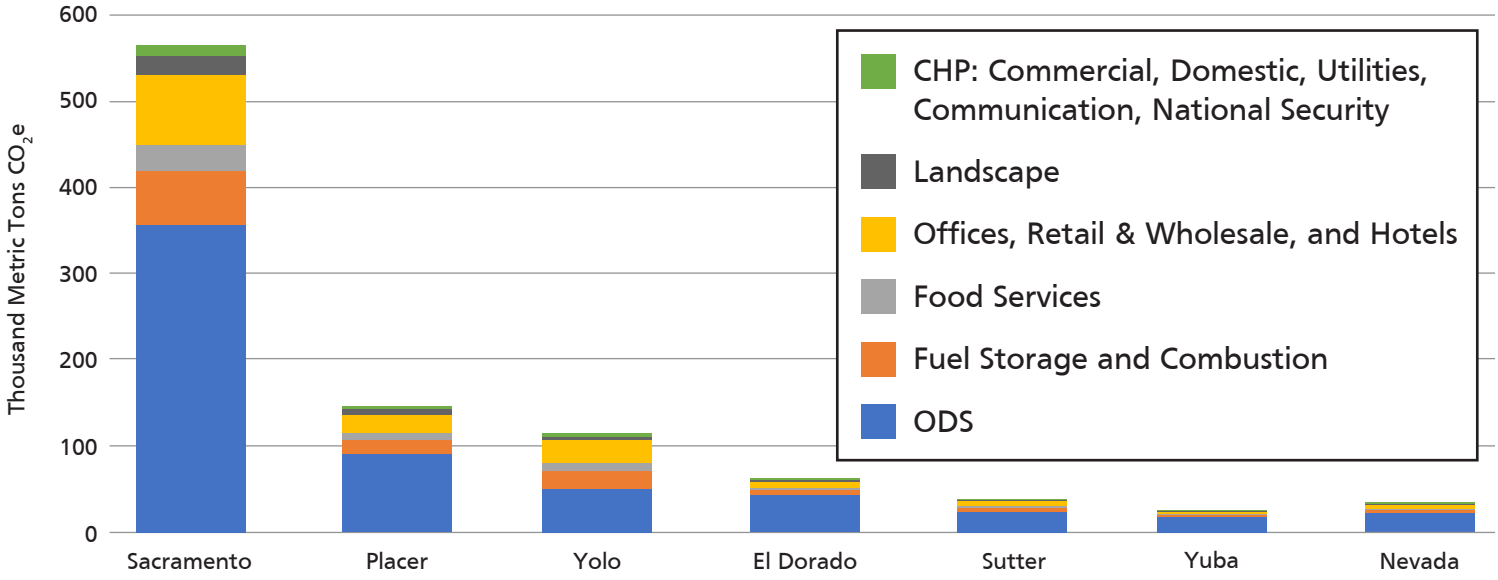
Commercial Sector

The commercial sector includes emissions from commercial heating, fuel storage, fertilizer use, and fugitive emissions of refrigerants and ODS. Most commercial sector emissions are generated through ODS fugitive emissions due to their high global warming potential (GWP), but there are also key contributors from commercial fuel combustion and fertilizer use.

Main Source of Emissions	2019 Regional GHGs (Thousand Metric Tons of CO_2e capita)
Fuel Combustion	Food Services, Offices, Health Care, Retail & Wholesale, Education, Hotels, Transportation Services, Combined Heat and Power (CHP): Commercial, Domestic Utilities, Commercial, National Security
Commercial Use of Nitrogen Fertilizer on Turf	Landscape
Fugitives	ODS

Commercial sector emissions are mainly generated by ODS (40%) and Fuel Combustion (17%). Emissions for each county are displayed by subsector in Figure 8.

Figure 8. Scaled 2019 Commercial CO_2e Emissions by County and Subsector



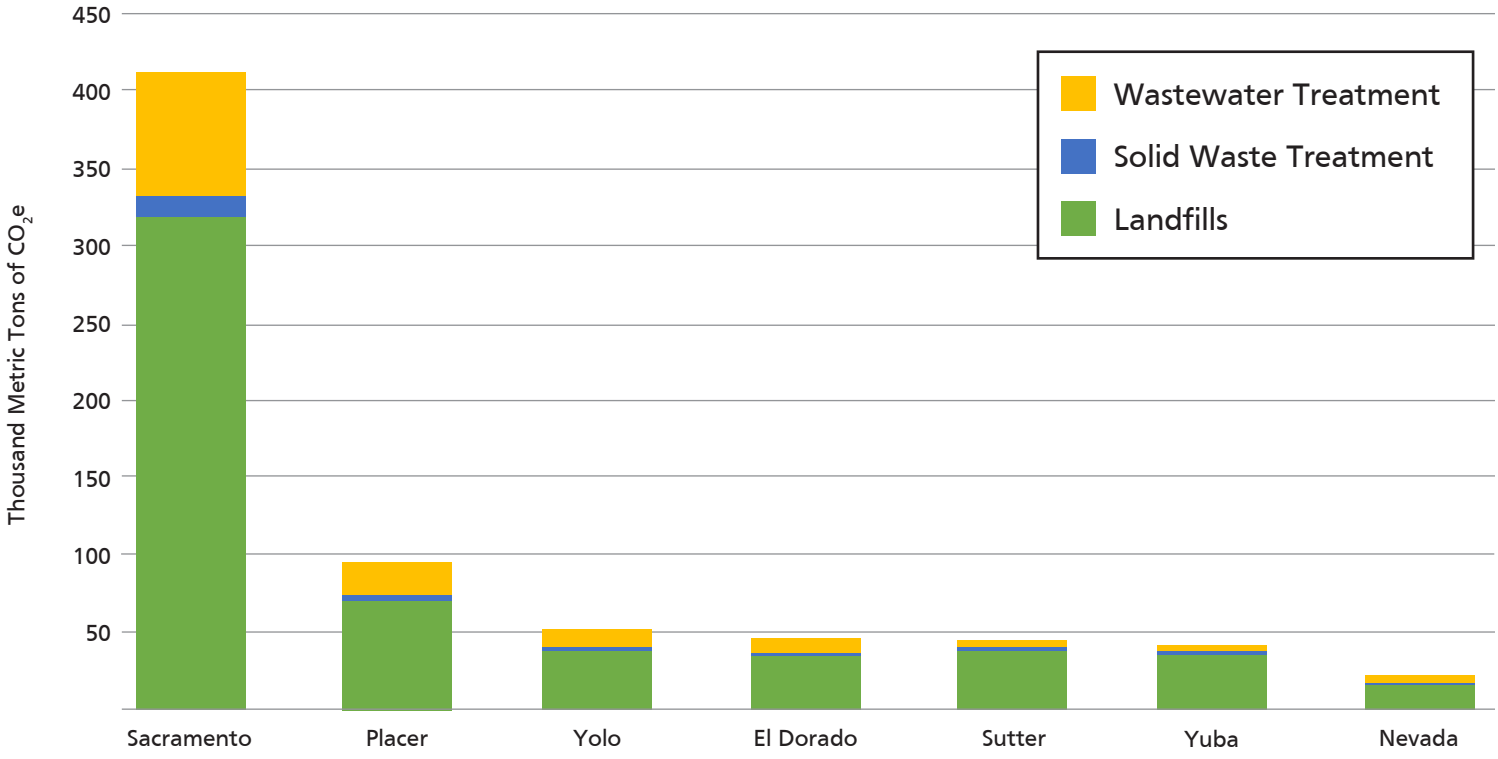
Recycling and Waste Sector

The recycling and waste sector includes emissions related to landfills and waste treatment. The following subsectors make up the recycling and waste sector:

- Landfills: emissions related to landfill gas (methane) generation
- Solid Waste Treatment: emissions related to composting
- Wastewater Treatment: emissions related to methane (CH_4) gas produced through anaerobic digestion used in wastewater treatment

Recycling and waste sector emissions are mainly generated by Landfills (78%) and Wastewater Treatment (19%). Emissions for each county are displayed by subsector in Figure 9.

Figure 9. Scaled 2019 Recycling and Waste CO_2e emissions by County and Subsector



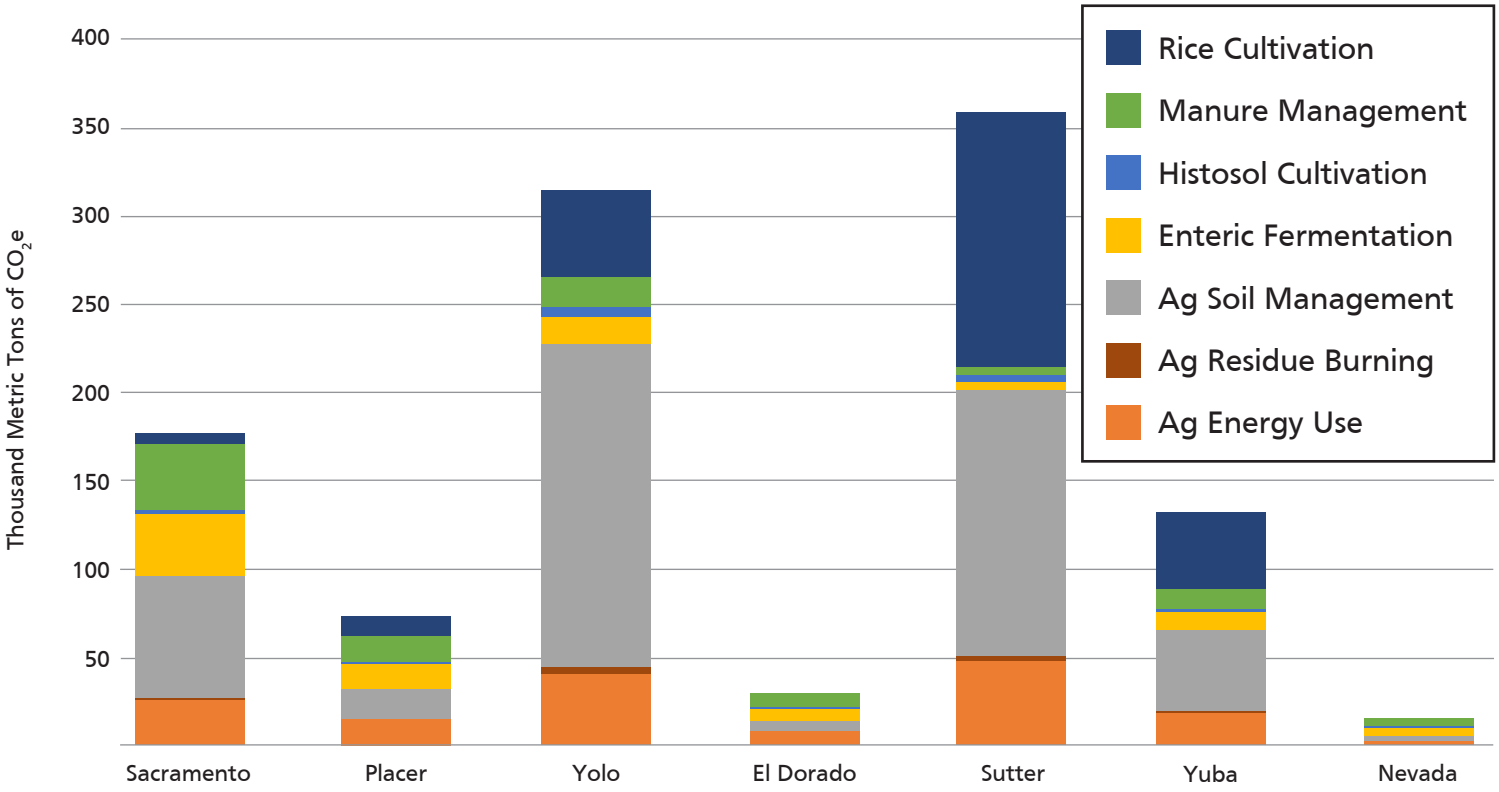
Agricultural Sector

The agricultural sector includes emissions related to energy use, crop residue and soil management, manure management, and crop cultivation. The following subsectors make up the agricultural sector:

- Agriculture Energy Use: energy consumption from off-road field equipment
- Agriculture Residue Burning: combustion emissions from crop residue burning
- Agriculture Soil Management: emissions related to nitrous oxide (N_2O) released during fertilizer and manure applications
- Enteric Fermentation: emissions from ruminant livestock (e.g., cattle & sheep) digestion
- Histosol Cultivation: N_2O emissions from agricultural soils
- Manure Management: methane emissions related to digesters or processes used in livestock waste management
- Rice Cultivation: emissions from methane-producing bacteria in the soil of rice cultivation

Agricultural sector emissions are mainly generated by Soil Management (43%) and Rice Cultivation (23%). There is substantial rice cultivation in the region, particularly in Yolo and Sutter counties. Emissions for each county are displayed by subsector in Figure 10.

Figure 10. Scaled 2019 Agriculture CO_2e Emissions by County and Subsector



Industrial Sector

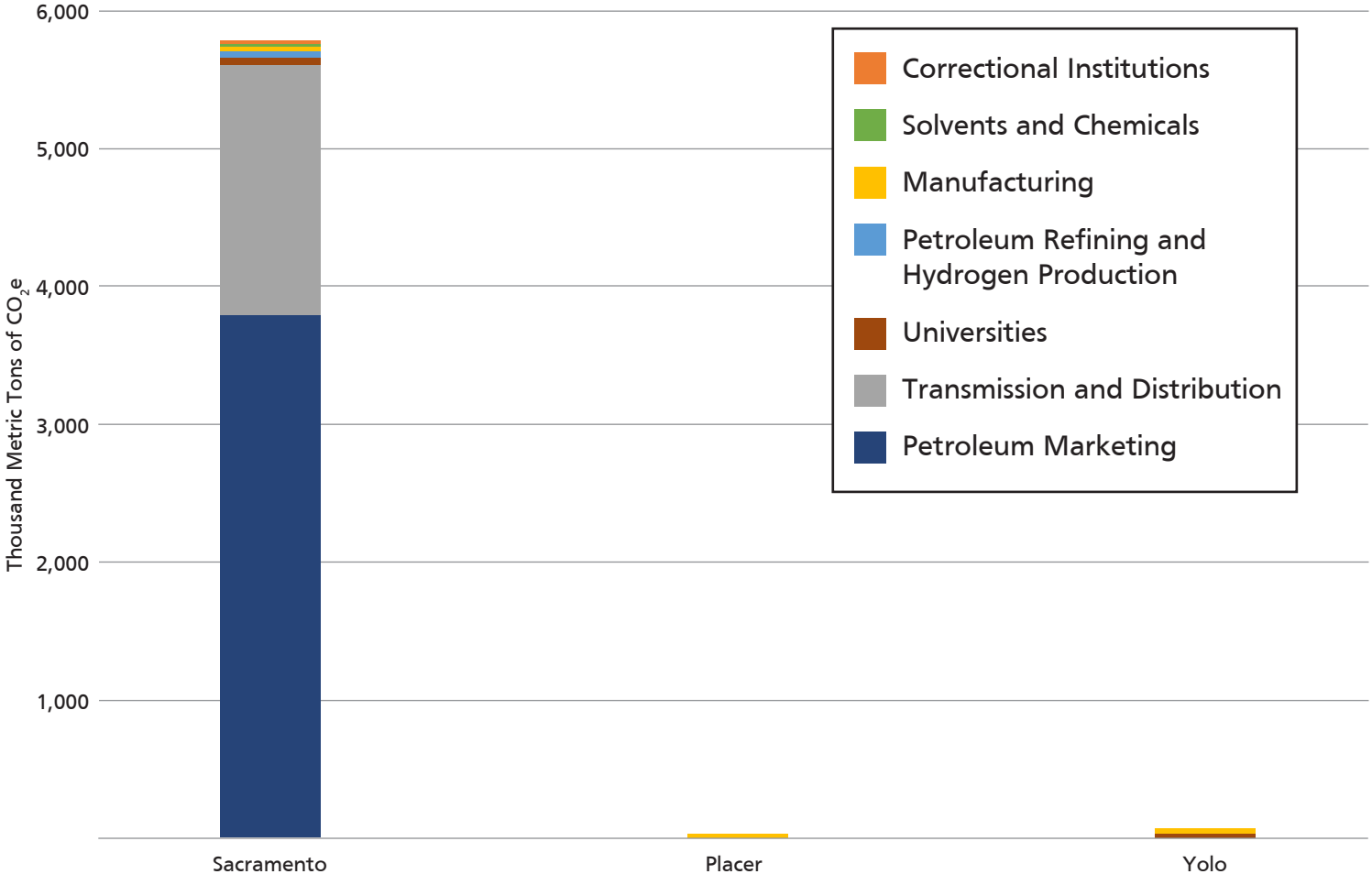
The industrial sector includes emissions related to factory, heavy industrial and large facility operations. The following subsectors comprise the industrial sector:

- Petroleum Marketing: emissions from fuel bulk stations
- Transmission and Distribution: emissions from pipeline transportation systems for natural gas
- Correctional Facilities: emissions related to on-site steam generation and fuel combustion
- Petroleum Refining and Hydrogen Production: emissions related to petroleum refining and hydrogen production operations
- Manufacturing: emissions related to fuel combustion on-site
- Solvents and Chemicals: emissions related to fuel combustion on-site
- Universities: emissions related to on-site steam generation and fuel combustion

The industrial sector inventory focuses on major emitting facilities. The warehousing industry, which has a relatively low GHG emissions intensity and comprises 75% of the zoned industrial square footage in the region, is excluded from the industrial sector.

Emissions in the industrial sector are mainly generated by Petroleum Marketing (64%) and Transmission and Distribution of Natural Gas (17%). Industrial emissions in Sacramento County are the largest in the Sacramento-Roseville CSA, which is consistent with its greater density of industrial facilities countywide. Emissions for each county are displayed by subsector in Figure 11.

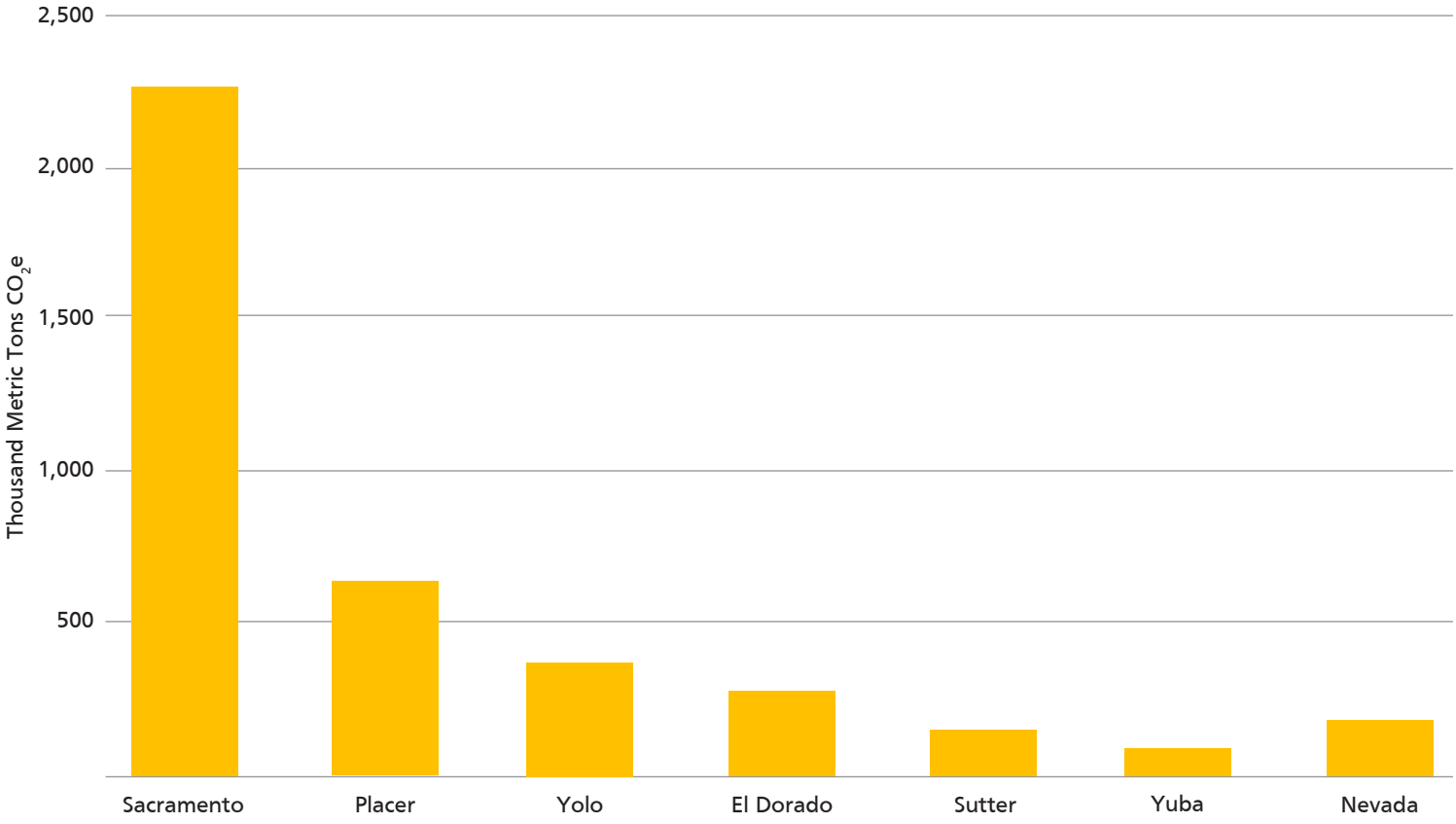
Figure 11. Scaled 2019 Industrial CO_2e Emissions by County and Subsector



Electricity Sector

The electricity sector includes emissions related to electricity usage within each of the Sacramento-Roseville CSA counties. While electricity is used across sectors, it is calculated separately for the purposes of a GHG inventory. Electrical sector emissions were based solely on local energy consumption. Emissions for each county are displayed in Figure 12.

Figure 12. Scaled 2019 Electricity Consumption CO_2e Emissions by County



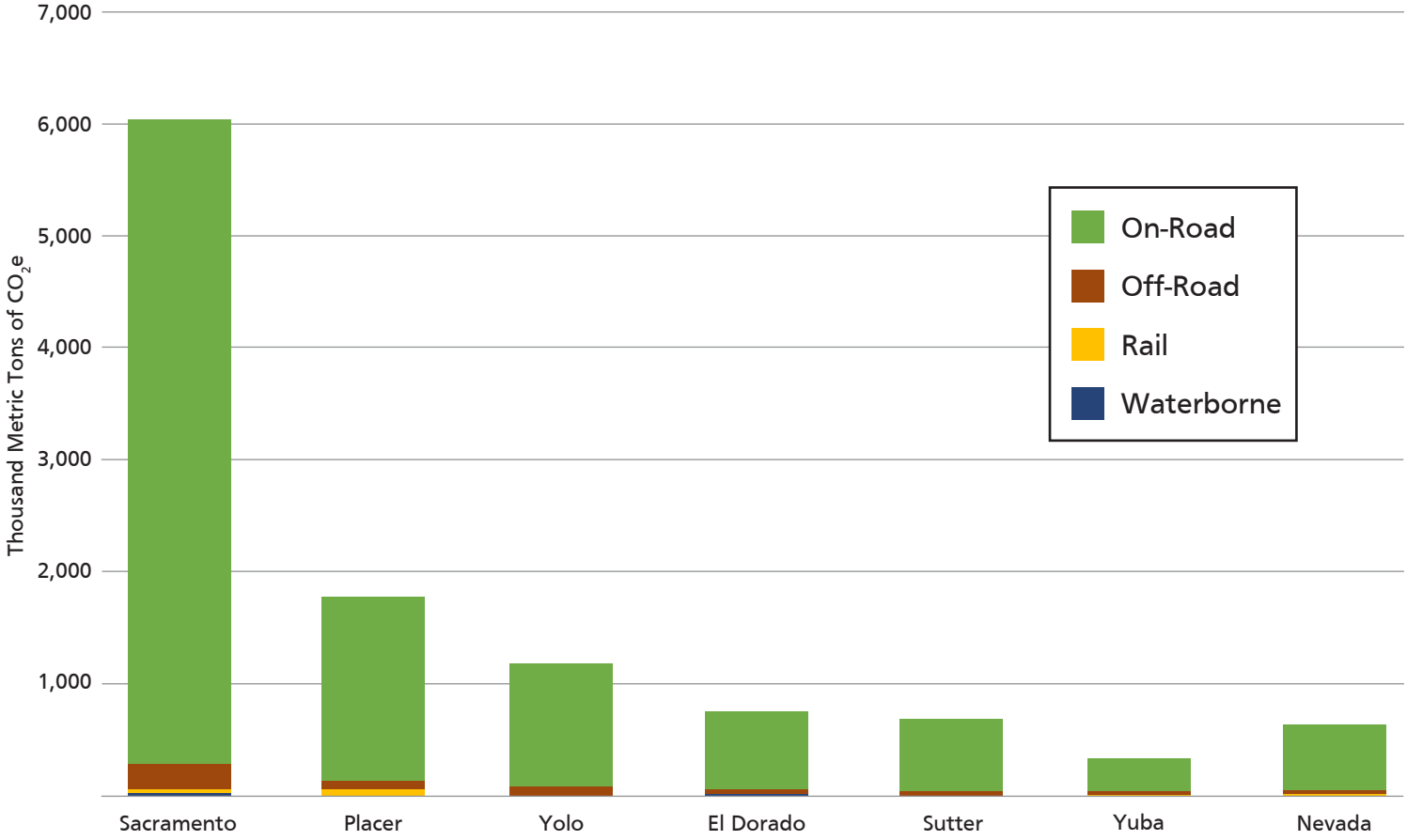
Mobile Sector

The mobile sector includes emissions generated from vehicle fleets, local rail trips, boats, and mobile off-road equipment. The following subsectors make up the mobile sector:

- On-Road Vehicles: motorcycles, light and heavy-duty vehicles, and buses
- Off-Road Equipment: equipment across industries like construction, lawn and garden, industrial/cargo, agricultural, oil and gas, etc.
- Rail: freight and passenger locomotives traveling within the region
- Waterborne: pleasure craft and harbor craft

Mobile sector emissions are mostly generated by On-Road Vehicles (93%), with significant contributions from passenger cars and heavy-duty trucks. Emissions for each county are displayed by subsector in Figure 13.

Figure 13. Scaled 2019 Mobile CO_2e Emissions by County and Subsector

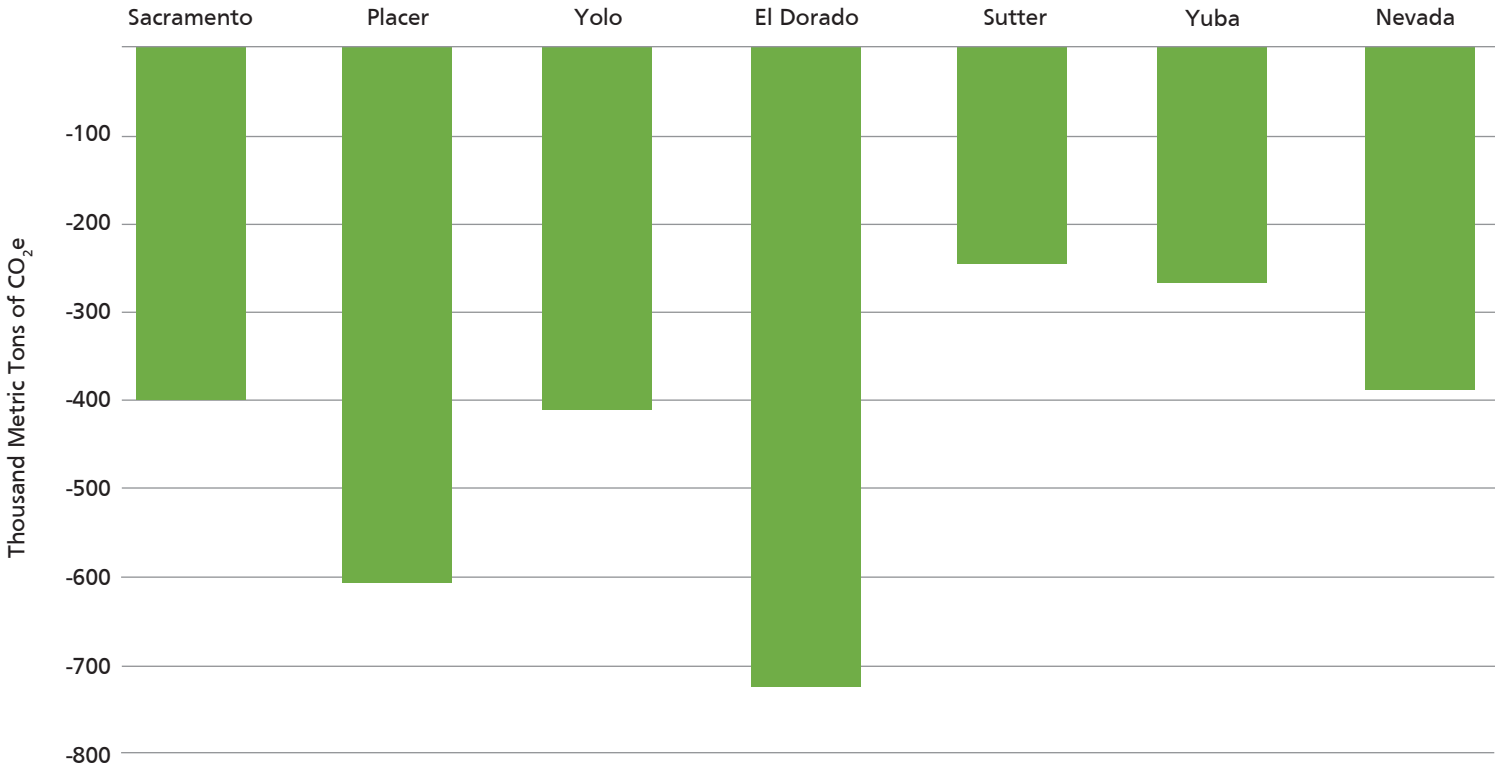


Forestry

The forestry sector represents carbon dioxide (CO_2) emissions sequestered by trees and represented by tree coverage; therefore, this sector, is an estimate of a carbon sink in the region. A carbon sink is a process or mechanism, natural or otherwise, that absorbs carbon from the atmosphere.

Forestry sequestered emissions are shown in Figure 14. Carbon sink emissions in El Dorado County are the largest in the Sacramento-Roseville CSA area based on the significant amount of forestland in the region. El Dorado County is the most forested county in the Sacramento-Roseville CSA.

Figure 14. Scaled 2019 Forestry Sequestered CO_2e by County



REFERENCES

[1] *Census, 2023. Accessed online at https://www2.census.gov/geo/maps/econ/ec2012/csa/EC2012_330M200US472M.pdf*

[2] *Even though a more recent year (2022) of forecasted emissions is available in the 2022 Final Scoping Plan , it was not leveraged for this effort because: 1) the level of subsector granularity in CARB's Annual Statewide Inventory is higher and allows more flexibility for scaling emissions and leveraging the inventory during the analysis of measures; 2) the Scoping Plan documentation focuses on describing methodologies for years affected by the Plan (2023 and beyond); hence, limited information is available for 2022 emissions; 3) differences are minor in overall emissions between the CARB Annual Statewide Inventory historical year 2020 and the Scoping Plan forecasted year 2022.*

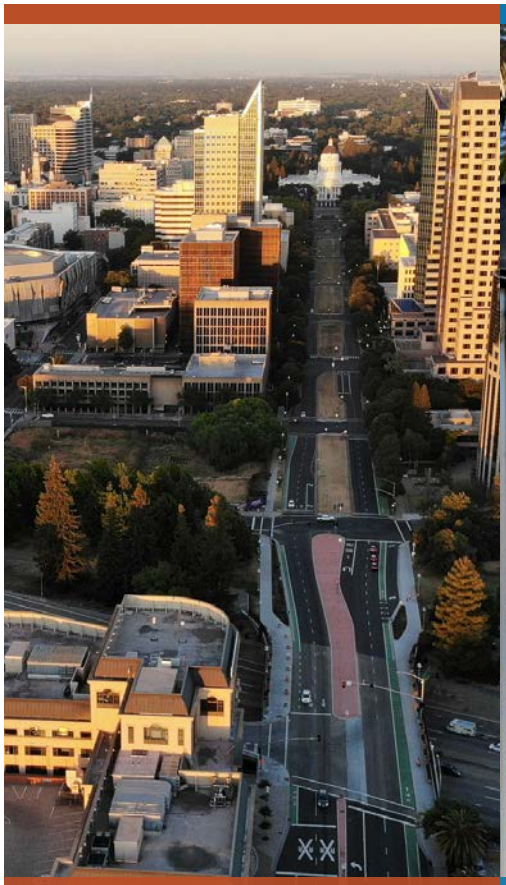
[3] *Figures and tables in this summary do not include sequestered carbon emissions from the Forestry sector.*

[4] *Carbon dioxide equivalent measured in the number of metric tons of CO_2 emissions with the same global warming potential as one metric ton of another greenhouse gas.*

[5] *Warehousing emissions associated with electricity use are included under the electricity sector; warehousing emissions associated with natural gas use are included under the commercial sector; and warehousing emissions associated with vehicles and equipment are included under the mobile sector.*

Chapter 3. Greenhouse Gas Reduction Measures

After conducting a GHG inventory and community outreach, 24 measures were selected for inclusion in the Plan. Implementation of these measures is anticipated to move the Sacramento region closer to carbon neutrality by 2030. The measures span five sectors including transportation, energy, natural and working lands, waste management and water. Implementation could potentially reduce GHG emissions by approximately 2.6 million MT CO_2e per year. The measures with the greatest near-term potential for GHG reductions are Zero-Emission Vehicle Adoption and Charging Infrastructure, Building Decarbonization/Electrification, Land Use Improvements, and Transportation Demand Management. Within the Plan, each measure's GHG mitigation potential is provided in MT CO_2e per year for a reduction target year of 2030. The Plan discusses scale of implementation, climate resiliency, authority to implement, health outcomes of measure implementation and equity considerations for vulnerable communities. The CAPCOA Handbook was leveraged for established GHG measure quantification methodologies. Nine measures included in the Plan were not initially quantified within the CAPCOA Handbook, and the CPRG planning team worked with CAPCOA to incorporate these actions as quantified measures within the CAPCOA Handbook during the development of the Plan, so all Californian jurisdictions can access the new measure quantification methodologies.



Built Environment

Transportation

Natural and Working Lands

Table 1. Capital Region Climate Priorities Plan GHG Reduction Measures

Measure Number	Measure Name	Sector
Measure BE-1	Land Use Improvements	Transportation
Measure BE-2	Building Energy Efficiency Improvements	Energy
Measure BE-3	Increase Use of Renewable Energy in New and Existing Buildings	Energy
Measure BE-4	Building Decarbonization/Electrification	Energy
Measure BE-5	Construction and Landscape Equipment Emissions Reduction	Energy
Measure BE-6	Install Cool Pavement	Energy
Measure BE-7	Reduce Solid Waste	Waste Management
Measure BE-8	Reduce Water Utility Emissions	Water
Measure BE-9	Reduce Wastewater Emissions	Waste Management
Measure BE-10	Require Edible Food Recovery Program Partnerships with Food Generators	Waste Management
Measure TR-1	ZEV Adoption and Charging Infrastructure	Transportation
Measure TR-2	Public Transit Improvements	Transportation
Measure TR-3	Provide Bus Rapid Transit	Transportation
Measure TR-4	Roadway Improvements for Multi-Modal Use and Access	Transportation
Measure TR-5	Transportation Demand Management Program	Transportation
Measure TR-6	Active Modes of Transportation for Youth	Transportation
Measure TR-7	Establish a School Bus Program	Transportation
Measure TR-8	Electric Bikeshare	Transportation
Measure NW-1	Wildfire Resilience and Management	Natural and Working Lands
Measure NW-2	Biomass Energy	Energy
Measure NW-3	Increase Tree Canopy	Natural and Working Lands
Measure NW-4	Carbon Sequestration Program/Carbon Farming	Natural and Working Lands
Measure NW-5	GHG Local Offset Program	Natural and Working Lands
Measure NW-6	Natural and Working Lands Equipment Emissions Reduction	Natural and Working Lands

Measure Categories

Relevant climate actions were organized into three main categories – Built Environment, Transportation, and Natural and Working Lands. The suite of measures and sub measures in the Built Environment category support infill development, building electrification, and energy efficiency. Measures in this category improve building energy efficiency, increase renewable energy use, and increase residential density. The Plan encourages infill housing development programs that allow residents to live closer to downtown areas where there is greater access to jobs and activities. Residents are more likely to walk or bike to destinations when they are located nearby. Living near jobs, schools, supermarkets, and health care centers can reduce vehicle trips and improve air quality, providing fuel savings and enhancing pedestrian and traffic safety. Additionally, by installing cool pavements in place of heat-absorbing pavements, neighborhoods can reduce energy emissions and reduce the effects of extreme heat.

Based on the GHG inventory conducted for the Sacramento-Roseville CSA, the largest source of emissions in the Sacramento region is from the transportation sector, which was selected as a sector for targeted emissions reduction. Within the Transportation category, there is a suite of measures and sub measures to improve public transit, encourage rideshare, and promote electric and cleaner fuel vehicle adoption. These measures provide alternatives to single-occupancy vehicle trips and reduce emissions from vehicles. Transportation emissions can be reduced by improving the emissions profile of vehicle fleets, or by reducing VMT. The measures presented here will lead to mode shifts from single-occupancy vehicles to shared (e.g., transit) or active modes of transportation (e.g., bicycling, walking).

The third category is Natural and Working Lands with measures that conserve land that acts as a carbon sink and promote healthy soils and forests. Measures in this category minimize the likelihood of severe or catastrophic wildfire behavior and improve the sequestering capabilities of natural lands. Implementation of these measures will lead to improved air quality, public health, and ecosystem health.

Figure 1. Capital Region Climate Priorities Plan Measure Categories

Co-Benefits

Co-benefits are alternative benefits of emissions reduction. Co-benefits are increasingly prevalent in justifying funding, planning, and implementing emissions reduction measures. The co-benefits of each measure included in the Plan are provided to give a full account of the advantages of implementation for a measure. While all measures achieve at least one co-benefit, some measures may also yield a disbenefit. For example, measures that electrify a fossil fuel source will lead to improved air quality and fuel savings but will also increase electricity consumption. Potential disbenefits are discussed within the measure's description.

Table 2. Co-Benefits of GHG Reduction Measures

Icon	Co-Benefit Category	Scope of Benefit
	Improved air quality	Criteria air pollutant (CAP) reductions
	Energy and fuel savings	Electricity, natural gas, refrigerant, propane, gasoline, or diesel reductions
	Vehicle miles traveled reductions	Reductions in VMT
	Water conservation	Water use reductions
	Enhanced pedestrian or traffic safety	Reduced collisions; pedestrian/bicyclist safety
	Improved public heath	Toxic air contaminant reductions (including exposure); increased physical activity; improved public safety
	Improved ecosystem health	Improved biological diversity and soil and water quality
	Enhanced energy security	Systemwide load reduction; local energy generation, levelling out peaks
	Enhanced food security	Stability of food systems; improved household access to food
	Social equity	Address existing social inequities (e.g., housing/anti-displacement, community engagement, availability of disposable income)

Beyond these co-benefits, each measure includes health and equity considerations and how the measure can increase climate resiliency. These considerations should be incorporated into decisions regarding measure implementation.

Authority to Implement, Monitoring, and Reporting

The State of California establishes statewide emissions targets. The California Global Warming Solutions Act of 2006 (AB 32) designates the CARB as the state agency responsible for monitoring and regulating sources of GHG emissions. Senate Bill (SB) 32 of 2016 requires CARB to ensure that statewide GHG emissions are reduced to 40% below 1990 levels by 2030. California aims to be carbon neutral by 2045. To be consistent with State of California emissions targets, the year 2030 was selected as the target date for emission reductions.

While many local jurisdictions in the capital region have climate action plans, this Plan will strengthen local action through coordination and implementation at the regional scale. The Plan presents clear actions and incorporates relevant legislation, rules, and polices describing stakeholders' authority to implement each GHG reduction measure. Each measure description details the monitoring and reporting mechanisms necessary to ensure that the measures are properly implemented, and reductions are achieved by the target date.

Land Use Improvements

Measure BE-1

GHG Mitigation Potential

286,356 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Living near jobs, schools, supermarkets, and medical care facilities improves connectivity between destinations and provides greater options for modes of travel resulting in better air quality from less passenger vehicle use and traffic.

Measure Description

This measure focuses on reducing VMT by increasing residential density through infill housing and mixed-use development. Reducing the distance that people must travel to get to goods and services and reducing the number of trips by single-occupancy vehicles leads to reductions in GHG emissions.

Increase Residential Density: Requires new residential developments to achieve a higher density than the average U.S. residential density. Increased density allows people greater options for modes of travel and results in shorter and fewer vehicle trips.

Infill Development: Encourages infill housing development programs that allow residents to live closer to downtown areas, increasing access to jobs and activities. Developing more housing closer to downtown areas leads to VMT and GHG reductions.

Subsector

Land Use; Transportation

Scale of Application by 2030

- Increase residential density by 20% across the region.
- Reduce approximately 150 million VMT per year through infill development.

Authority to Implement

- **Legislation, Rules, and Policy:** California vests land use authority with local jurisdictions, provided state requirements for comprehensive planning and housing needs are met. However, VMT are considered transportation and environmental impacts in California by SB 743 (Steinberg, 2013). Directing growth and investment into communities with high access and low VMT, along with constructing the necessary public infrastructure to support such growth, are actions supported by state housing, transportation, air quality, and climate goals.
- **Incentives:** California regions must achieve VMT reduction targets as required by SB 375 (Steinberg, 2008) or lose access to certain state transportation funding. Regulatory streamlining is also available for projects consistent with qualified climate action plans and certain infill development. Metropolitan planning organizations (MPOs) and regional transportation planning agencies (RTPAs) also have authority to direct flexible funding into projects that support infill development.

Monitoring and Reporting

Annual reporting by local jurisdictions and quadrennial transportation modeling by MPOs and RTPAs will track this measure.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure T-1)[1] and the CAPCOA Handbook Update (measure T-55).[2] The majority of the GHG reductions are achieved through the increase in residential density and the associated VMT reductions. Emissions for passenger cars and passenger trucks for the region were modeled using CARB's vehicle Emissions Factor Model (EMFAC)[3] and applying the percentage of GHG reductions estimated as a result of the measure. Calculations for infill development are based on the estimated annual VMT reduction in 2030 as provided by SACOG from the Green Means Go program.[4] The GHG reductions are calculated based on the estimated VMT reductions and the light-duty vehicle fleet emission factors from EMFAC2021.[3] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-1. Potential Emissions Reductions from Measure BE-1 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Increase Residential Density	240,933
Infill Development	45,423
Total Reduction	**286,356**

Health and Equity Considerations

Building residential units in areas with a mix of shops and businesses within easy walking distance provides substantial population health benefits. People who live in areas with high residential density and access to goods and services are likely to be more physically active than residents of neighborhoods in which homes are separated from commercial areas. Residents tend to have lower rates of obesity, type 2 diabetes, high blood pressure and other chronic medical problems. Living in compact areas with greater accessibility can also provide residents better access to health-promoting goods and services.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023.*

[3] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[4] *Sacramento Area Council of Governments (SACOG). 2024. Green Means Go Calculation and Methodology. Provided by Sac Metro Air District January 28, 2024.*

[5] *Creatore, MI et al. 2016. Association of Neighborhood Walkability With Change in Overweight, Obesity, and Diabetes. J Am Med Assoc 315(20):2211-2220. Doi:10.1001/jama.2016.5898. Available: https://jamanetwork.com/journals/jama/fullarticle/2524191. Accessed: December 2024.*

[6] *Ewing R et al. 2003. Relationship Between Urban Sprawl and Physical Activity, Obesity, and Morbidity. Am J Health Promotion 18(1):47-57. Available: https://pubmed.ncbi.nlm.nih.gov/13677962/. Accessed: January 2024.*

[7] *Frank L et al. 2006. Many Pathways from Land Use to Health: Associations between Neighborhood Walkability and Active Transportation, Body Mass Index, and Air Quality. J Amer Planning 72(1):75-87. Available: https://www.tandfonline.com/doi abs/10.1080/01944360608976725. Accessed: December 2024.*

[8] *Fuzhong L et al. 2008 Built Environment, Adiposity, and Physical Activity in Adults Aged 50-75. Am J Prev Med 35(1):38-46. doi: 10.1016/j amepre.2008.03.021. Available: https://pubmed.ncbi.nlm.nih.gov/18541175/. Accessed: January 2024.*

[9] *Fuzhong L et al. 2009. Built environment and changes in blood pressure in middle-aged and older adults. Prev Med 48(2009):237-241. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2775535/. Accessed: January 2024.*

[10] *Sturm R and Cohen DA. 2004. Suburban sprawl and physical and mental health. Public Health 118(7)488-496. Available: https://doi org/10.1016/j.puhe.2004.02.007. Accessed: January 2024.*

Building Energy Efficiency Improvements

Measure BE-2

GHG Mitigation Potential

11,143 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Energy-efficient buildings increase resiliency to extreme events such as power outages and extreme heat or precipitation. Increased building efficiency can also reduce energy costs, providing cost savings.

Measure Description

This measure is based on the replacement of existing appliances with energy-efficient models to improve energy consumption in buildings.

Require Energy Efficient Appliances: This measure is based on the adoption of ENERGY STAR-certified appliances that exceed the energy efficiencies of conventional appliances. Appliances applicable to this measure include residential and commercial refrigerators, washing machines, dishwashers, and ceiling fans. Replacing conventional appliances with less energy-intensive alternatives will reduce overall energy consumption, resulting in GHG emission reductions. Despite greater upfront costs, more energy-efficient models would result in lower energy bills in the long term.

Subsector

Energy Efficiency Improvements

Scale of Application by 2030

- 20% level of participation across either commercial or residential buildings in the region.
- Application includes upgrading refrigerators, washing machines, dishwashers and ceiling fans.

Authority to Implement

- **Legislation, Rules, and Policy:** The California Energy Commission (CEC), through the appliance efficiency regulations (Title 20), sets minimum efficiency levels for energy and water consumption in appliances. Energy-efficient appliances may also be required as part of a larger environmental program through the California Environmental Quality Act (CEQA).
- **Incentives:** The Inflation Reduction Act (IRA) of 2022 created two programs to encourage home energy retrofits: Home Efficiency Rebates (HOMES) to fund whole house energy efficiency retrofits and the Home Electrification and Appliance Rebates (HEEHRA) to help low- to moderate-income households "go electric" through qualified appliance rebates. These programs are expected to launch in 2024.

Monitoring and Reporting

Building energy efficiency improvements will be tracked through rebate program reporting.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure E-2).[1] The GHG reductions are achieved through reductions in energy consumption by replacing conventional electric appliances with more energy-efficient alternatives. This measure applies to electricity as natural gas ENERGY STAR appliances were not evaluated. Electricity consumption by county for 2022 was gathered from the CEC[2] and analysis assumed that 40% of countywide electricity consumption comes from buildings.[3] The estimated electricity reduction of ENERGY STAR appliances as compared with conventional appliances was obtained from CAPCOA Table E-2.1.[1] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-2. Potential Emissions Reductions from Measure BE-2 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Require Energy Efficient Appliances	11,143
Total Reduction	**11,143**

Health and Equity Considerations

Building energy efficiency retrofits reduce symptoms of respiratory and cardiovascular conditions and allergies. Natural daylight in energy-efficient buildings improves sleep, reduces headaches, and reduces eyestrain.

The accessibility of rebate programs should be a factor in decision making when considering home weatherization for lower income households. Additionally, incentives should be offered to motivate landlords to pursue residential building energy efficiency upgrades or home weatherization for renter energy savings.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *CEC. 2016. Electricity Consumption by County. https://ecdms.energy.ca.gov/elecbycounty.aspx*

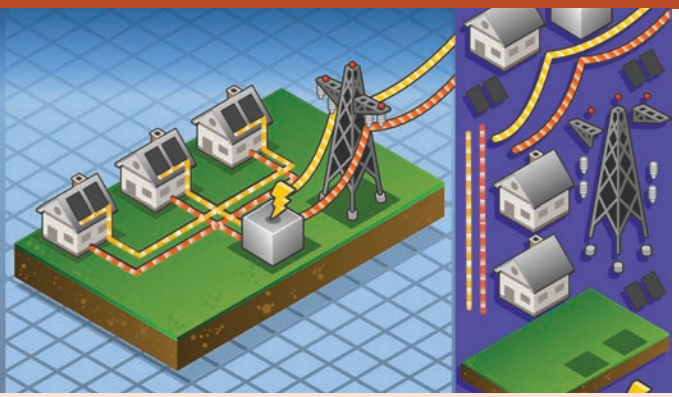
[3] *USEIA. 2023. How much energy is consumed in U.S. buildings? November 2023. Available online at: https://www.eia.gov/tools/faqs/faq php?id=86&t=1*

[4] *International Energy Agency. 2019. Multiple Benefits of Energy Efficiency. Paris. License: CC BY 4.0. Available: https://www.iea.org reports/multiple-benefits-of-energy-efficiency/health-and-wellbeing. Accessed: January 2024*

[5] *National Renewable Energy Laboratory. 2002. A Literature Review of the Effects of Natural Light on Building Occupants. U.S. Department of Energy Laboratory, Contract No. DE-AC36-99-GO10337. Available: https://www.nrel.gov/docs/fy02osti/30769.pdf. Accessed: January 2024.*

Increase Use of Renewable Energy in New and Existing Buildings

Measure BE-3



GHG Mitigation Potential

30,532 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Onsite renewable energy provides redundancy during power outages and surplus energy back to the electric grid, making communities more resilient during extreme events and power outages.

Measure Description

This measure focuses on generating zero-emission renewable energy (such as from solar and wind) in new and existing developments to displace the use of grid electricity, which relies on a more carbon-intensive fossil fuel.

Require Renewable Surplus Buildings: This measure requires installing renewable energy infrastructure and producing surplus renewable energy onsite for new and existing buildings. The surplus renewable energy generated must be sold back to the electric grid. This measure would result in carbon-negative buildings, which reduce more GHG emissions than they generate. Renewable surplus buildings would produce renewable energy that offsets the amount of emissions generated from the development's electricity and onsite fuel consumption.

Subsector

Building Decarbonization

Scale of Application by 2030

- Produce 250,000 megawatt hours (MWh) of onsite renewable energy per year in new and existing buildings across the Sacramento-Roseville CSA.

Authority to Implement

- **Legislation, Rules, and Policy:** The California Solar Mandate requires new construction projects to have onsite solar generation or join a community solar farm. There are no provisions for local governments to specifically require more, unless additional renewable energy generation is part of a larger environmental compliance strategy.
- **Incentives:** State and federal incentive programs such as EPA's Solar for All program are available for installation of solar and battery storage systems. Solar systems are also exempt from property tax in California.

Monitoring and Reporting

Local electric utilities can report annual renewable energy interconnection applications, which can track adoption of distributed energy generation installations. Larger projects, such as community renewable energy farms, can also be tracked and reported by the utilities.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures E-17).[1] The GHG reductions are achieved through the surplus production of zero-emission renewable energy onsite for new and existing developments. The GHG intensity of electricity is based on the projections from SMUD for 2027 in the CAPCOA Handbook (Table E-4.3). For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-3. Potential Emissions Reductions from Measure BE-3 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Require Renewable Surplus Buildings	30,532
Total Reduction	**30,532**

Health and Equity Considerations

Building energy efficiency retrofits reduce symptoms of respiratory and cardiovascular conditions and allergies. Natural daylighting in energy efficient buildings improves sleep, reduces headaches, and reduces eyestrain.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *International Energy Agency. 2019. Multiple Benefits of Energy Efficiency. Paris. License: CC BY 4.0. Available: https://www.iea.org reports/multiple-benefits-of-energy-efficiency/health-and-wellbeing. Accessed: January 2024*

[3] *National Renewable Energy Laboratory. 2002. A Literature Review of the Effects of Natural Light on Building Occupants. U.S. Department of Energy Laboratory, Contract No. DE-AC36-99-GO10337. Available: https://www.nrel.gov/docs/fy02osti/30769.pdf. Accessed: January 2024.*

Building Decarbonization/Electrification

Measure BE-4

GHG Mitigation Potential

253,713 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Limiting wood burning eliminates the need to purchase firewood as fuel and increases carbon sequestration through trees. All-electric developments offer better grid reliability especially as the electric grid integrates more renewable energy.

Measure Description

This measure focuses on decarbonizing existing buildings and new developments by promoting the transition from fossil fuel powered devices to electric appliances and all-electric end uses. The most common energy end uses are natural gas systems for space heating, water heating, and cooking ranges. Appliances (such as stoves, water heaters and fireplaces) when powered by wood, natural gas, or propane are more emissions intensive than their electric counterparts as electricity from the grid is increasingly transitioned to renewable sources. The implementation of this measure is made up of two parts:

All-Electric Development: This measure deploys new residential or commercial developments that use all-electric appliances and end uses. Opting-in for installing electric systems for space heating, water heating, cooking, pool heating, and any other system that would otherwise rely on natural gas or propane decreases GHG emissions.

Limit Wood-Burning Devices and Natural Gas/Propane Fireplaces in Residential Developments: The most efficient alternatives to wood-burning devices or gas fireplaces are electric fireplace inserts and electric heat pumps. This measure applies to existing and new residential dwelling units.

Subsector

Building Decarbonization

Scale of Application by 2030

- Electrify 50 million square feet of new commercial buildings.
- Electrify 75,000 new residential units.
- Convert from wood-burning to electrified heating in 5,500 existing and new residential units.

Authority to Implement

- **Legislation, Rules, and Policy:** Due to *California Restaurant Association v. City of Berkeley*, Case No. 21-16278 (9th Cir. 2023), local jurisdictions cannot ban specific energy infrastructure (such as natural gas connections) in new construction due to federal preemption inherent in the 1975 Energy Policy and Conservation Act (EPCA). However, the EPCA does not preempt air emission standards. California air district rules regarding air emission standards for appliances and voluntary CEQA compliance pathways would be permissible.
- **Incentives:** CARB's woodsmoke reduction program provides funding for replacement of uncertified wood-burning devices. New construction can use CARB's Building Initiative for Low-Emissions Development Program, while existing buildings can utilize local utility programs to convert from mixed-fuel buildings to all electric.

Monitoring and Reporting

Annual reporting from incentive programs tracks progress on deployment of these systems.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures E-14 and E-15).[1] The majority of GHG reductions are achieved through design and implementation of all-electric end uses for new residential and commercial developments. The GHG intensity of electricity is based on the projections from SMUD for 2027 in the CAPCOA Handbook (Table E-4.3). For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of these sub measures across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-4. Potential Emissions Reductions from Measure BE-4 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
All-Electric Development	249,720
Limit Wood Burning	3,993
Total Reduction	**253,713**

Health and Equity Considerations

Conversion from gas stoves to electric reduces the risk of development and severity of asthma, chronic lung disease, and respiratory infections. Indoor combustion of wood, natural gas and propane increases risk of respiratory infections, chronic lung disease, lung cancer, heart disease, stroke, type 2 diabetes, and premature mortality. Children, older adults, people with asthma, heart, or lung disease, people from low-income communities, and people of color are most vulnerable to the effects of indoor air pollution. Homes without indoor fuel combustion reduce environmental triggers for these conditions and protect against outdoor air pollutants and wildfire smoke.

Wood burning can be the primary or sole heating source for some residents, and wood burning in some areas may cost less than operating and maintaining a heat pump. Consider programs to assist lower income residents in repairing and replacing non-wood-burning heating devices.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *American Lung Association. 2022. Literature Review on the Impacts of Residential Combustion: Final Report. Available: https://www.lung org/getmedia/2786f983-d971-43ad-962b-8370c950cbd6/ICF_Impacts-of-Residential-Combustion_FINAL_071022.pdf. Accessed: January 2024.*

[3] *Belanger K and Triche EW. 2008. Indoor Combustion and Asthma. Immunol Allergy Clin North Am. 2008 Aug; 28(3): 507–vii. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2760246/ Accessed: January 2024*

[4] *Gruenwald T et al, 2023. Population Attributable Fraction of Gas Stoves and Childhood Asthma in the United States. Int. J. Environ. Res. Public Health 20(1),75. Available: https://www.mdpi.com/1660-4601/20/1/75. Accessed: January 2024*

[5] *Saki H et al. Study of relationship between nitrogen dioxide and chronic obstructive pulmonary disease in Bushehr, Iran. Clinical Epidemiology and Global Health. Vol 8, Issue 2, June 2020, Pages 446-449. https://doi.org/10.1016/j.cegh.2019.10.006 Accessed: January 2024*

[6] *The White House. 2022. Clean Indoor Air Benefits Everyone. Available: https://www.whitehouse.gov/ostp/news-updates/2022/12/08 clean-indoor-air-benefits-everyone/#:~:text=Cleaner%20indoor%20air%20improves%20cognition,conditions%20like%20asthma%20and%2 allergies. Accessed: January 2024*

[7] *United States Environmental Protection Agency, Effects of NO2. 2023. Available: https://www.epa.gov/no2-pollution/basic-information about-no2#Effects. Accessed: January 2024*

Construction and Landscape Equipment Emissions Reduction

Measure BE-5

GHG Mitigation Potential

13,134 to 76,116 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

The replacement of conventional gasoline- or diesel-fueled equipment with a low-emissions alternative can lead to long-term cost savings from reduced fuel and maintenance costs.

Measure Description

This measure focuses on the emission reduction potential of replacing conventional gasoline or diesel-fueled equipment with a low-emission alternative. This measure is made up of several components and is applicable to construction, agricultural, industrial, and landscaping equipment. The implementation of this measure is made up of three parts:

Use Electric or Hybrid Powered Construction Equipment: This sub measure requires the replacement of conventional gasoline- and diesel-fueled construction equipment with electric- or hybrid-powered alternatives. The replacement of heavily polluting equipment types will reduce fossil fuel combustion and result in a net reduction in GHG emissions.

Use of Cleaner-Fuel Construction Equipment: This sub measure requires the transition to cleaner fossil-fueled alternatives for construction equipment in place of conventional diesel-fueled or gasoline-fueled equipment. Specifically, this measure is based on the replacement of construction equipment with compressed natural gas (CNG) alternatives; however, users could expand this use to cover additional fuel types, such as renewable diesel combined with newer equipment with increased fuel efficiency. The use of CNG and renewable diesel alternatives should be limited to instances where electric or hybrid alternatives are unavailable.

Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment: This sub measure requires the use of zero-emission (electric) landscaping equipment over conventional gasoline-fueled equipment. This measure covers the use of chainsaws, chippers, lawn mowers, leaf blowers/vacuums, riding mowers, tillers, and trimmers. The replacement of heavily polluting equipment with electric equipment will reduce fossil fuel consumption and result in a net reduction in GHG emissions.

Subsector

Construction/Lawn and Landscaping

Scale of Application by 2030

- 55% penetration rate of electric-powered construction equipment.
- 30% penetration rate of cleaner-fuel construction equipment.
- 10% penetration rate of electric landscaping equipment.

Authority to Implement

- **Legislation, Rules, and Policy:** Construction equipment in California is subject to Off-Road Diesel Regulation, which as of January 1, 2023, requires all new fleet engines be Tier 3 or higher. Construction projects are also subject to CEQA, and jurisdictions and lead agencies may require cleaner equipment. As of January 1, 2024, construction fleets subject to the Off-Road Diesel Regulation must use renewable diesel. Starting with model year 2024, most small off-road engines (those used in landscaping equipment) must be zero emission. Local governments also have the authority to ban certain devices (such as leaf blowers) using their police powers.
- **Incentives:** CARB offers a professional Lawn and Garden Equipment exchange program for small businesses and sole proprietors. Local air districts may use Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) funding for lawn and garden equipment incentive programs.

Monitoring and Reporting

Reductions from construction and landscaping equipment can be tracked through annual reporting from incentive programs and inventory estimates from CARB.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures C-1-A, C-1-B, and LL-1).[1] Table BE-5 shows the reductions from the different components of this measure. Options A and B apply to the regional fleet of construction equipment, and could be applied independently (i.e., to different portions of the fleet, up to 65%). To show the range of possible emissions, Table BE-5 shows what would happen if only one of the two options were implemented. The largest GHG reductions are achieved through the replacement of diesel-fueled construction equipment with an electric alternative, which would represent a best-case scenario. The market availability for electric construction equipment is still nascent, although it is expected to grow in the future.

Emissions for construction and landscaping equipment for the region were modeled using CARB's EMFAC model.[2] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of these sub measures across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030 noted above.

Table BE-5. Potential Emissions Reductions from Measure BE-5 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Use Electric or Hybrid Powered Construction Equipment (option A)	73,091
Use Clean-Fuel Construction Equipment (option B)	10,110
Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape (option B)	3,024
Total Minimum Reduction (option B)	**13,134**
Total Maximum Reduction (option A)	**76,116**

Health and Equity Considerations

Exposure to diesel and gas emissions generates systemic inflammation and produces effects in the lungs, heart, blood, blood vessels, and brain. Replacing diesel construction equipment with cleaner-fuel equipment reduces the risk of cardiovascular, lung and respiratory disease, and cancer to workers. Replacement of gas-powered equipment with inherently quieter electric-only equipment reduces both the risk of pollutant-related conditions and the effects related to noise – hearing loss and impacts of noise stress including hypertension, elevated cholesterol, and increased risk of heart disease.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[3] *Hammer MS et al. Environmental Noise Pollution in the United States: Developing an Effective Public Health Response. Environmental Health Perspectives (2014) 122:2. Available: https://ehp.niehs.nih.gov/1307272/. Accessed: January 2024.*

[4] *Kerns E et al. 2018. Cardiovascular conditions, hearing difficulty, and occupational noise exposure within US industries and occupations. Am J Ind Med 2018 Jun;61(6):477-491. doi: 10.1002/ajim.22833. Available: https://pubmed.ncbi.nlm.nih.gov/29537072/. Accessed: January 2024.*

[5] *Koutros S et al. 2020. Diesel exhaust and bladder cancer risk by pathologic stage and grade subtypes. Environment International 135: February 2020, 10534. Available: https://doi.org/10.1016/j.envint.2019.105346. Accessed: January 2024.*

[6] *U.S. Office of Occupational Safety and Health Administration. 2013. OSHA/MSHA Hazard Alert: Diesel Exhaust/Diesel Particulate Matter. Available: https://www.osha.gov/sites/default/files/publications/OSHA-3590.pdf. Accessed: January 2024.*

Install Cool Pavement

Measure BE-6

GHG Mitigation Potential

117 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Cool pavements can reduce the effects of UHI, especially in the evening, improving pedestrian comfort during warmer nights. Cool pavements can also reduce ground-level ozone formation and the temperature of stormwater runoff. UHI mitigation strategies such as cool pavements should be prioritized in paved areas of communities disproportionately impacted by the UHI effect.

Measure Description

This measure focuses on emission reductions from the installation of cool pavement in place of conventional dark pavements.

Installing Cool Pavement: This measure would install cool pavement in place of conventional dark-colored, heat-absorbent pavements such as asphalt. By installing cool pavement, electricity consumption for cooling in surrounding buildings would decrease, thus reducing the GHG emissions associated with electricity generation. Cool pavement installation should be prioritized in neighborhoods impacted by urban heat islands (UHI), with significant paved surface area, low tree canopy, or high vulnerability due to age, employment, income, linguistic isolation, among other sensitivity indicators.

Subsector

Building Energy

Scale of Application by 2030

- Install cool pavement for 18,480,000 square feet of paved surfaces across the region.

Authority to Implement

- **Legislation, Rules, and Policy:** For public pavement, such as roads, trails, sidewalks, alleys, plazas, and publicly owned parking facilities, local jurisdictions and agencies can designate their own standards, which can include cool pavement requirements such as minimum albedo. For new development, jurisdictions may adopt design standards with cool pavement requirements.
- **Incentives:** MPOs and RTPAs can include additional points for projects with cool pavements during competitive or flexible funding rounds.

Monitoring and Reporting

Adoption of cool pavement ordinances and design standards by jurisdictions could be used as a method to track new cool pavement installation projects.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook Update (measure E-21).[1] The extent of cool pavement installed by 2030 is assumed to be 18,480,000 square feet based on the use of cool pavement for 350 lane-miles and an assumed lane width of 10 feet.[2] In some areas, cool pavements may increase energy demand for heating during the winter season. Emission reduction estimates consider the increase in natural gas demand during the winter as a result of installing cool pavement. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-6. Potential Emissions Reductions from Measure BE-6 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Install Cool Pavement	117
Total Reduction	**117**

Health and Equity Considerations

Cool pavements can reduce the health effects of extreme heat, which include heat rash, heat cramps, fainting and dizziness, muscle breakdown, heat exhaustion, and heatstroke. When extreme temperatures extend into multiple days, the effect can be fatal. Socioeconomic status is a significant determinant of heat vulnerability. Vulnerable and sensitive communities are disproportionately at risk of negative heat effects. A potential disbenefit of cool pavement installation includes reflectivity concerns.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District on December 22, 2023.*

[2] *California Code of Regulations. 2023. Cal. Code Regs. tit. 14 § 1273.01. Accessed January 2024. Available online at: https://casetext.com regulation/california-code-of-regulations/title-14-natural-resources/division-15-department-of-forestry-and-fire-protection/chapter-7-fire protection/subchapter-2-state-minimum-fire-safe-regulations/article-2-ingress-and-egress/section-127301-width*

[3] *Capital Region Climate Readiness Collaborative. 2019. Urban Heat Island Mitigation Plan. Available: https://www.airquality.org LandUseTransportation/Documents/UHI%20Mitigation%20Plan.pdf. Accessed: January 2024.*

Reduce Solid Waste

Measure BE-7

GHG Mitigation Potential

17,605 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Recycling and organics diversion programs reduce the amount of waste that would otherwise be disposed of in landfills avoiding the emission of CH_4 and other GHGs.

Measure Description

This measure will implement or expand waste management services to reduce the volume of landfill waste. Diverting waste from landfills to recycling or composting facilities will reduce the generation of GHG emissions, mainly CH_4, a byproduct of landfill decomposition. This measure is composed of two parts:

Institute or Extend Recycling Services: Expanding recycling services would reduce the volume of waste that is disposed of in landfills, ultimately reducing CH_4 emissions from landfill decomposition. Though specialized waste streams for recycling also produce GHG emissions, they do so at a lower rate. In addition, upstream emissions from production of new raw materials are indirectly reduced by using recycled materials.

Implement Organics Diversion Program: Implementing an organics diversion program will reduce the quantity of organic waste sent to landfills. Organic waste includes both edible and non-edible food waste such as food-soiled paper, yard waste, and non-hazardous wood waste. Diverting these waste products from landfills will reduce the emissions associated with landfill decomposition. Such implementation will require more composting facilities, compost pickup services, compost bins, and community education and outreach.

Subsector

Solid Waste

Scale of Application by 2030

- 15% participation in recycling and organics waste diversion programs (either by expanding existing programs or establishing new services).

Authority to Implement

- **Legislation, Rules, and Policy:** In the capital region, residential solid waste collection and operation of solid waste landfills tend to be municipal operations or franchises, whereas commercial solid waste collection is private. It is within the authority of the local government, in their role as operator, to require recycling or diversion beyond state requirements and to collect fees to cover operational expenses.
- **Incentives:** Integrated waste management fees, imposed on solid waste operators by the California Department of Resources and Recycling and Recovery (CalRecycle), are used for solid waste reduction, recycling and reuse, composting, environmentally safe transformation, and safe land disposal practices. Municipal governments can also have different fee schedules for collection, with smaller fees for smaller waste bins and no fee for recycling and green waste pick up.

Monitoring and Reporting

Annual reporting for recycling and organics diversion is required per the Integrated Waste Management Act, the Per Capita Disposal Measurement System, and SB 1383 (Lara, 2013: short-lived climate pollutants).

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures S-1 and S-2).[1] The majority of GHG reductions are achieved by expanding recycling services. EPA's Waste Reduction Model (WARM)[2] was used to estimate emission reductions based on the population participation and estimated disposal rates by location/county. The diversion of edible food to food banks as an alternative to composting is not captured in the methodology for this measure, but is described in Measure BE-10. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-7. Potential Emissions Reductions from Measure BE-7 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Institute or Extend Recycling Services	15,717
Implement Organics Diversion Program	1,888
Total Reduction	**17,605**

Health and Equity Considerations

Improved access to recycling facilities can ensure recycling practices in residential communities.

Edible food scraps and food waste donated to food banks or other non-profit organizations can increase community food security and improve the nutritional status of vulnerable populations.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *EPA. 2023. Waste Reduction Model (WARM). https://www.epa.gov/warm/versions-waste-reduction-model-warm#15*

[3] *Sacramento County Environmental Management. 2024. Edible Food Recovery – SB 1383. Available: https://emd.saccounty.gov/EHFoodProtect-RetailFood/Pages/FoodRecovery.aspx#:~:text=Permitted%20food%20facilities%20such%20as,charitable%20organizations%20or%20individuals%20directly. Accessed: January 2024.*

Reduce Water Utility Emissions

Measure BE-8

GHG Mitigation Potential

1,441 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Water conservation improves water availability especially under drought conditions and when California experiences reduced snowpack. Replacing turf with drought-tolerant landscaping and California native species can combat the effects of UHI.

Measure Description

This measure focuses on the conservation of water resources by requiring low-flow water fixtures in buildings, reducing the amount of water-inefficient turf grass in landscaping, and designing water-efficient landscapes. Electricity is required to source and transport municipal water, however, reducing water consumption reduces energy use and GHG emissions. The implementation of this measure is made up of three parts:

Require Low-Flow Water Fixtures: Requires the use of low-flow and high-efficiency water fixtures (such as toilets, showerheads, faucets, washing machines, and dishwashers) in residential and non-residential buildings. Low-flow water fixtures use less water than conventional fixtures, thereby reducing the energy associated with municipal water transport and processing, and wastewater treatment after use.

Reduce Turf in Landscapes: Requires removing turf grass, which has higher water demands than most other types of vegetation. Maintaining landscapes without turf reduces water consumption compared to areas with turf.

Design Water-Efficient Landscapes: Requires the design of landscapes that are water efficient and have lower water demands than the California Department of Water Resources (DWR) 2015 Model Water Efficient Landscape Ordinance (MWELO) requirements.[1] Irrigating water-efficient landscapes reduces water consumption compared to conventional landscapes.

Subsector

Water

Scale of Application by 2030

- Installing low-flow fixtures in residential dwellings for up to 20% of residential water usage.
- Removing 200,000 square feet of turf.
- Implementing 5,000 residential/commercial landscaping projects that replace traditional landscape areas with landscapes.
    - » Projects could be either approximately 1,000 square feet of landscape area, or approximately 500 square feet of special landscape area (with edible plants, recreational area, irrigation with recycled water, or water features with recycled water).

Authority to Implement

- **Legislation, Rules, and Policy:** The state requires water purveyors achieve conservation targets, typically through rebates and incentives for their customers. End users are also required to have water meters, which encourages conservation. The California Building Code has provisions for water conservation, and structural remodels of a certain size will require upgrades to increase conservation. Jurisdictions may impose outdoor watering restrictions and landscaping requirements for drought-tolerant plants and efficient irrigation.
- **Incentives:** Water conservation rebates are typically provided by water purveyors, and can include fixtures (such as toilets), as well as turf removal subsidies.

Monitoring and Reporting

Reductions in water utility emissions can be tracked by water providers through annual reporting to the California State Water Resources Control Board.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures W-4, W-5, and W-6).[2] The majority of GHG reductions are achieved through the installation and use of low-flow fixtures in residential buildings. The water energy-intensity factor is based on the Sacramento River Hydrologic Region in the CAPCOA Handbook (Table W-1.1). The GHG intensity of electricity is based on the projections for SMUD for 2027 in the CAPCOA Handbook (Table E-4.3). For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030 noted above.

Table BE-8. Potential Emissions Reductions from Measure BE-8 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Require Low-Flow Water Fixtures	1,331
Reduce Turf in Landscapes and Lawns	109
Design Water-Efficient Landscapes	0.73
Total Reduction	**1,441**

Health and Equity Considerations

When designing new water-efficient landscapes, selecting low-allergen plants can reduce risk of exacerbation of allergies and asthma. The removal of turf grass can reduce exposure to fertilizers, herbicides, and pesticides, which may trigger irritation of the skin, eyes, nose, and throat.

REFERENCES

[1] *California Department of Water Resources. 2022. Model Water Efficient Landscape Ordinance. https://water.ca.gov/Programs/Water-Use And-Efficiency/Urban-Water-Use-Efficiency/Model-Water-Efficient-Landscape-Ordinance*

[2] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[3] *Asthma and Allergy Foundation of America. 2018. Smart Gardening: Tips for an Allergy-Friendly Garden Available: https://community.aafa org/blog/smart-gardening-tips-for-a-allergy-friendly-gardening. Accessed: January 2024.*

[4] *Californians for Pesticide Reform. 2021. Pesticides and Human Health. Available: https://www.pesticidereform.org/pesticides-human health/. Accessed: January 2024.*

[5] *Healthline. 2021. Symptoms of Plant Food Poisoning. Available: https://www.healthline.com/health/fertilizers-and-household-plant foods#causes. Accessed: January 2024.*

Reduce Wastewater Emissions

Measure BE-9

GHG Mitigation Potential

63,153 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

CH_4 emissions from wastewater treatment can be reduced by recovering emissions via capture technology. CH_4 recovery provides fuel redundancy during extreme events, but CH_4 combustion can increase air pollution. Care should be taken so that combustion emissions have no impact on nearby sensitive or vulnerable populations.

Measure Description

This measure focuses on reducing GHG emissions from wastewater treatment plants that have anaerobic digestion processes, a common source of CH_4 that is a more potent GHG than CO_2.

Establish CH_4 Recovery in Wastewater Treatment Plants: This measure requires capturing and combusting the CH_4 emissions from existing wastewater treatment plants. The combustion or flaring of CH_4 converts the emissions into CO_2, which has a lower global warming potential than CH_4. Additional reductions (and revenue/savings) may be achieved if the heat from combustion is used to generate electricity for onsite energy use, or alternatively, if the captured CH_4 is processed to be sold as a transportation fuel, or converted into clean hydrogen fuel, under the Low Carbon Fuel Standard. This measure is most applicable for wastewater treatment plants that have anaerobic digestion infrastructure, and may not be appropriate for treatment plants that use lagoons to process wastewater.

Subsector

Methane Recovery

Scale of Application by 2030

- Capturing and flaring the CH_4 from 15% of the total wastewater treated in the region.

Authority to Implement

- **Legislation, Rules, and Policy:** Wastewater treatment plants are typically operated by public agencies and subject to regulations by the Central Valley and Lahontan Regional Water Quality Control Boards. It is within the authority of these agencies to upgrade their facilities to capture CH_4 and increase user fees, issue bonds, or receive grants to cover the capital and operational expenses.

Monitoring and Reporting

Reductions in wastewater emissions can be tracked through annual reporting to Regional Water Quality Control Boards.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure E-19).[1] Calculations assume that the wastewater is treated at facilities with primary treatment, and the CH_4 emissions are captured and flared. The amount of wastewater treated per day was obtained from sanitation or public works reports for each county. Additional GHG reductions may be achieved for this measure, such as using the heat from CH_4 combustion to generate electricity for onsite use or processing the captured CH_4 for use as transportation fuel, were not quantified. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-9. Potential Emissions Reductions from Measure BE-9 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Establish CH_4 Recovery in Wastewater Treatment Plants	63,153
Total Reduction	**63,153**

Health and Equity Considerations

While odors emitted by wastewater treatment plants are not a direct cause of disease, they can lead to nausea, headaches, and respiratory problems. Reduce odor impacts on the nearby community by implementing all available deodorization methods. During construction of new CH_4 recovery facilities, control dust and noise impacts on the surrounding community to avoid generating the respiratory and cardiovascular effects of exposure to particulate pollution and noise stress.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *Lebrero R et al. 2011. Odor Assessment and Management in Wastewater Treatment Plants: A Review. Critical Reviews in Environmental Science and Technology 41(10)915-950. DOI: 10.1080/10643380903300000. Available: https://www.tandfonline.com/doi abs/10.1080/10643380903300000. Accessed: January 2024.*

[3] *Lewkowska P et al. 2016. Characteristics of odors emitted from municipal wastewater treatment plant and methods for their identification and deodorization techniques. Environmental Research 151:573-586. Available: https://www.sciencedirect.com/science/article/abs/pii S001393511630487X. Accessed: January 2024.*

Require Edible Food Recovery Program Partnerships with Food Generators

Measure BE-10

GHG Mitigation Potential

1,288 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Salvaging edible food that would otherwise be sent to a landfill provides food security for underserved populations. Food recovery conserves resources, reduces waste, and lowers CH_4 emissions.

Measure Description

This measure focuses on recovering edible food to reduce the amount of non-diverted organic waste that ends up in the landfill. Reducing food waste reduces GHG emissions associated with landfill decomposition, which produces CH_4.

Require Edible Food Recovery Program Partnerships with Food Generators: Requires food handling organizations (such as food service establishments, wholesale providers, and retail providers of food) to partner with food recovery programs to reduce the amount of food that would be sent to landfills. The extra edible food can be collected and redistributed for consumption by those in need.

Subsector

Solid Waste

Scale of Application by 2030

- Recovering 2,500,000 pounds of edible food per year.
- Deployment of 100 distribution centers equipped with one delivery vehicle and one walk-in refrigeration unit per center.

Authority to Implement

- **Legislation, Rules, and Policy:** SB 1383 (Lara, 2016) requires food businesses to donate the maximum amount of edible food they would otherwise dispose of, to food recovery organizations. These businesses include wholesale food vendors, food distributors, grocery stores, food service providers, restaurants, institutional cafeterias, venues, and hotels.
- **Incentives:** Recovery from Tier 2 facilities, which typically provide prepared food, is more difficult due to temperature concerns and timing. Providing funding to food recovery organizations for vehicles, equipment, and personnel can increase the successful recovery of edible food.

Monitoring and Reporting

Required edible food recovery will be monitored through SB 1383 (Lara, 2013) reporting by food generators.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook Update (measure S-3).[1] Net GHG reductions are achieved through the recovery of edible foods and accounting for the increase in GHG emissions from transportation vehicles and refrigeration equipment used in the food recovery process. Calculations assume the use of gasoline for refrigerated vans, large walk-in commercial refrigerators with solid doors, default refrigerant charge size, and default leak rates based on the CAPCOA Handbook Update. The GHG intensity of electricity is based on the projections for SMUD for 2027 in the CAPCOA Handbook (Table E-4.3).[2] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table BE-10. Potential Emissions Reductions from Measure BE-10 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Require Edible Food Recovery Program Partnerships with Food Generators	1,288
Total Reduction	**1,288**

Health and Equity Considerations

Edible foods diverted from landfills and redistributed for consumption can increase community food security and improve the nutritional status of vulnerable populations.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District on December 22, 2023.*

[2] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

ZEV Adoption and Charging Infrastructure

Measures TR-1

GHG Mitigation Potential

1,179,172 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

When compared to traditional internal combustion engine vehicles, ZEVs can reduce the effects of extreme heat by reducing the amount of exhaust heat in the surrounding environment. Charging stations that include shade, solar, or tree canopies can improve battery health and provide respite for passengers as they wait for their vehicles to charge.

Measure Description

This measure focuses on increasing the use of cleaner fuel and zero-emission vehicles (ZEVs) by replacing conventional combustion vehicles that generate more GHG emissions, and by increasing access to charging infrastructure for ZEVs. The measure covers light-duty vehicles such as passenger cars and light-duty trucks. The implementation of this measure is made up of two parts:

Use of Cleaner-Fuel Vehicles: Requires transitioning conventional gasoline- or diesel-powered vehicles to a combination of cleaner-fuel vehicles that include battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). This measure would support fleet transition within the Sacramento-Roseville CSA to cleaner vehicle use and would complement the planned transition to ZEV-only sales required by California's Advanced Clean Cars II (ACCII) program. Currently, the ACCII regulation requires that new vehicle sales in California would reach 68% by 2030.[1]

Provide Electric Vehicle (EV) Charging Infrastructure: Requires installing more EV chargers at buildings with designated parking areas (such as commercial, educational, retail, and multi-family buildings). Greater availability of charging infrastructure would increase the share of miles that PHEVs can drive in electric mode instead of gasoline-powered mode, thus reducing GHG emissions from gasoline consumption. In addition, a greater number of electric vehicle chargers will indirectly support the transition to ZEVs.

Subsector

Clean Vehicles and Fuels; Parking or Road Pricing/ Management

Scale of Application by 2030

- Converting 30% of the light-duty vehicle fleet to a cleaner vehicle technology (15% to BEVs and 15% to PHEVs).
- Installing 6,500 electric chargers (5,000 in Sacramento County and 1,500 across remaining counties in the CSA).

Authority to Implement

- **Legislation, Rules, and Policy:** Local jurisdictions have authority to enact building codes beyond state standards. California's Green Building Standards Code (CALGreen) has mandatory measures, Tier 1 measures, and Tier 2 measures. Adopting Tier 2 standards for vehicle charging will ensure appropriate infrastructure for ZEV deployment.
- **Incentives:** Local utilities have rebate programs for charging infrastructure, as well as preferential rates for EV charging. Vehicle deployment can be aided with low-income light duty programs, such as Clean Cars 4 All (CC4A) and medium- and heavy-duty programs through the Carl Moyer Program or the Sacramento Emergency Clean Air Transportation program. The statewide Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) also offers point-of-sale vouchers for medium- and heavy-duty vehicles. The statewide Clean Vehicle Rebate Project (CVRP) which had 532,690 recipients statewide has closed. Finally, federal incentives are also available as tax credits.

Monitoring and Reporting

Progress is measured through annual reporting on programs administered by CARB and local air districts. California EMFAC data will also disclose penetration of ZEVs. Deployment of electric vehicle supply equipment (EVSE) can also be tracked through annual climate action plan reporting by local jurisdictions.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures T-14 and T-30).[2] The potential GHG reductions from the transition of baseline gasoline vehicle fleet to these cleaner-fuel vehicles varies across the vehicle technology selected. The estimated GHG reductions from converting 15% of the baseline light-duty vehicle fleet to each of these technologies is shown in Table TR-1. The calculation assumes that a total of 30% of baseline light-duty vehicles would transition to these cleaner vehicle options. The maximum GHG reductions are achieved when transitioning conventional fuel vehicles to BEVs. As ZEV technology advances and the market shapes cost and demand for these vehicles in the future, the extent to which these technologies penetrate conventional fuel fleets may vary.

The measure also includes incremental GHG reductions associated with providing EV charging infrastructure for PHEVs. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table TR-1. Potential Emissions Reductions from Measure TR-1 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Use of Cleaner-Fuel Vehicles (15% BEVs)	700,942
Use of Cleaner-Fuel Vehicles (15% PHEVs)	467,728
Provide EV Charging Infrastructure	10,502
Total Reduction	**1,179,172**

Health and Equity Considerations

Exposure to gasoline and diesel emissions generates systemic inflammation and produces effects in the lungs, heart, blood vessels, and brain. Children, older adults, people from low-income communities, and people of color are most vulnerable. ZEV use can reduce emissions that cause deficits in lung function, asthma, high blood pressure, cancer, type 2 diabetes, cognitive difficulties, and premature death, among other health outcomes. Drivers of EVs also avoid exposure to gasoline vapors containing toxic air contaminants that increase the risk of cancer.

REFERENCES

[1] *CARB. Advanced Clean Cars II Regulation Adoption. Meeting Workshop Presentation. August 2022. Accessed Jan 2024 at https://ww2.arbca.gov/sites/default/files/barcu/board/books/2022/082522/22-10-1pres.pdf*

[2] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[3] *World Health Organization. 2019. Health consequences of air pollution on populations. Available: https://www.who.int/news/item/15-11 2019-what-are-health-consequences-of-air-pollution-on-populations#:~:text=It%20increases%20the%20risk%20of,poor%20people%2 are%20more%20susceptible. Accessed: January 2024*

[4] *US Environmental Protection Agency. 2023. Research on Near Roadway and Other Near Source Air Pollution. Available: https://www.epa.gov/air-research/research-near-roadway-and-other-near-source-air-pollution. Accessed: January 2024*

Public Transit Improvements

Measure TR-2

GHG Mitigation Potential

31,215 - 31,621 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Extending transit network coverage or hours and providing safety features at transit stations incentivizes transit and improves ridership resulting in less passenger vehicle use and traffic.

Measure Description

This measure focuses on improving a rider's experience when using public transportation. Improving the rider's experience and enhancing the accessibility of transit services makes it a more viable mode of transportation and facilitates a modal shift away from single-occupancy vehicles. The implementation of this measure is made up of the four parts.

Extend Transit Network Coverage or Hours: Public transportation networks would be expanded by adding or modifying existing transit services through expansion of service into new areas or by additional frequency of service throughout the day. Modifications to local transit services can accommodate various commute times for alternative-shift workers and would encourage the use of public transportation and reduce VMT and associated emissions.

Increase Transit Service Frequency: Increasing the frequency of select service lines will reduce the commuter waiting time and overall trip duration to improve the experience and attractiveness of public transportation, encouraging a modal shift away from vehicles and reducing associated emissions.

Provide Transit Shelters (Bus Shelters Only): This measure involves providing additional amenities to make it safer and more comfortable to wait for the bus by installing bus shelters.

Provide Transit Shelters (Bus Shelters and Real-Time Arrival Information): This measure involves providing bus shelters with real-time arrival information displays. Transit ridership research shows that adding these amenities decreases both the real and perceived waiting time, encouraging increased ridership.

Subsector

Transit

Scale of Application by 2030

- Increase transit service hours by 50%.
- Increase transit frequency by 30% for 90% of transit routes.
- Add 48 new transit stops with new bus shelters and benches.
- Increase the average number of boardings per day at each transit station with bus shelters and real-time arrival information to 100 boardings.
- Increase the average number of boardings per day across the transit agencies in the region to 26,250 boardings.

Authority to Implement

- **Legislation, Rules, and Policy:** Transit providers have the authority to increase service hours and coverage, as long as funding is secured, and service is provided consistent with federal regulations. Improvements to transit shelters may be made by either the transit provider or the local jurisdiction, provided the location has necessary right-of-ways or easements. Transit shelters may also be included as conditions of approval for new developments in some circumstances.
- **Incentives:** As some state funding is only available for regions that achieve their VMT reduction targets, investing in comprehensive public transit improvements will help maintain or increase transit ridership and help ensure continued eligibility for these funds.

Monitoring and Reporting

Public transit improvements can be tracked through annual reporting by transit providers.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook Update (measures T-25, T,26, and T-46).[1,2] Table TR-2 shows the individual contributions to emission reductions from each of the measure components. Expansion of transit network coverage or hours generates the greatest emission reductions. Emissions for commuting passenger cars and passenger trucks for the region were modeled using CARB's EMFAC[2] and applying the percent reduction estimated as a result of the measure. The percentage of VMT associated with commuter traffic was derived from the commute share of household generated-VMT in the Sacramento metro area.[3] Two scenarios were modeled to show the possible range of reductions:

- **Scenario A:** Expansion of public transit network, increased transit service frequency, installation of bus shelters and real-time arrival information.
- **Scenario B:** Expansion of public transit network, increased transit service frequency, installation of bus shelters.

In both scenarios, the emission reduction values from the expansion of the transit network and increased transit service frequency are applicable, however the scenarios diverge with the inclusion of real-time arrival information. For additional details on inputs and assumptions for this specific analysis in Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table TR-2. Potential Emissions Reductions from Measure TR-2 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Expanded Transit Network Coverage or Hours	24,844
Increase Transit Service Frequency	5,957
Provide Transit Shelters (Bus Shelters and Real-Time Arrival Information)	819.7
Provide Transit Shelters (Bus Shelters Only)	414.4
Total Reduction	**31,215 – 31,621**

Health and Equity Considerations

Increased access to efficient public transit promotes walking and results in reductions in obesity, heart disease, hypertension, stroke, type 2 diabetes, osteoporosis, and cancer. Regardless of income, public transit users walk more than non-transit users. Psychological wellbeing is often higher when using transit, as driving is the most stressful commute mode. In communities served by transit, traffic injuries are lower and community security increases from street-level monitoring of city streets and transit waiting areas.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District on December 22, 2023.*

[3] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[4] *SACOG. 2016. Metropolitan Transportation Plan/Sustainable Communities Strategy. Available online at: https://www.sacog.org/sites/main files/file-attachments/mtpscs_complete.pdf*

[5] *Besser LM and Dannenber AL. 2005. Walking to Public Transit: Steps to Help Meet Physical Activity Recommendations Am J Prev Med 2005;29(4). Doi:10.1016/j.ampre.2005.06.010. Available: https://www.cdc.gov/healthyplaces/articles/besser_dannenberg.pdf. Accessed: January 2024.*

[6] *Guzman Habinger J et al. 2020. Active Transportation and Obesity Indicators in Adults from Latin America: ELANS Multi-Country Study. Int J Environ Res Public Health. 2020 Oct; 17(19): 6974. 2020 Sep 24. doi: 10.3390/ijerph17196974. Available: https://www.ncbi.nlm.nih.gov/pmc articles/PMC7579005/. Accessed: January 2024.*

[7] *Legrain A et al. 2015. Am stressed, must travel: The relationship between mode choice and commuting stress. Transportation Research Part F: Traffic Psychology and Behaviour 34. October 2015, Pages 141-151. Available: https://www.sciencedirect.com/science/article/abs/pii S1369847815001370. Accessed: January 2024.*

[8] *Litman, T. 2020. Evaluating Public Transportation Health Benefits. Victoria Transport Policy Institute, April 2020. Available: https://www.vtpi org/tran_health.pdf. Accessed: December 2023.*

[9] *Litman, T. 2023. Safer Than You Think! Revising the Transit Safety Narrative. Victoria Transport Policy Institute, May 2023. Available: https:/ www.vtpi.org/safer.pdf. Accessed: January 2024.*

[10] *Mortin A. 2014. Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey. Preventive Medicine 69. Dec 2004, 296-303. Available: https://www.sciencedirect.com/science/article/pii S0091743514003144. Accessed: January 2024.*

Provide Bus Rapid Transit

Measure TR-3

GHG Mitigation Potential

17,981 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

BRT improves connectivity between destinations thus incentivizing transit and results in less passenger vehicle use and traffic.

Measure Description

This measure focuses on providing more efficient public transportation options to encourage increased ridership and shift away from single-occupancy vehicle use, thereby decreasing transportation GHG emissions.

Provide Bus Rapid Transit: This measure facilitates the conversion of an existing bus route to a bus rapid transit (BRT) system. A BRT system will be equipped with exclusive right-of-way (e.g., busways, queue jumping lanes) at congested intersections, increased limited-stop service (e.g., express service), intelligent transportation technology (e.g., transit signal priority, automatic vehicle location systems), and advanced technology vehicles (e.g., articulated buses, low-floor buses). BRT also includes enhanced station design, efficient fare-payment smart cards or smartphone apps, branding of the system, and use of vehicle guidance systems. The enhanced components of a BRT system and increased frequency of service will improve transit reliability and reduce transit wait times. This will increase ridership and reduce VMT and associated GHG emissions.

Subsector

Transit

Scale of Application by 2030

- Increase transit frequency (bus arrivals per hour) due to BRT by 125%.
- 20% level of implementation across all bus routes.

Authority to Implement

- **Legislation, Rules, and Policy:** BRT requires coordination between the transit provider and the local or state jurisdiction with authority over the right-of-way. The transit agency must commit to providing frequent service, and the jurisdiction must commit to right of way dedication, signal priority/preemption, and facility improvements. Failure by either partner can result in a lower level of service for BRT.
- **Incentives:** Funding agencies can require minimum levels of service or maximum travel time through corridors to ensure BRT is implemented.

Monitoring and Reporting

Annual reports from MPOs and RTPAs would track implementation of this measure.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure T-28).[2] Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030. Emissions for light-duty vehicles for the region were modeled using CARB's EMFAC[3] and applying the percent reduction estimated as a result of the measure. The level of implementation refers to the number of transit routes with BRT systems as a fraction of the total transit routes in the plan/community. Increased transit frequency is estimated as transit frequency with the BRT measure minus existing transit frequency, where frequency is measured as the number of arrivals over a given time (e.g., buses per hour). For additional details on inputs and assumptions for this specific analysis for the Sacramento-Roseville CSA, see Appendix C.

Table TR-3. Potential Emissions Reductions from Measure TR-3 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Provide Bus Rapid Transit	17,981
Total Reduction	**17,981**

Health and Equity Considerations

Increased access to efficient public transit promotes walking and results in reductions in obesity, heart disease, hypertension, stroke, type 2 diabetes, osteoporosis, and cancer. Regardless of income, public transit users walk more than non-transit users. Psychological wellbeing is often higher when using transit, as driving is the most stressful commute mode. In communities served by transit, traffic injuries are lower and community security increases from street-level monitoring of city streets and transit waiting areas.

REFERENCES

[1] *Kingsley, 2021. SacRT Bus. Available online at: https://media.bizj.us/view/img/11445673/sacrt-bus*900xx6720-3780-0-350.jpg*

[2] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[3] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[5] *Besser LM and Dannenber AL. 2005. Walking to Public Transit: Steps to Help Meet Physical Activity Recommendations Am J Prev Med 2005;29(4). Doi:10.1016/j.ampre.2005.06.010. Available: https://www.cdc.gov/healthyplaces/articles/besser_dannenberg.pdf. Accessed: January 2024.*

[6] *Guzman Habinger J et al. 2020. Active Transportation and Obesity Indicators in Adults from Latin America: ELANS Multi-Country Study. Int J Environ Res Public Health. 2020 Oct; 17(19): 6974. 2020 Sep 24. doi: 10.3390/ijerph17196974. Available: https://www.ncbi.nlm.nih.gov/pmc articles/PMC7579005/. Accessed: January 2024.*

[7] *Legrain A et al. 2015. Am stressed, must travel: The relationship between mode choice and commuting stress. Transportation Research Part F: Traffic Psychology and Behaviour 34. October 2015, Pages 141-151. Available: https://www.sciencedirect.com/science/article/abs/pii S1369847815001370. Accessed: January 2024.*

[8] *Litman, T. 2020. Evaluating Public Transportation Health Benefits. Victoria Transport Policy Institute, April 2020. Available: https://www.vtpi org/tran_health.pdf. Accessed: December 2023.*

[9] *Litman, T. 2023. Safer Than You Think! Revising the Transit Safety Narrative. Victoria Transport Policy Institute, May 2023. Available: https:/ www.vtpi.org/safer.pdf. Accessed: January 2024.*

[10] *Mortin A. 2014. Does active commuting improve psychological wellbeing? Longitudinal evidence from eighteen waves of the British Household Panel Survey. Preventive Medicine 69. Dec 2004, 296-303. Available: https://www.sciencedirect.com/science/article/pii S0091743514003144. Accessed: January 2024.*

Roadway Improvements for Multi-Modal Use and Access

Measure TR-4

GHG Mitigation Potential

44,259 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Bike boulevards and bikeway networks encourage bicycling as a more sustainable mode of transportation. The replacement of vehicle trips with bicycle trips results in less fuel consumption and pollution, leading to healthier air, water, and ecosystems.

Measure Description

This measure focuses on the improvement and expansion of multi-model transportation routes to encourage a mode shift from single-occupancy vehicles to active modes of transportation such as bicycling or walking. The implementation of this measure is made up of three parts:

Provide Pedestrian Network Improvements: This measure will expand the sidewalk network to improve connectivity and access. Increasing the number of well maintained pedestrian sidewalks will enhance the pedestrian experience and encourage people to walk instead of drive. The GHG reductions associated with this measure are based on the displacement of light-duty VMT.

Construct or Improve Bike Boulevards: This measure will construct or improve peripheral Class III bicycle boulevards that connect to the larger bikeway network. These supplementary Class III bikeways create safe, low-stress connections to encourage a mode shift from driving to bicycling, thus displacing VMT and reducing GHGs.

Expand Bikeway Network: This measure will expand a bikeway network. A bicycle network is an interconnected system of bike lanes, boulevards, and paths that improve the bicycling conditions of a community, often redesigning streets to accommodate protective infrastructure, signage, and paint to facilitate a safe and convenient route of travel. Bicycle networks also have the capacity to increase the "catchment area" of existing transit hubs through increased access, ultimately increasing public transit ridership.

Subsector

Neighborhood Design

Scale of Application by 2030

- Expand pedestrian sidewalk network by 15%.
- Add accompanying bike boulevards to displace 20% of the community/project area VMT.
- Expand the existing bike network by 45%.

Authority to Implement

- **Legislation, Rules, and Policy:** Local and state governments have authority to set roadway and pathway design specifications and approve new roadways and active modes facilities through California's Subdivision Map Act and CEQA. Jurisdictions in California also have the right of eminent domain for active modes facilities.
- **Incentives:** State and federal transportation programs offer billions in funding, but program design may not incentivize complete streets or active modes. Reframing competitive grants to give additional points for multi-modal use and access would encourage development of sustainable transportation systems.

Monitoring and Reporting

Annual reporting by public works departments and the California Department of Transportation (Caltrans) would track implementation of this measure.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures T-18, T-19B, and T-20).[1] The majority of GHG reductions are achieved through the improvement and expansion of existing bike and pedestrian networks, which yield the largest reduction of VMT within the measure components. Emissions for passenger cars and passenger trucks for the region were modeled using CARB's EMFAC[2] and applying the percent reduction estimated as a result of the measure. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of these sub measures across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table TR-4. Potential Emissions Reductions from Measure TR-4 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Provide Pedestrian Network Improvements	42,291
Construct or Improve Bike Boulevard	1,003
Expand Bike Network	966
Total Reduction	**44,259**

Health and Equity Considerations

Enabling walking and biking can lead to higher rates of physical activity and lower rates of obesity, heart disease, hypertension, stroke, type 2 diabetes, osteoporosis, and cancer. Walkable and bikeable neighborhoods are associated with mental health benefits such as less depression and less cognitive decline. Lower income communities tend to have less safe infrastructure for walking and biking with fewer sidewalks, marked crosswalks, and lighting. Traffic injury rates tend to decline as walking and bicycling increase in communities because drivers become more cautious. Improving conditions for active travel can help improve equity by providing better mobility for disadvantaged communities.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[3] *Gibbs K et al. Income Disparities in Street Features that Encourage Walking – A BTG Research Brief. Chicago, IL: Bridging the Gap Program, Health Policy Center, Institute for Health Research and Policy, University of Illinois at Chicago (2012), http://www.bridgingthegapresearch r og/_asset/02fpi3/btg_street_walkability FINAL 03-09-12.pdf*

[4] *Gordon-Larsen P et al. 2009. Active commuting and cardiovascular disease risk: the CARDIA study. Archives of Internal Medicine 2009 169(13):1216-1213. doi:10.1001/archinternmed.2009.163 Available: https://jamanetwork.com/journals/jamainternalmedicine fullarticle/773531. Accessed: December 2023.*

[5] *Jacobsen P. 2003. Safety in numbers: more walkers and bicyclists, safer walking and bicycling. Inj Prev. 2003 Sep; 9(3): 205–209. doi: 10.1136/ip.9.3.205. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1731007/. Accessed: January 2024.*

[6] *Litman T. 2023. Evaluating Active Transport Benefits and Costs: Guide to Valuing Walking and Cycling Improvements and Encouragement Programs. Victoria Transport Policy Institute. November 2023. Available: https://vtpi.org/nmt-tdm.pdf. Accessed: January 2024.*

Transportation Demand Management Program

Measure TR-5

GHG Mitigation Potential

34,227 – 222,477 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Sharing commute trips with others improves social cohesion, which could help build resiliency during emergencies or extreme events. Accessible rideshare programs would lower transportation costs for all employees. EV carpooling or vanpooling programs could reduce localized air pollution from exhaust emissions.

Measure Description

This measure focuses on the emission reductions associated with decreased commuter VMT by encouraging or mandating the shift away from single-occupancy vehicle use to alternative modes of transportation such as public transportation, carpooling, or bicycling. Four potential components of the transportation demand management (TDM) program are described below:

Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring): This sub measure involves the mandated implementation of a commute trip reduction (CTR) program with employers to discourage single occupancy commuting trips from employees. A CTR program requires the implementation of CTR marketing, and a combination of elements such as ridesharing programs, subsidized or discounted transit programs, end-of-trip bicycle facilities, and employer-sponsored vanpool to facilitate participation by employees. This measure could also include mandatory reduction requirements (including penalties for non-compliance) that are monitored and reported to ensure program success.

Implement Commute Trip Reduction Program (Voluntary): This sub measure is a more flexible alternative to the previous component that would implement a voluntary CTR program that leverages employer-provided services, infrastructure, and incentives to encourage the use of alternative forms of transportation such as public transit, ridesharing/vanpooling, and bicycling. In addition, this measure will involve the marketing of such services to educate and inform employees of the alternative transportation services available to them. The voluntary nature of this option translates to smaller potential reductions.

Provide Ridesharing Program: This sub measure would implement a ridesharing program to encourage the displacement of single-occupancy commute trips to carpool/ridesharing alternatives. Actions to promote this program may include providing an app or website for ride coordination and designating premium parking spaces for ridesharing vehicles.

Implement Subsidized or Discounted Transit Program: This measure would provide subsidized, discounted, or free transit passes for qualified individuals. By reducing the cost of public transportation, it makes this mode of transportation more desirable, encouraging a shift away from single-occupancy vehicle trips.

Subsector

Trip Reduction Programs

Scale of Application by 2030

- 76% of employees eligible for a CTR program.
- 30% of employees able to opt-into ridesharing program.
- 30% of working individuals eligible for subsidized transit program.
- 75% of fare reduction for subsidized transit program.
- 46% participation rate from regional workforce to TDM programs.

Authority to Implement

- **Legislation, Rules, and Policy:** New growth areas can create permanent, on-going assessments to fund TDM, such as through a community finance district, assessment, homeowner association dues, or other non-revocable mechanisms. Mandatory membership in a transportation management organization can also be a development condition.
- **Incentives:** TDM programs typically provide incentives for individuals using sustainable modes through prizes, recognition, guaranteed ride homes, or reduced transportation costs.

Monitoring and Reporting

TDM programs can be tracked through annual reporting by transportation management associations and modeling by MPOs and RTPAs.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measures T-5, T-6, T-8, and T-9).[1] Table TR-5 shows the individual contributions of emission reductions from all four components of the measure. A mandatory approach for CRT programs generates the largest possible reductions. Since CRT programs could be implemented through either a voluntary or mandatory program and yield different emission reductions, two scenarios were modeled for the TDM program:

- **Option A:** Implement CTR Program (Mandatory Implementation and Monitoring) – includes all remaining programs.
- **Option B:** Implement CTR Program (Voluntary) – includes all remaining programs.

In practicality, this measure could be implemented on both a mandatory and voluntary basis and would vary from employer to employer.

Emissions for commuting passenger cars and passenger trucks for the region were modeled using CARB's EMFAC[2] and applying the percent reduction estimated as a result of the measure. The percentage of VMT associated with commuter traffic was derived from the commute share of household-generated VMT in the Sacramento metro area.[3] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table TR-5. Potential Emissions Reductions from Measure TR-5 across the Sacramento-Roseville CSA

Scenario	Measure Breakdown	Metric Tons CO_2e/Year
Option A	Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)	222,477
Option B	Implement Commute Trip Reduction Program (Voluntary)	34,227
Remaining Programs	Provide Ridesharing Program	27,200
	Implement Subsidized or Discounted Transit Program	1,590
Total Reduction		**34,227 – 222,477**

Health and Equity Considerations

Ridesharing and carpooling provide opportunities to enhance social connections and establish relationships that create a sense of belonging. This social cohesion boosts the physical and mental health, safety, and resilience of individuals and the community. Shifting from car travel to transit, walking or bicycling introduces regular physical movement that reduces systemic inflammation and the risk of cardiovascular disease, type 2 diabetes, chronic obstructive pulmonary disease, and cancer. It strengthens muscles and bones, improving the ability to carry out everyday activities, and reduces depression and anxiety. It also improves the ability to think and learn, reducing the risk of dementia.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[3] *SACOG. 2016. Metropolitan Transportation Plan/Sustainable Communities Strategy. Available online at: https://www.sacog.org/sites main/files/file-attachments/mtpscs_complete.pdf*

[4] *Gleeson, M., Bishop, N., Stensel, D. et al. The anti-inflammatory effects of exercise: mechanisms and implications for the prevention and treatment of disease. Nat Rev Immunol 11, 607–615 (2011). https://doi.org/10.1038/nri3041. Available: https://www.nature.com/articles nri3041. Accessed: January 2024.*

[5] *U.S. Centers for Disease Control and Prevention. 2023. Benefits of Physical Activity. Available: https://www.cdc.gov/physicalactivity/basics pa-health/index.htm#reducing-disease. Accessed: January 2024.*

[6] *U.S. Centers for Disease Control and Prevention. 2023. How Does Social Connectedness Affect Health? Available: https://www.cdc.gov emotional-wellbeing/social-connectedness/affect-health.htm. Accessed: January 2024.*

[7] *Woods, JA et al. 2011. Exercise, Inflammation and Aging. Aging Dis. 2012 Feb; 3(1): 130–140. Available: https://www.ncbi.nlm.nih.gov pmc/articles/PMC3320801/. Accessed: January 2024*

[8] *World Health Organization. 2022. Physical activity. Available: https://www.who.int/news-room/fact-sheets/detail/physical-activity. Accessed: January 2024.*

Active Modes of Transportation for Youth

Measure TR-6

GHG Mitigation Potential

37,365 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Replacing private vehicle trips with walking, bicycling, or bus trips can help reduce onsite air pollution at schools, especially if the bus is a ZEV.

Measure Description

This measure focuses on providing funding for new sidewalks, bike lanes, off-street pathways, and street crossings to help children and students use active modes of transportation to get to school, thereby shifting trips away from private vehicles. Reducing single-occupancy vehicle VMT related to school commutes will reduce GHG emissions.

The measure builds on the federally funded Safe Routes to Schools Program that funds new projects for sidewalks, bike lanes, and off-street pathways, and street crossings projects to help youth use active modes of transportation to get to school.

Subsector

Trip Reduction Programs, VMT reduction

Scale of Application by 2030

- 20% of students within two miles are driven to school after project implementation; or
- 31% decrease in number of students within two miles being driven to school.

Authority to Implement

- **Legislation, Rules, and Policy:** Local jurisdictions can improve rights-of-way to support active modes around schools, parks, youth centers, and other destinations for youth. Active modes programing is typically initiated and operated by local school districts, parent-teacher associations, transportation management associations, or CBOs, and is most successful with an active onsite coordinator.
- **Incentives:** The Federal Safe Routes to School Program and California's Active Transportation Program provide education, best practices, and funding for active modes of transportation. New developments can also include funding for active modes programing as part of a larger environmental compliance strategy.

Monitoring and Reporting

Awarding of funds and implementation of programs will be monitored by the MPOs and RTPAs.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook Update (measure T-56).[1] Potential GHG reductions are due to the modal shift away from single-occupancy commuter trips to alternative active modes of transportation such as bicycling, walking, or using public transit. The analysis assumes any mode shift away from private vehicle trips will lead to a direct reduction in emissions, including bus trips. Emissions for passenger cars and passenger trucks in the region were modeled using CARB's EMFAC[2] and a fraction of emissions associated with school travel reported by the Safe Routes to School program was applied.[3] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table TR-6. Potential Emissions Reductions from Measure TR-6 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Active Modes of Transportation for Youth	37,365
Total Reduction	**37,365**

Health and Equity Considerations

Shifting children's trips to school from private cars trips to bus, bicycling or walking trips initiates regular physical movement that improves blood pressure and blood sugar levels and reduces risk of chronic diseases such as type 2 diabetes and obesity. Consistent physical activity in children also generates mental and behavioral health benefits such as improved attention and memory, less anxiety and depression, and higher self confidence and self esteem. Cooperative active travel such as "walking school buses" can increase social connections that enhance a sense of belonging and boost physical and mental health.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District on December 22, 2023.*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[3] *Safe Routes to School National Partnership (SR2S Partnership). 2013. Travel to School in California: Key Findings from the National Household Travel Survey. Accessed December 2023. Available online at: https://saferoutespartnership.org/sites/default/files/pdf/Travel%20to%2 School%20in%20California%20Policy%20Brief%20PAGES.pdf.*

[4] *Massachusetts General Hospital. 2021. Physical Activity and Mental Health: What is the Connection? Available: https://www.massgeneral.org children/physical-activity/mental-health. Accessed: February 2024.*

[5] *U.S. Centers for Disease Control and Prevention. 2023. Health Benefits of Physical Activity for Children, Adults, and Adults 65 and Older. Available: https://www.cdc.gov/physicalactivity/basics/adults/health-benefits-of-physical-activity.html. Accessed: February 2024.*

Establish a School Bus Program

Measure TR-7

GHG Mitigation Potential

11,882 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

A school bus program can help reduce onsite air pollution from exhaust emissions at schools by reducing private vehicle trips, especially if the buses are ZEVs.

Measure Description

This measure focuses on reducing commuter VMT and emissions by establishing a school bus program to replace single-occupancy vehicle trips to and from school. This measure would focus on school bus routes with enough occupancy to offset emissions from operating school buses. Additional reductions would be achieved by implementing an electric school bus program.

Subsector

Trip Reduction Programs, VMT reduction

Scale of Application by 2030

- 50% of students in the Sacramento-Roseville CSA participate in the bus service.
- 100% of students are served by a bus system (regardless of whether they ride).

Authority to Implement

- **Legislation, Rules, and Policy:** School districts and county offices of education may establish and operate school bus programs. Funding can be provided through the California Department of Education Home-to-School Transportation Reimbursement funding, local sources, or fees imposed on riders.
- **Incentives:** The CEC, CARB and local air districts offer funding for zero-emission school buses and charging infrastructure. Establishing charging infrastructure near major field trip destinations such as Sutter's Fort State Historic Park will encourage school districts to use zero-emission school buses when visiting the Sacramento-Roseville CSA.

Monitoring and Reporting

The Capital Region School Bus Consortium, a partnership between air districts and school districts, monitors implementation of this measure.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions from this measure is based on the guidelines in the CAPCOA Handbook Update (measure T-40).[1] GHG reductions would be achieved by establishing a bus program to bring students to and from school, shifting trips away from single-occupancy vehicles. GHG reductions are based on the light-duty vehicle emission factors from CARB's EMFAC[2] and the light-duty vehicle occupancy rate based on the CAPCOA Handbook[3] offset by the increased school bus emissions from CARB's EMFAC. An average occupancy rate of 25 students per bus was assumed. For additional details on inputs and assumptions for this measure, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the 2030 scale of application.

Table TR-7. Potential Emissions Reductions from Measure TR-7 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Establish a School Bus Program	11,882
Total Reduction	**11,882**

Health and Equity Considerations

Shifting children's trips to school from private cars to bus, bicycle or walking trips initiates regular physical activity that improves blood pressure and blood sugar levels and reduces the risk of chronic diseases such as type 2 diabetes and obesity. Consistent physical activity in children also yields mental and behavioral health benefits such as the improved ability to think and learn, less anxiety and depression, and higher self confidence and self esteem. Bus or vanpool programs can enhance social connections that create a sense of belonging and boost physical and mental health.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District on December 22, 2023.*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[3] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[4] *U.S. Centers for Disease Control and Prevention. 2023. Health Benefits of Physical Activity for Children, Adults, and Adults 65 and Older. Available: https://www.cdc.gov/physicalactivity/basics/adults/health-benefits-of-physical-activity.html. Accessed: February 2024.*

[5] *U.S. Centers for Disease Control and Prevention. 2023. How Does Social Connectedness Affect Health? Available: https://www.cdc.gov emotional-wellbeing/social-connectedness/affect-health.htm. Accessed: January 2024.*

Electric Bikeshare

Measure TR-8

GHG Mitigation Potential

684 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Electric bikeshare programs encourage bicycling as a more sustainable mode of transportation. The replacement of vehicle trips with bicycle trips results in less fuel consumption and pollution, leading to healthier air, water, and ecosystems.

Measure Description

This measure focuses on emission reductions associated with the shifting trips from single-occupancy vehicles to electric bicycles.

Transition conventional to electric bikeshare: This measure evaluates the emission reduction potential associated with establishing and expanding access to electric bikeshare programs. Research conducted by the state of California found that the establishment of electric bicycle rideshare programs increases ridership at a greater rate than traditional programs. Electric-assist peddling allows riders ease of travel with the capacity to climb hills.

Subsector

VMT reduction

Scale of Application by 2030

- 15% of residences in the region have access to electric bikeshare programs.

Authority to Implement

- **Legislation, Rules, and Policy:** As these systems operate in the public right-of-way, local governments have authority over operators, bicycle parking, sidewalk riding, and other operational considerations. In areas with multiple jurisdictions, it is recommended they coordinate to ensure user consistency between destinations.
- **Incentives:** Private operators have historically focused on the city centers of Davis, Sacramento, and West Sacramento. Public subsidies or a public operator will likely be required to serve other locations, such as suburban areas. Subsidies for individual riders, such as mobility wallets or discounted passes, can help expand service into lower income and disadvantaged communities to increase access to programming.

Monitoring and Reporting

Deployed vehicles and square miles of service area as reported by local jurisdictions can track electric bikeshare programming.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure T-22-B).[1] By providing electric bikeshare access, individuals are encouraged to shift travel from single-occupancy vehicles to electric bicycles, displacing VMT and reducing GHGs. The GHG reductions are based on the accessibility of the program and other assumptions from the CAPCOA Handbook. Emissions for passenger cars, passenger trucks, and motorcycles were estimated using CARB's EMFAC[2] and the percentage of GHG reductions estimated as a result of the measure were applied. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table TR-8. Potential Emissions Reductions from Measure TR-8 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Expand Electric Bikeshare Access	684
Total Reduction	**684**

Health and Equity Considerations

Commuters who switch from passenger vehicle use to electric bicycle use initiate regular physical activity that reduces risk of cardiovascular disease, type 2 diabetes, chronic obstructive pulmonary disease, cancer, depression, anxiety, and dementia. Electric bicycle users also avoid exposure to carcinogenic gasoline vapors at filling stations. An electric bikeshare program is a more affordable option than owning a car and can improve access to healthcare and other health-promoting goods and services.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac/*

[3] *Gleeson, M., Bishop, N., Stensel, D. et al. The anti-inflammatory effects of exercise: mechanisms and implications for the prevention and treatment of disease. Nat Rev Immunol 11, 607–615 (2011). https://doi.org/10.1038/nri3041. Available: https://www.nature.com/articles nri3041. Accessed: January 2024.*

[4] *Litman T. 2023. Evaluating Active Transport Benefits and Costs: Guide to Valuing Walking and Cycling Improvements and Encouragement Programs. Victoria Transport Policy Institute. November 2023. Available: https://vtpi.org/nmt-tdm.pdf. Accessed: January 2024.*

[5] *U.S. Centers for Disease Control and Prevention. 2023. Benefits of Physical Activity. Available: https://www.cdc.gov/physicalactivity/basics/pa health/index.htm#reducing-disease. Accessed: January 2024.*

[6] *Woods, JA et al. 2011. Exercise, Inflammation and Aging. Aging Dis. 2012 Feb; 3(1): 130–140. Available: https://www.ncbi.nlm.nih.gov/pmc articles/PMC3320801/. Accessed: January 2024.*

[7] *World Health Organization. 2022. Physical activity. Available: https://www.who.int/news-room/fact-sheets/detail/physical-activity. Accessed: January 2024.*

Wildfire Resilience and Management

Measure NW-1

GHG Mitigation Potential

2,357 MT CO2e/yr Annual Average for 2025-2075

Co-Benefits

Climate Resilience

Reestablishing forests that were impacted by severe or catastrophic wildfire improves ecosystem resilience and health. Reforestation provides wildlife habitat, water filtration, healthier soil, and promotes carbon sequestration. Using forestry waste to create biochar, a soil additive, also improves carbon sequestration.

Measure Description

This measure focuses on lowering the intensity of wildfires in forested areas by implementing fuel treatments. During a wildfire event, the majority of GHG emissions are released from the burning of live tree biomass. With fuel treatments, the treated forest stands will have lower fire severity than untreated forest strands, leading to lower GHG emissions from the overstory canopy.

Wildfire Resilience and Management: Requires the use of fuel treatments to reduce future wildfire intensity. Treated forest stands will result in less severe wildfires and will reduce the amount of stored carbon released during wildfires.

Subsector

Natural and Working Lands

Scale of Application by 2030

- Treating 4,000 acres of mixed-conifer forest and 4,000 acres of ponderosa forest annually for 50 years, starting in 2025.

Authority to Implement

- **Legislation, Rules, and Policy:** Local jurisdictions have the authority to require private property owners to maintain vegetation around structures to create defensible space for first responders. Local and state governments can also enter into a stewardship agreement with private and federal landowners to treat forestry areas.
- **Incentives:** Funding and rebates for forest fuel treatments such as the federal Forest Health Program can help ensure management of higher-risk lands and continued sequestration of carbon.

Monitoring and Reporting

Prescribed burns can be tracked through burn permits issued by local air districts and fire agencies.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook Update (measure N-7)[1] and the calculation spreadsheet provided by the Sac Metro Air District.[2] The calculations estimate carbon balances for untreated and fuel treated scenarios based on the annual burn rate, carbon consumption by fire type, net ecosystem productivity, and other inputs. In the short term, there are increases in carbon emissions from the fuel treatments and prescribed burns. In the long term, GHG reductions are achieved through reduced wildfire intensity. The average forest stand age is assumed to be 100 years old, based on research that suggests 100-200 year old trees dominate contemporary western mixed-conifer and ponderosa forests.[3] The total additional acres of forests treated was determined based on the Tobacco Gulch Ecological Restoration Project[4] and the Lake Tahoe West Landscape Restoration Strategy[5] and was scaled up for the capital region. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Average annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application.

Table NW-1. Potential Emissions Reductions from Measure NW-1 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Cumulative Total Reduction (for 2025 to 2050)	117,842
Total Reduction	**2,357**

Health and Equity Considerations

Cultural burns are a form of land management used by Indigenous tribes for generations to promote sustainable forest growth and make forests more resilient. Expanding cultural burns across federal and tribal lands could restore the productivity of forestland. SB 332 (Dodd, 2021), effective January 1, 2022, affirms the right to cultural burns.

Minimizing the likelihood of severe wildfires protects against widespread damage to public health from smoke, dust, and stress. Wildfire smoke activates inflammatory pathways and can trigger severe respiratory conditions, heart attacks, strokes, cardiac arrests, early deaths, pregnancy loss, low birth weight, and preterm delivery. Extreme wildfires often have severe mental health effects such as post-traumatic stress disorder, depression, and generalized anxiety in both adults and children, potentially lasting for years after the event.

Programs to reduce wildfire smoke exposure should consider vulnerable populations including outdoor workers and the unhoused who are disproportionately exposed to wildfire smoke.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023.*

[2] *Sac Metro Air District. 2023. Measure NW-1 Calculation Sheet. Provided by Sac Metro Air District December 26, 2023.*

[3] *Stevens et al. 2015. Average Stand Age from Forest Inventory Plots Does Not Describe Historical Fire Regimes in Ponderosa Pine and Mixed Conifer Forests of Western North America. Available online at: https://www.fs.usda.gov/research/treesearch/52503*

[4] *USDA. 2023. Tobacco Gulch Understory Burning on the Georgetown, Ranger District. Available online at: https://www.fs.usda.gov/detail eldorado/news-events/?cid=FSEPRD1143767*

[5] *Lake Tahoe West. 2019. Landscape Restoration Strategy. Available online at: https://www.nationalforests.org/assets/images/LTW Landscape-Restoration-Strategy-02Dec2019-FINAL.pdf*

[6] *Reuters. 2023. What are the health risks from wildfire smoke? Available: https://www.reuters.com/world/americas/what-are-health-risks wildfire-smoke-2023-06-07/. Accessed: January 2024.*

[7] *To P, Eboreime E, Agyapong, V.I.O. 2021. The Impact of Wildfires on Mental Health: A Scoping Review. Behav. Sci. 11 (126). https://doi org/10.3390/ bs11090126. Available: https://pubmed.ncbi.nlm.nih.gov/34562964/ Accessed: February 2024.*

[8] *U.S. Environmental Protection Agency. 2023. Health Effects Attributed to Wildfire Smoke. Available: https://www.epa.gov/wildfire-smoke course/health-effects-attributed-wildfire-smoke. Accessed: January 2024.*

[9] *Wettstein ZS et al. 218. Cardiovascular and Cerebrovascular Emergency Department Visits Associated With Wildfire Smoke Exposure in California in 2015. J Am Heart Assoc. 7(8): e007492. Available: 10.1161/JAHA.117.007492. Accessed: January 2024.*

Biomass Energy

Measure NW-2

GHG Mitigation Potential

846 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Using waste from agricultural and forestry practices for biomass can support decarbonization efforts. Biomass energy avoids emissions from agricultural or forestry burns or burns waste more efficiently to create products such as biochar, a soil additive that improves carbon sequestration. However, biomass that is solely grown for fuel can be environmentally disruptive by displacing land for food production and increasing GHG emissions.

Measure Description

This measure focuses on the local generation of electricity (or cogeneration) with biomass to displace fossil fuel based electricity generation. Biomass energy has lower lifecycle GHG emissions than conventional fossil fuel energy because of the carbon uptake from plants grown to produce biomass fuel.

Biomass Energy: This measure would support new biomass fuel electricity generation capacity to produce electricity, or electricity and heat (cogeneration). By installing biomass energy generation locally, the carbon intensity of the electricity supply would decrease, reducing GHG emissions from local electricity consumption.

Subsector

Building Energy

Scale of Application by 2030

- Generate one megawatt (MW) of biomass energy in the Sacramento-Roseville CSA.

Authority to Implement

- **Legislation, Rules, and Policy:** SB 1109 (Caballero, 2022) requires that investor-owned utilities purchase at least 125 MW of electricity from biomass generating facilities. Additional requirements can make biomass more viable.
- **Incentives:** Community choice aggregators and electric utilities can contract with biomass energy providers to provide a stable revenue stream for the providers and a stable base load for the utilities.

Monitoring and Reporting

Annual reporting of installed biomass capacity and generation can be used to track biomass energy implementation.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Update (measure E-26).[1] The amount of biomass electricity generation installed by 2030 is assumed to be one MW. Emissions reduction estimates are based on replacing higher carbon intensity electricity in California with lower carbon intensity biomass electricity using woody crops and forestry waste. For additional details on inputs and assumptions, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030. Higher GHG emission reductions may be achieved if cogeneration is used to satisfy onsite heating needs.

Table NW-2. Potential Emissions Reductions from Measure NW-2 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Biomass Energy	846
Total Reduction	**846**

Health and Equity Considerations

Any plans for new biomass processing facilities would need input from local members of vulnerable or sensitive communities to ensure that impacts or disbenefits from biomass production and processing are addressed before installation. Non-combustion biomass energy projects, including those that create clean hydrogen, should also be considered.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023.*

Increase Tree Canopy

Measure NW-3

GHG Mitigation Potential

4,353 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Increased tree canopies enhance shade and reduce the impacts of extreme heat. Trees contribute to improved air and water quality, flood prevention and habitat conservation. Trees also sequester carbon and provide neighborhood beautification.

Measure Description

This measure focuses on increasing the carbon sequestration capacity of the region by planting more trees. Trees in developed areas may also provide other benefits by increasing tree canopy and shaded areas, which can reduce the UHI effect and decrease electricity use for air conditioning in buildings.

Expand Urban Tree Planting: This measure requires increased tree planting in developed areas. Trees capture and store atmospheric CO_2 as they grow, which reduces the amount of GHGs in the environment. Areas with less tree canopy should be a priority for tree-planting programs. Tree-planting programs should consider the following when selecting trees: (1) tree species that are native and require minimal water and maintenance, (2) species that emit low levels of biogenic volatile organic compounds, and (3) low-allergen trees.

Subsector

Natural and Working Lands

Scale of Application by 2030

- Plant 150,000 new trees in developed areas.

Authority to Implement

- **Legislation, Rules, and Policy:** Jurisdictions in California have authority to require landscape plans that include planting and maintenance of trees, as well as ordinances to protect existing trees. Ordinances can include landscape irrigation systems where trees and turf are on different valves, allowing trees to be watered during droughts. Local jurisdictions can pass and enforce tree ordinances to protect and expand canopies in their jurisdictions, while local and state agencies with land holdings (such as school districts, cities, and Caltrans) can implement policies to protect and expand tree canopy on their properties.
- **Incentives:** Local jurisdictions can include funding for turf removal as well as tree planting. The California Department of Forestry and Fire Protection (CAL FIRE) offers grants to tree planting organizations such as the Sacramento Tree Foundation. The Sacramento Tree Foundation and SMUD offer free shade trees to customers through the Free Shade Tree Program.

Monitoring and Reporting

Passage of tree ordinances and tree policies, plus regional canopy estimates will track progress on this measure.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure N-2).[1] The CAPCOA Handbook recommends the use of various modeling tools that model CO_2 sequestration from trees, such as the i-Tree County tool,[2] depending on the scale of the application. Carbon sequestration rates per acre of canopy were estimated using the i-Tree County Tool, by inputting the number of trees to be planted. Urban trees may also provide indirect GHG reductions by reducing the UHI effect, which can vary depending on individual project sites. Indirect GHG reductions were not quantified in this measure. For additional details on inputs and assumptions for this specific analysis for the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table NW-3. Potential Emissions Reductions from Measure NW-3 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Expand Tree Planting	4,353
Total Reduction	**4,353**

Health and Equity Considerations

Planting trees and expanding tree canopy, especially in lower income neighborhoods, can improve overall population health and reduce obesity, cardiovascular disease, high blood pressure, type 2 diabetes, asthma, and lung cancer. Tree canopies can reduce the health effects of extreme heat such as heatstroke and heat-related mortality, and reduce exposure to ultraviolet radiation, a major risk factor for most skin cancers. Urban trees and vegetation can improve an individual's ability to cope with stress. Street trees also tend to slow traffic, reducing crashes and injury rates.

REFERENCES

[1] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[2] *American Forests. 2023. i-Tree County Tool. Version 0.5.0. Accessed online October 2023 at: https://county.itreetools.org/*

[3] *Kardan O et al. 2015. Neighborhood greenspace and health in a large urban center. Sci Rep 2015 Jul 9:5:11610. Doi: 10.1038/srep11610. Available: https://www.nature.com/articles/srep11610. Accessed: January 2024.*

[4] *Lovasi G.S., Quinn J.W., Neckerman KM, et al. 2008. Children living in areas with more street trees have lower prevalence of asthma. Journal of Epidemiology & Community Health 2008;62:647-649. Available: https:///jech.bmj.com/content/62/7/647 Accessed: January 2024*

[5] *Ulmer JM et al. 2016. Multiple health benefits of urban tree canopy: The mounting evidence for a green prescription. Health & Place 42 (2016) 54-62. Available: https://www.fs.usda.gov/pnw/pubs/journals/pnw_2016_ulmer001.pdf. Accessed: January 2024*

[6] *Wolf K.L. et al. 2020. Urban Trees and Human Health: A Scoping Review. Int J Environ Res Public Health. 2020 Jun; 17(12): 4371. Published online 2020 Jun 18. doi: 10.3390/ijerph17124371. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7345658/#B215 ijerph-17-04371. Accessed: January 2024.*

[7] *Wolf, K.L., S. Krueger, and M.A. Rozance. 2014. Stress, Wellness & Physiology - A Literature Review. In: Green Cities: Good Health (www greenhealth.washington.edu). College of the Environment, University of Washington. Available: https://depts.washington.edu/hhwb Thm_StressPhysiology.html. Accessed: January 2024.*

Carbon Sequestration Program/Carbon Farming

Measure NW-4

GHG Mitigation Potential

168,014 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

Depending on the type of carbon sequestration project, various resiliency benefits such as improved air quality and water conservation could be achieved. A carbon sequestration project such as a reforestation project would plant trees in areas that have previously been disturbed by wildfires or drought. These projects increase the carbon sequestration capabilities of natural and working lands and support more resilient and healthier ecosystems.

Measure Description

This measure will establish carbon sequestration or carbon farming projects. Carbon emissions are sequestered through the absorption of CO_2 from the atmosphere into a carbon sink (e.g., tree planting) or storage (e.g., injection into underground reservoirs). Carbon sequestration can occur through biological, chemical, or physical processes.

Establish a Carbon Sequestration Project: The measure reduces GHG emissions by implementing projects that follow the Natural Resources Conservation Service (NRCS) conservation practices from the U.S. Department of Agriculture (USDA).[1] These projects sequester carbon by conserving, maintaining, and restoring natural resources on ranches, farmland and forestland. Some example projects include:

- Converting irrigated cropland to permanent unfertilized grass cover.
- Replacing synthetic nitrogen fertilizer with beef feedlot manure on managed irrigated pasture.
- Replacing a strip of cropland with one row of woody plants.
- Conversion of grasslands to a farm woodlot.
- Adding legume seasonal cover crop to irrigated cropland.
- Restoring highly disturbed areas by planting permanent vegetative cover.
- Adding biochar as a soil amendment to irrigated cropland.

Subsector

Carbon Sequestration, Miscellaneous

Scale of Application by 2030

- 100,000 acres of carbon farming projects that follow NRCS practices in the region.

Authority to Implement

- **Legislation, Rules, and Policy:** Agricultural operations are protected through right-to-farm ordinances at the state and local levels, with certain practices, such as agricultural burning, regulated by appropriate agencies by jurisdiction. Crop selection and rotation are typically exempt from CEQA, but conversion of farmland to urban land uses constitutes an environmental impact and is subject to local land use regulation.
- **Incentives:** The California Department of Food and Agriculture's Healthy Soils Program includes financial and technical assistance. The Strategic Growth Council's Sustainable Agricultural Lands Conservation Program protects critical agricultural lands by facilitating conservation easements. Local and regional governments can build on these programs by offering financial, technical, and material support. For example, successful local organics diversion programs can increase the availability of compost, which can reduce synthetic fertilizer application.

Monitoring and Reporting

Participation in state and local programs will be monitored through annual reporting.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure M-1).[2] The potential GHG reductions come from adopting NRCS conservation practices and applying them to farms, ranches and forestland. The estimated GHG reductions shown here are based on implementing projects that add up to 20,000 acres in each of the five conservation practice categories, for a total of 100,000 acres. The five conservation practice categories are:

- Cropland to herbaceous cover
- Grazing lands
- Woody plantings
- Restoration of disturbed lands
- Cropland management

Within each of the five NRCS conservation practices there are several types of projects with varying degrees of carbon sequestration. GHG estimates reflect an average reduction per acre for each of the five conservation practices. Due to the varying degree of GHG reductions per conservation practice (shown in Table NW-4), the maximum reductions would be achieved by applying projects with the greatest carbon sequestration rates, such as woody plantings or restoration of disturbed lands, where feasible. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table NW-4. Potential Emissions Reductions from Measure NW-4 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Establish an NRCS Practice Project: 20,000 acres of Woody Plantings	138,116
Establish an NRCS Practice Project: 20,000 acres of Restoration of Disturbed Lands	17,679
Establish an NRCS Practice Project: 20,000 acres of Cropland to Herbaceous Cover	6,749
Establish an NRCS Practice Project: 20,000 acres of Cropland Management	3,745
Establish an NRCS Practice Project: 20,000 acres of Grazing Lands	1,724
Total Reduction	**168,014**

Health and Equity Considerations

Depending on the location of the carbon sequestration project, care should be taken to ensure that any disbenefits to vulnerable or sensitive communities are avoided.

New carbon sequestration projects could create new job opportunities for members of lower income and disadvantaged neighborhoods, improving economic equity.

REFERENCES

[1] *NRCS. COMET-Planner Tool: Evaluate Potential Carbon Sequestration and Greenhouse Gas Reductions from Adopting NRCS Conservation practices. Accessed Jan 2024 at http://www.comet-planner.com/*

[2] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

Greenhouse Gas Local Offset Program

Measure NW-5

GHG Mitigation Potential

171,683 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

GHG offset programs such as livestock projects can help conserve natural and working lands. Nutrients from agricultural byproducts can improve soil health and crop yields and reduce nutrient runoff, protecting local waterways.

Measure Description

This measure focuses on funding and implementing local offset programs designed to mitigate the emission of GHGs. An offset program allows individuals, businesses, and governments to invest in environmental projects around the world in order to balance their carbon footprint.

Geographic priorities for GHG reductions from offset programs should be as follows: (1) near disadvantaged communities with existing air quality issues or areas with at-risk populations in the Sacramento-Roseville CSA, (2) within other areas in the Sacramento-Roseville CSA, (3) within the state of California, and (4) outside of the state of California.

Establish Offset Program: The measure requires implementing a project that would offset local GHG emissions. Emission reductions are project-specific and should be from sources that follow rigorous protocols and third-party verification. Project types could fall under five different categories including livestock, mine CH_4 capture, ODS, rice cultivation, and U.S. Forests projects based on CARB's GHG Local Offset Program Projects.[1] These can be accessed and registered through verified carbon markets such as The Climate Action Reserve.[2]

Subsector

Carbon Sequestration, Miscellaneous

Scale of Application by 2030

- Investing in three verified GHG local offset projects that accomplish reductions for an average of 60,000 MT CO_2e per year per project.

Authority to Implement

- **Legislation, Rules, and Policy:** These projects exist beyond current regulations so their implementation can result in carbon reduction credits. Recent GHG CEQA threshold studies of natural- and low-global warming potential refrigerants by the Sac Metro Air District and the Bay Area Air Quality Management District determined there is insufficient deployment in the region to make a finding of feasibility for requiring these projects. These projects can be an option as part of a larger environmental compliance program. Credits can be tracked and exchanged through the Sacramento Carbon Exchange Program (Rule 250) adopted in 2010.
- **Incentives:** SMUD has piloted a Natural Refrigerant Incentive Program. Additional funding for more deployment will help determine the appropriate refrigerants and use cases for the Sacramento-Roseville CSA.

Monitoring and Reporting

GHG offset programs can be tracked through annual reporting from incentive programs and carbon credit registration.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook (measure M-2).[3] CARB's GHG Local Offset Program groups projects into five different categories including livestock, mine CH_4 capture, ODS, rice cultivation, and U.S. Forests projects. Emission reductions associated with mine CH_4 capture and rice cultivation projects are not quantified here. Emission reductions for the remaining project types are taken as the average emission reductions for each project type across a number of ongoing and completed projects (active since 2011 or later) near the Sacramento-Roseville CSA registered with The Climate Reserve.[4] Due to the variance in emission reductions across project types, maximum GHG reductions would be achieved when projects are coupled with carbon sequestration. For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table NW-5. Potential Emissions Reductions from Measure NW-5 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Sample Offset Project (Livestock Project)	11,085
Sample Offset Project (Ozone Depleting Substances)	77,188
Sample Offset Project (U.S. Forests)	83,410
Total Reduction	**171,683**

Health and Equity Considerations

Depending on the location of the GHG offset program, care should be taken to ensure that any disbenefits to vulnerable or sensitive communities are avoided.

New local GHG offset programs could create new job opportunities for members of lower income and disadvantaged neighborhoods, improving economic equity.

REFERENCES

[1] *CARB. 2023. California Air Resources Board's Compliance Offset Protocols https://ww2.arb.ca.gov/our-work/programs/compliance-offset program/compliance-offset-protocols*

[2] *Climate Action Reserve. Climate Action Registry Map of Projects 2023. Accessed Jan 2024 at https://www.climateactionreserve.org/registry map/*

[3] *CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. https://www.airquality.org/ClimateChange/Documents/Final%20Handbook_AB434.pdf*

[4] *NRCS. COMET-Planner Tool: Evaluate Potential Carbon Sequestration and Greenhouse Gas Reductions from Adopting NRCS Conservation Practices. Accessed Jan 2024 at http://www.comet-planner.com/*

Natural and Working Lands Equipment Emissions Reduction

Measure NW-6

GHG Mitigation Potential

348 MT CO_2e/yr by 2030

Co-Benefits

Climate Resilience

The replacement of conventional gasoline- or diesel-fueled equipment with a low-emissions alternative can lead to long term cost savings from reduced fuel and maintenance costs.

Measure Description

This measure focuses on replacing conventional gasoline- or diesel-fueled, off-road natural and working lands equipment with an electric counterpart. The replacement of conventional equipment will reduce fossil fuel combustion and result in a net reduction of GHG emissions.

Use of Electric Off-Road Equipment for Natural and Working Lands: This measure pertains to small equipment with engines that are less than 25 horsepower. The measure includes agricultural equipment such as tractors and all-terrain vehicles (ATVs) that are often used in the management of natural and working lands. Conventional gasoline- or diesel-fueled equipment would be replaced with electric alternatives. This measure also accounts for indirect emissions resulting from increased electricity usage associated with equipment charging.

Subsector

Agricultural Off-Road Equipment

Scale of Application by 2030

- 55% penetration rate of electric-powered equipment for tractors and ATVs used in natural and working lands across the region.

Authority to Implement

- **Legislation, Rules, and Policy:** CARB's Off-Road Diesel Regulations require construction fleets to transition to cleaner equipment. Local jurisdictions may require cleaner equipment than state standards as part of a larger environmental compliance plan.
- **Incentives:** Air districts and CARB provide incentive funds for deployment of cleaner and zero-emission off-road equipment, such as construction or agricultural equipment.

Monitoring and Reporting

Progress is measured through annual reporting on programs administered by CARB and local air districts. Model data updates from CARB's Off-Road and Small Off-Road Engines (SORE) program will also disclose penetration of hybrid and zero-emission engines.

GHG Reductions Quantification Summary

The methodology for estimating emission reductions is based on the guidelines in the CAPCOA Handbook Update (measure M-6).[1] Table NW-6 shows the reductions from this measure. GHG reductions are achieved through the replacement of small (less than 25 horsepower) gasoline- and diesel-fueled agricultural tractors and ATVs with an electric counterpart. Replacement of agricultural equipment with hybrid-electric models would result in smaller net reductions in the future. GHG emission reductions are partially offset by GHG emissions resulting from increased electricity usage associated with charging electric equipment.

Emissions for the applicable agricultural equipment in the region were estimated using CARB's EMFAC.[2] For additional details on inputs and assumptions for this specific analysis in the Sacramento-Roseville CSA, see Appendix C. Annual emission reductions below represent the implementation of this measure across the Sacramento-Roseville CSA and obtainment of the scale of application by 2030.

Table NW-6. Potential Emissions Reductions from Measure NW-6 across the Sacramento-Roseville CSA

Measure Breakdown	Metric Tons CO_2e/Year
Use of Electric Off-Road Equipment for Natural and Working Lands	348
Total Reduction	**348**

Health and Equity Considerations

Replacing diesel agricultural equipment with cleaner-fuel equipment reduces the risk to workers of cardiovascular, lung and respiratory disease, and cancer. Replacing gas-powered equipment with electric-only equipment reduces both the risk of pollutant-related conditions and effects related to noise – hearing loss and impacts of noise stress including hypertension, elevated cholesterol, and increased risk of heart disease.

REFERENCES

[1] *Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023.*

[2] *CARB. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Available online at: https://arb.ca.gov/emfac Hammer MS et al. Environmental Noise Pollution in the United States: Developing an Effective Public Health Response. Environmental Health Perspectives (2014) 122:2. Available: https://ehp.niehs.nih.gov/1307272/. Accessed: January 2024.*

[3] *Kerns E et al. 2018. Cardiovascular conditions, hearing difficulty, and occupational noise exposure within US industries and occupations. Am J Ind Med 2018 Jun;61(6):477-491. Doi: 10.1002/ajim.22833. Available: https://pubmed.ncbi.nlm.nih.gov/29537072/. Accessed: January 2024.*

[4] *Koutros S et al. 2020. Diesel exhaust and bladder cancer risk by pathologic stage and grade subtypes. Environment International 135: February 2020, 10534. Available: https://doi.org/10.1016/j.envint.2019.105346. Accessed: January 2024.*

[5] *U.S. Office of Occupational Safety and Health Administration. 2013. OSHA/MSHA Hazard Alert: Diesel Exhaust/Diesel Particulate Matter. Available: https://www.osha.gov/sites/default/files/publications/OSHA-3590.pdf. Accessed: January 2024.*

Funding Opportunities for Measure Implementation

The CPRG program was implemented under the Inflation Reduction Act of 2022 to spur climate action throughout the country and is providing $4.6 billion for competitive grants to enact GHG reduction programs, policies, projects, and measures. Implementation of the 24 measures included in this Plan will require significant investment into the region, from the public and private sectors. This section explains how the region will organize to identify and procure funding opportunities to advance climate priorities.

Working Groups

To advance the three main measure categories, six working groups were formed to develop actionable steps to implement the measures listed within the Plan. Each category is supported by two working groups. The working groups are composed of members of the steering committee and other staff and their work includes coordinating regional approaches, finding capacity for implementation, securing funding, and delivering projects.

Table 1. List of Working Groups

Measure Category	Working Groups
Built Environment	Infill Development
	Building Electrification
Transportation	Active Modes
	Public Fleet ZEVs and Transit
Natural and Working Lands	Forest Treatments and Biomass
	Carbon Farming

Funding Opportunities

Below is a non-exhaustive list of funding opportunities for the consideration of each working group. As projects and programs are identified and developed, the working groups will collaborate with the appropriate jurisdictions, tribal partners, or agencies to pursue and implement the projects and programs.

Built Environment

Infill Development

Most funding for this working group originates from the State of California, with programs such as the Regional Early Action Planning Grants Program, which is overseen by the California Department of Housing and Community Development. Funding is also available through the Strategic Growth Council and its Transformative Climate Communities and Affordable Housing and Sustainable Communities programs.

Building Electrification

A range of incentives and rebate programs for electrification are now available at the federal, state, and local level. Multiple federal programs are available to decarbonize buildings. The EPA offers the National Clean Investment Fund, Solar for All, and the Environmental and Climate Justice Community Change Grants program. The Department of Energy (DOE) manages the Energy Efficiency and Conservation Block Grant Program, the Better Buildings Challenge, and the Energy Future Grants. The IRA's HEEHRA, HOMES program, and other programs are key drivers of household electrification. In some instances, the Inflation Reduction Act may cover up to 100% of up-front costs for households at or below 80% of Area Median Income (AMI), while covering up to 50% of equipment costs for households between 80% and 150% of AMI, providing critical support as low- and moderate-income households electrify their homes.

At the state level, most funding is provided by the CEC through the California Electric Homes Program, Golden State Rebates, and energy rebates from investor-owned and municipal utilities. The CEC's Equitable Building Decarbonization Program is providing over $600 million statewide for a direct install program. The TECH Clean California program is actively supporting household electrification, with wide program participation across the state.

Local utilities, including SMUD, are providing a wide range of incentives and technical support for households, businesses, and property managers that are electrifying their buildings. With the range of incentives and tax credits currently available, household electrification can be comparable or even less expensive than a like-for-like gas replacement in many cases.

Transportation

Active Modes

Federal programs are mostly overseen by the Department of Transportation (DOT), and include the Neighborhood Access and Equity Grant Program, the All Stations Accessibility Program, the Carbon Reduction Program, Safe Streets and Roads for All, and Rebuilding American Infrastructure with Sustainability and Equity. The Sacramento region contains U.S. Forests and other federal lands and is eligible for the Federal Lands Transportation Program for active modes improvements.

State programs are overseen by various agencies. Caltrans oversees the Safe Route to School Program, the Sustainable Communities Competitive and Technical grants, and the Highways to Boulevards program. The California Transportation Commission funds the Local Transportation Climate Adaptation Program and the Active Transportation Program. The Department of Parks and Recreation funds the Recreational Trails Program as well as the Rural Recreation and Tourism Program funded under the 2018 Parks and Water Bond Act (Proposition 68).

Public Fleet ZEVs and Transit

Key federal programs to deploy electric vehicle charging infrastructure are the Charging and Fueling Infrastructure Program and the National Electric Vehicle Infrastructure Formula Program overseen by the DOT. Federal tax credits are also available for eligible ZEVs. The EPA, meanwhile, helps with education transportation funding via the Clean School Bus Program.

Several voucher programs are available for vehicles through CARB or local air districts including CC4A, the CVRP, and the HVIP. For transit fleets, the California State Transportation Agency offers the Zero-Emission Transit Capital Program. Regarding charging and fueling, the CEC offers several programs, such as the Clean Transportation Program's Rural Electric Vehicle Charging program; Reliable, Equitable and Accessible Charging for Multi-Family Housing; Fast and Available Charging for All Californians; Light-Duty Vehicle and Multi-Use Hydrogen Refueling Infrastructure; and Innovative Hydrogen Refueling Solutions for Heavy Transport.

Mobility hub projects to reduce VMT through public transit, bike and ride share often include programs such as Our Community CarShare Sacramento (OCCS) which is a cost-sharing transportation program for residents to reserve zero-emission vehicles, displacing traditional combustion engine vehicle trips. The OCCS program is administered by the Sac Metro Air District. Mobility hubs are often coupled with public amenities such as shade, EV charging stations, and secure bike parking.

Natural and Working Lands

Forest Treatments and Biomass
Regarding biomass energy projects, the federal government is funding research pilots with DOE's Bioenergy Technologies Funding Office. In 2024, DOE's Industrial Efficiency and Decarbonization Office announced an $83 million Energy and Emissions Intensive Industries funding opportunity that aims to decrease emissions in the hardest to decarbonize industrial sectors and achieve the nation's clean energy goals. Projects that generate revenue should consider EPA's National Clean Investment Fund, which is a green infrastructure bank.

For forest health projects, CAL FIRE has forest health grants such as the Forest Health Program that focus on increasing forest fuels management, fire reintroduction, treatment of degraded areas, and conservation of forests.

Carbon Farming
The EPA and the USDA have several grant, loan, financing, and technical assistance programs. Some of the funding opportunities are annual while other funding opportunities are managed through third parties. Programs most relevant to this working group are the EPA's National Clean Investment Fund, the Clean Investment Accelerator, the USDA's Climate-Smart Commodities program, and the USDA's Rural Innovation Stronger Economy Grants.

At the state level, the Governor's Office of Planning and Research is introducing CEQA analysis requirements regarding impacts to the land's ability to sequester carbon. This may create a market for developers to fund carbon sequestration projects on natural and working lands.

Chapter 4. Community Engagement

Community outreach and engagement is crucial for the successful implementation of any public planning process. Through a combination of direct outreach and a review of previous outreach efforts, the planning team assessed the local priorities of Sacramento's socially and geographically diverse communities to better understand how to formulate GHG emissions reduction strategies that maximize accessibility to meaningful co-benefits. The importance of culturally sensitive outreach as a necessary component of project planning, development, and implementation was evident through community engagement for the Plan. This Plan aims to achieve emission reductions while simultaneously addressing community needs with a particular focus on equitable implementation.

Community Engagement Approach

To inform the community engagement strategy, the planning team formed the OAC[1] comprised of local CBOs and other trusted community partners nominated by the CPRG steering committee. The OAC served three primary roles: i) to assist the planning team in developing effective engagement methods that suit the diversity of the Sacramento region, ii) to help identify gaps in the low income and disadvantaged communities (LIDAC) maps generated using state and federal mapping tools, and iii) to ground truth the results of primary data collection.

Prior to developing the community engagement strategy, the planning team reviewed existing regional community engagement plans such as Valley Vision's Livability Poll and SacRT's Bus Stop Improvement Plan for region-specific best practices and presented this review to the OAC. This process resulted in the identification of three primary data-collection strategies: i) a survey based on the co-benefits of priority GHG reduction measures, ii) a review of previous regional community engagement efforts, and iii) interviews with community stakeholders.

Three Pillars for Community Outreach:

1. Review of Previous Outreach Efforts
2. Community Benefits Survey
3. Community Stakeholder Interviews

To inform where to focus efforts in addressing the needs of LIDACs, the planning team utilized a LIDACs Map Viewer (shown in Appendix D) developed by SACOG that includes data from the Climate and Economic Justice Screening Tool (CEJST), the Environmental Justice Screening and Mapping Tool (EJScreen), and the California Communities Environmental Health Screening Tool (CalEnviroScreen 4.0). Combined, these tools give a comprehensive overview of the region's LIDACs. The map viewer was distributed to the OAC members to review and identify any potential gaps on the map.

After conducting community engagement strategies and data collection during the summer and early fall of 2023, the planning team launched a community benefits survey, which was open for seven weeks from October 23 to December 11, 2023. Stakeholder interviews were conducted between October and December 2023. In total, the planning team collected 850 survey responses, interviewed 27 individuals representing 23 organizations from an array of sectors, and reviewed 13 regional community plans that contained results from direct community outreach campaigns.

Community Survey

To incorporate community voices into this Plan, the planning team created and distributed a community benefits survey focused on understanding which GHG reduction measures would provide the greatest benefits to LIDACs. The survey questions were drafted with assistance from the OAC, which provided input during initial committee discussions. Based on input from the OAC, the survey questions were framed around the potential co-benefits of GHG reduction measures that could be funded by the CPRG program. Rather than asking for feedback on specific projects, respondents were asked to prioritize certain actions that could improve public health or energy reliability in their communities. The results of the community benefits survey are available in Appendix D.

Survey Outreach

The survey was accessible online through SurveyMonkey for seven weeks from October 23 through December 11, 2023 and was available in English, Spanish, Hmong, Chinese, Russian, and Vietnamese. The survey was promoted via tabling at various in-person community events, emailing promotional materials to trusted community partners and stakeholders, targeted social media posts, and physically distributing flyers across the seven-county region. To incentivize participation in the survey, the Sac Metro Air District provided a $300 Visa gift card as a prize for respondents who wished to enter an optional raffle available after the survey's completion. Smaller gifts and prizes were available at each in-person outreach event.

In total, the outreach team attended four in-person community events across Sacramento, Yuba, and Placer counties. Due to time constraints and availability, no in-person outreach was conducted in Nevada, El Dorado, Sutter, or Yolo County. At each of these events, the outreach team provided eventgoers with an opportunity to take the survey and provided additional information and assistance as needed. In addition to receiving an influx of survey responses at these events, the outreach team engaged and educated interested community members about the climate planning process and CPRG program and discussed community concerns and questions about pollution reduction strategies.

The outreach team also coordinated with the Health Education Council, a member of the OAC, which volunteered to distribute promotional survey flyers at their bi-weekly free produce distribution event. The survey was also shared with 10 locally nominated priority communities in Sacramento County that experience disparate impacts from air pollution. Physical flyers were distributed at the Martin Luther King, Jr. Library in the Meadowview neighborhood of Sacramento.

To supplement the lack of in-person engagement in certain counties, the outreach team sent emails with survey information and promotional materials to various trusted community partners asking them to share the survey with their networks. The full list of partnering organizations can be found in Appendix D and includes the OAC members and community groups that were engaged during the stakeholder interview process.

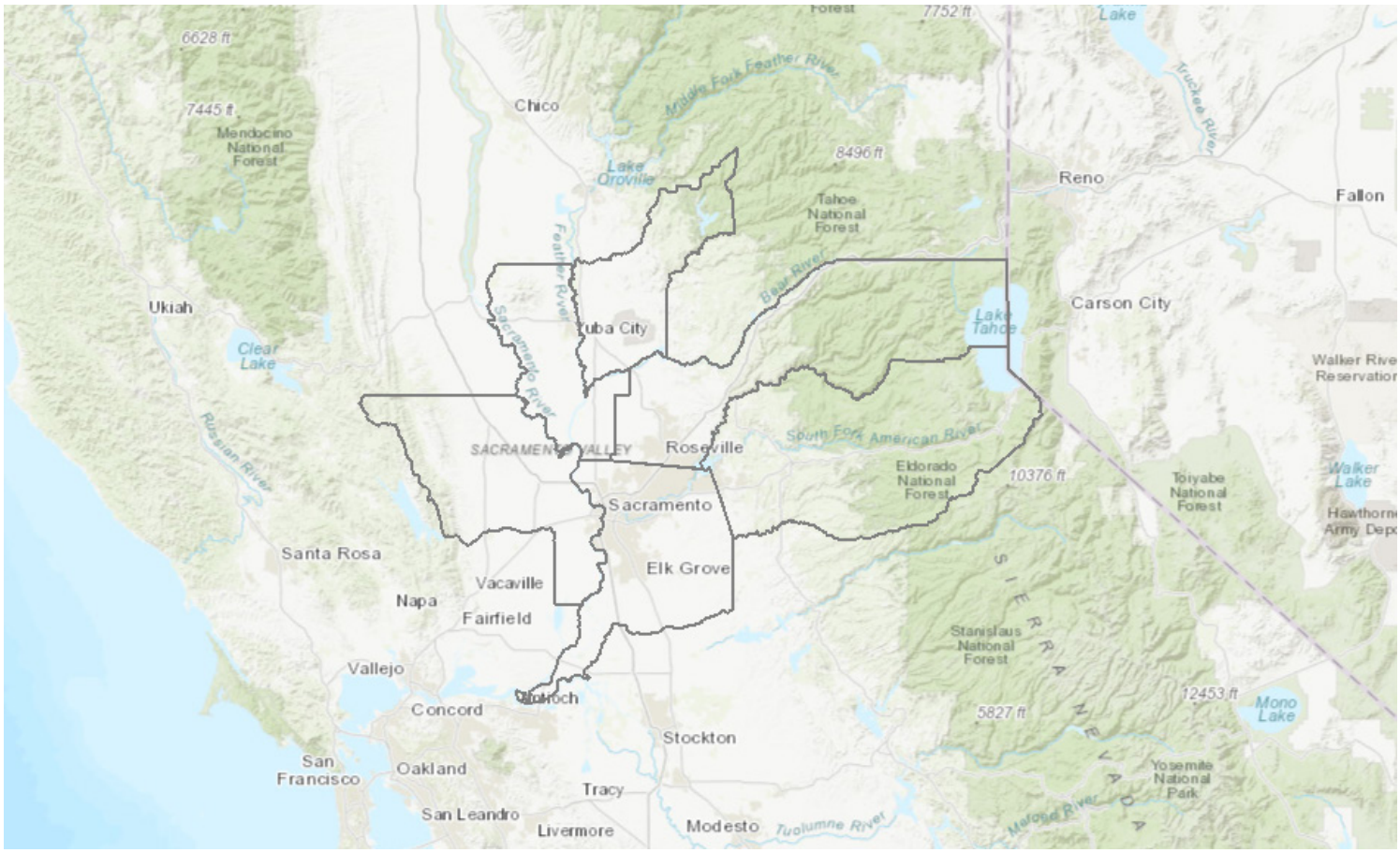
Demographics

A total of 850 responses were received through the online survey, with 388 of those responses coming from regions outside of this plan's focus area or with invalid zip code entries. Analysis of survey responses was limited to responses with validated zip codes to ensure that only relevant data was being assessed. Of the 462 responses with validated zip codes, the majority were received in English (n=428), followed by Chinese (n=21), and Spanish (n=14) with no other translation options utilized. To achieve the goal of amplifying the voices of and receiving feedback from LIDACs, the survey results were additionally filtered to highlight responses from those located in areas designated as EPA IRA Disadvantaged Communities, or Justice40 CEJST communities. Where relevant, the results were also filtered to highlight responses from lower income and non-English speakers. Each subsequent section will discuss the overall survey results from responses with validated zip codes, and how those results compare to responses from identified LIDACs in the region.

Geographic Region

Survey respondents were asked to share their ZIP code. Staff analyzed the results to determine the number of responses from each of the seven counties participating in this climate plan. The majority of responses came from Sacramento (63%), followed by Placer (10%) and Yuba (9.5%) Counties. Additionally, 364 responses came from ZIP codes within an area designated as an EPA IRA Disadvantaged Community, or Justice40 CEJST[2] community. Respondents were also asked to self identify their neighborhood as urban, suburban, rural, valley-rural, or mountain. Most respondents indicated that they live in an urban area (47%), followed by suburban (27%), and rural (16%). Staff analysis of ZIP codes yielded different results than the self-identified neighborhood classifications showing 36.5% suburban, 34% urban, 14% valley-rural, and 14% mountain area responses. This discrepancy is likely due to ambiguous definitions and varying perspectives among survey respondents pertaining to urban, suburban, and rural classifications. Respondents who completed the survey at an in-person outreach event had clarifying questions about which option they should select to accurately describe their neighborhood. It is important to understand neighborhood classifications because priorities and concerns can differ across these classifications. While over 70% of valley-rural and mountain area respondents are concerned with and impacted by wildfires and smoke, less than 30% of urban area respondents expressed the same concern. The perception is that some climate solutions are more critical in one region over another, yet this is not always the case. For instance, sustainable forest management in rural mountain communities helps reduce the likelihood of wildfire-induced power outages in urban and suburban neighborhoods.

Figure 1. Topographic Map of Sacramento Region.



Source: Esri, United States Geological Survey.

Housing Status

Respondents were asked to indicate their current housing status. Of the 462 responses, 55% were homeowners, 34% were renters, and nearly 10% preferred not to say. Three respondents were experiencing homelessness and one other survey respondent was living with family. These results differ widely when reviewing lower income and non-English responses where 56% of respondents were renters, and 30% were homeowners. Renters and homeowners have differing needs that inform their perspectives on GHG measure priorities and co-benefits. Renters typically face more barriers in replacing energy-inefficient appliances in their homes. Given the number of homeowners who responded to the survey, it is understandable that the survey results are skewed towards co-benefits that seemingly are higher priorities for homeowners.

Figure 2. Housing Status

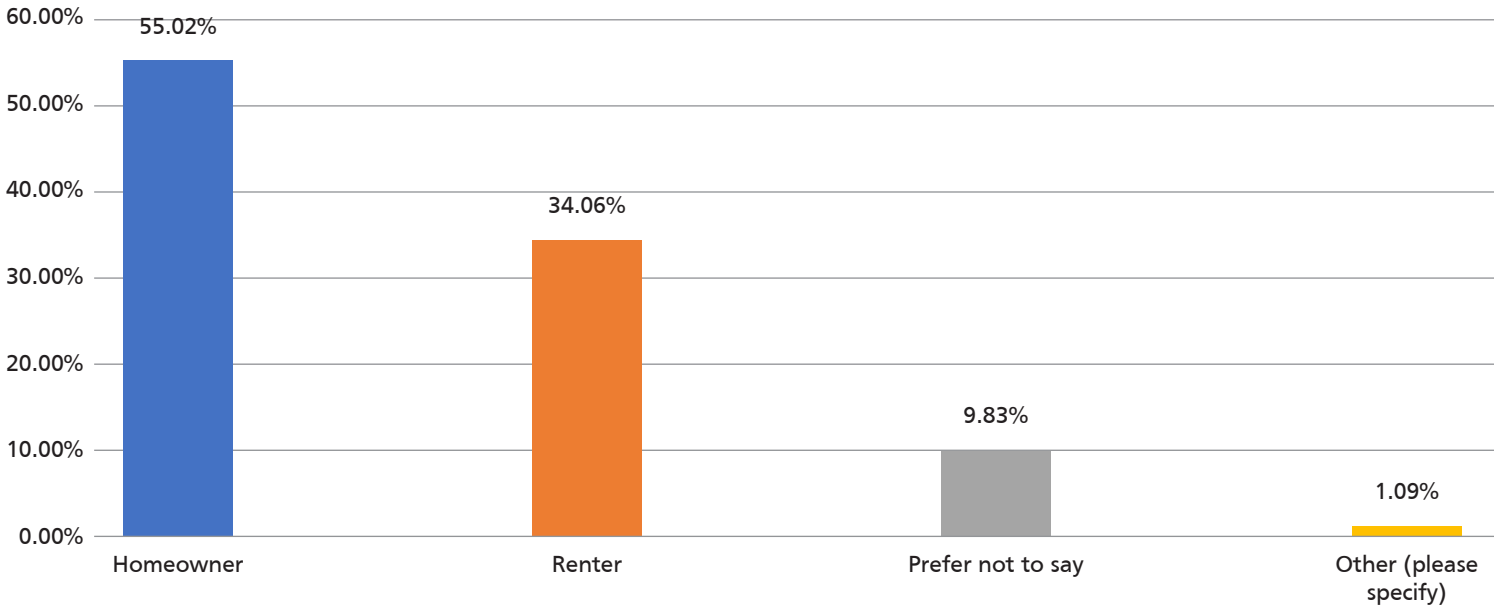
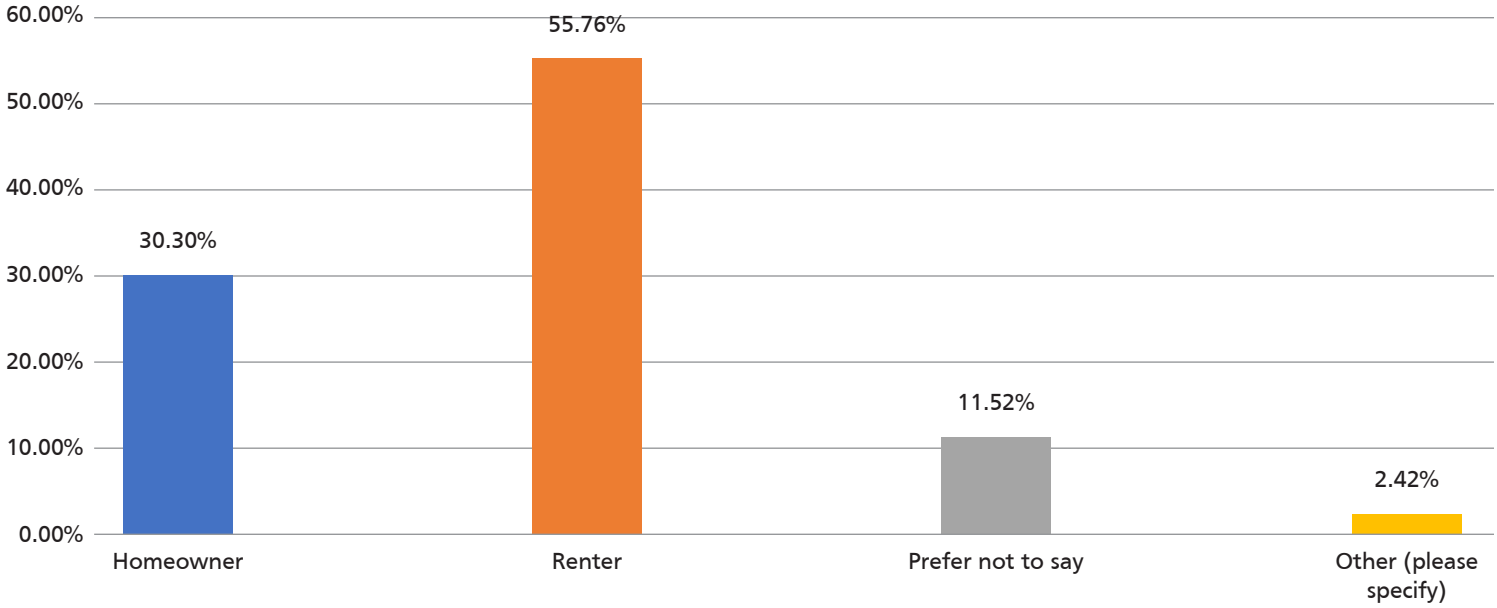


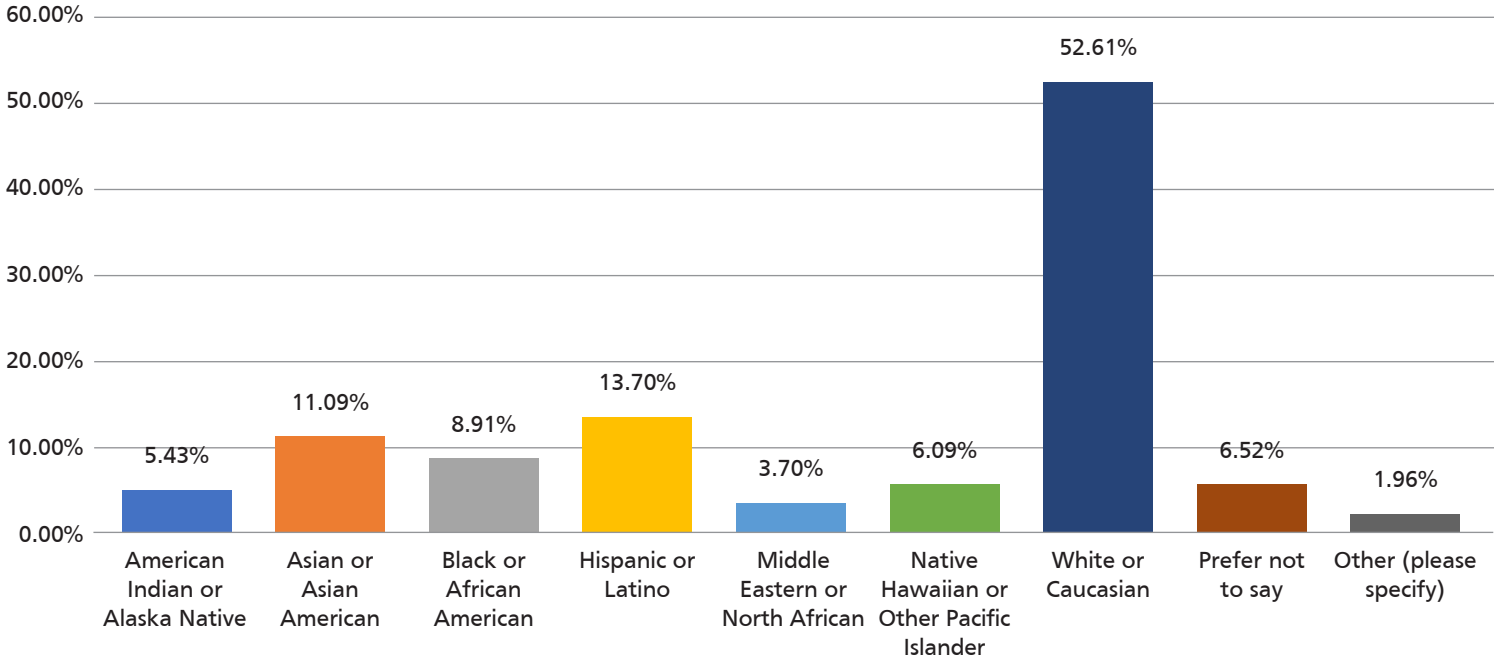
Figure 3. Housing Status for Lower Income and Non-English-Speaking Respondents



Race

Figure 4 illustrates the breakdown of race among survey respondents. The majority of respondents identified as White or Caucasian at 52%, followed by Hispanic or Latino at 13%, and Asian or Asian American at 11%. A total of 8.9% of respondents identified as Black or African American, 6.1% as Native Hawaiian or other Pacific Islander, 5.4% as American Indian or Alaska Native, 3.7% as Middle Eastern or North African, and 6.5% of respondents preferred not to self identify.

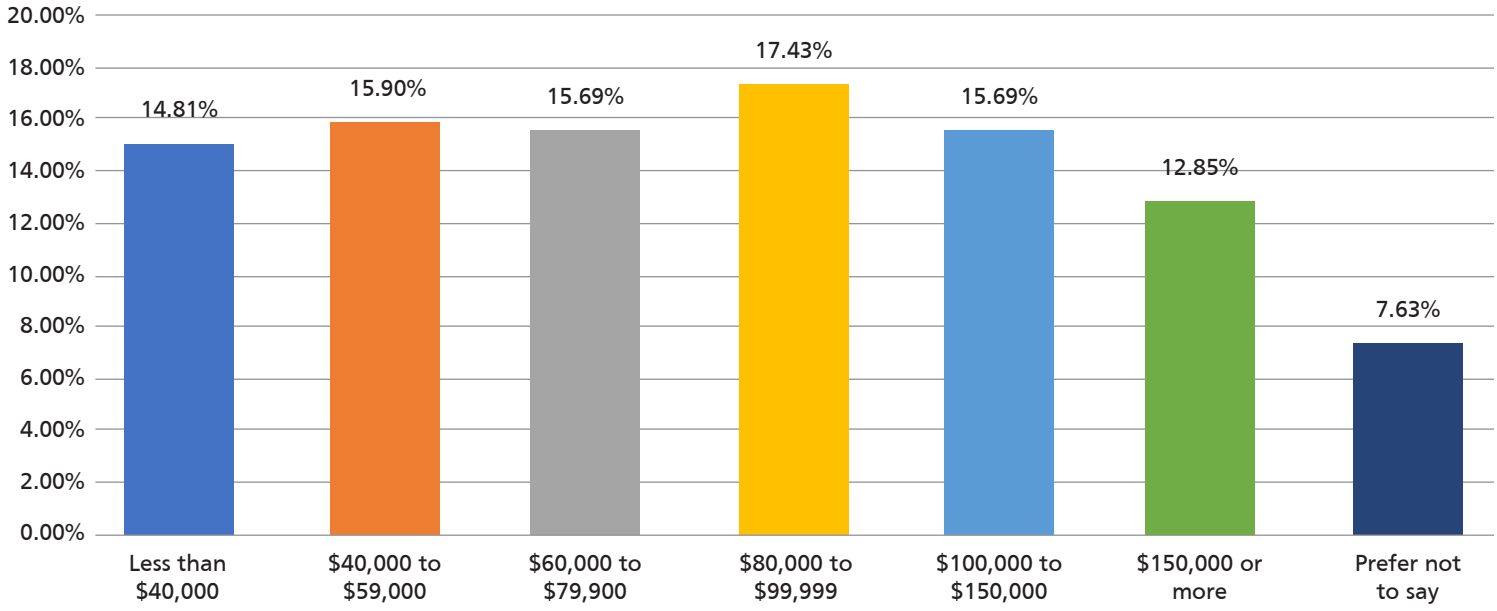
Figure 4. Race



Household Income

Figure 5 illustrates that responses were widely distributed across household income levels. For our data analysis, any responses of "less than $40,000" or "$40,000 to $59,000" were classified as lower income. This classification is distinct from the LIDAC classification that includes responses across all income levels but only includes results located in areas designated as EPA IRA Disadvantaged Communities, or Justice40 CEJST communities. Highlighting this distinction is important as residents with lower incomes are typically more susceptible to climate risks. Those with higher incomes who live in the same neighborhoods as those with lower incomes would likely be more resilient when exposed to the same climate hazards.

Figure 5. Income



Regional Priorities

Understanding which sources of air pollution are of most concern for communities in the region better informs the prioritization of measures and implementation projects geared towards air pollution reduction. Respondents were most concerned with air quality impacts from passenger vehicles and trucks, and wildfire smoke. Some common themes among the open-ended responses include concerns over yard waste burn piles and leaf blowers. The LIDAC responses showed a similar concern for wildfire smoke exposure. However, responses to this question differed widely by geographic region. Urban area respondents indicated that wildfires were a much smaller concern in relation to impacts from passenger vehicles and trucks, industrial facilities, and construction. Conversely, concern for wildfire smoke exposure is especially pronounced in mountain and valley-rural areas where there is a higher risk for uncontrolled forest and brush fires.

Figure 6. Air Quality Impact Priorities

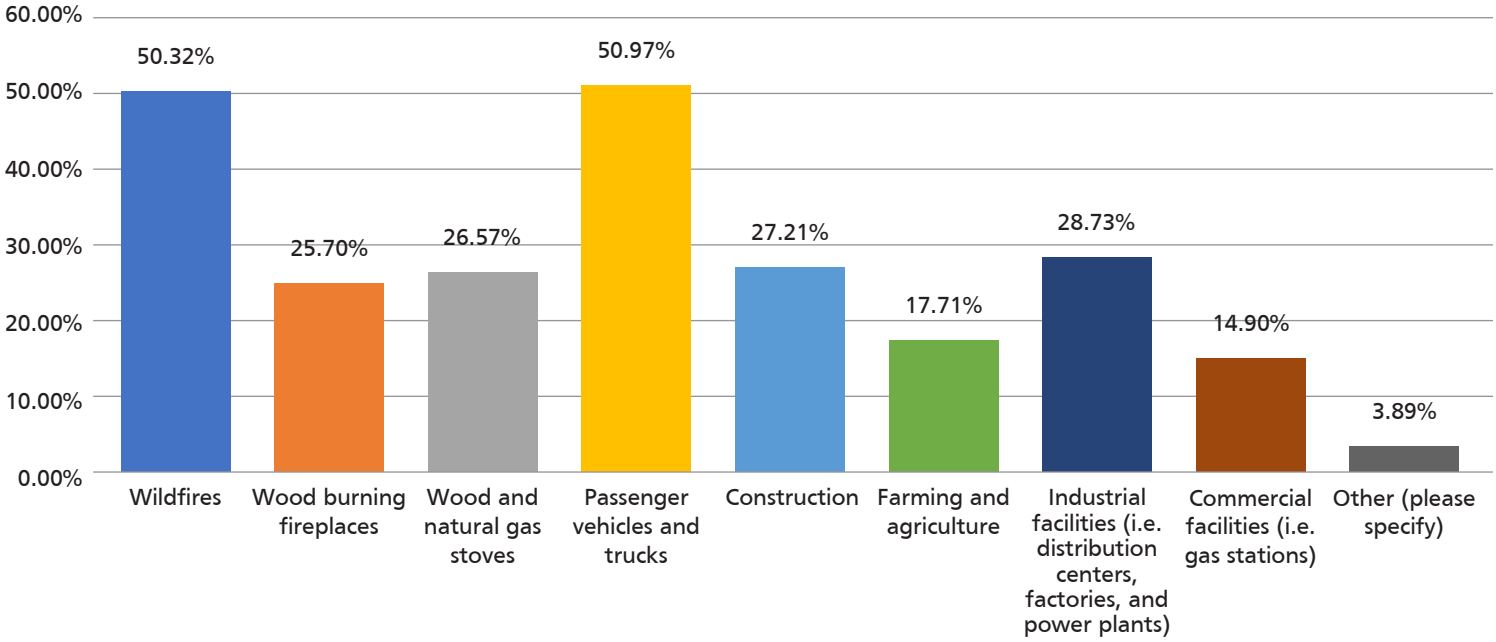
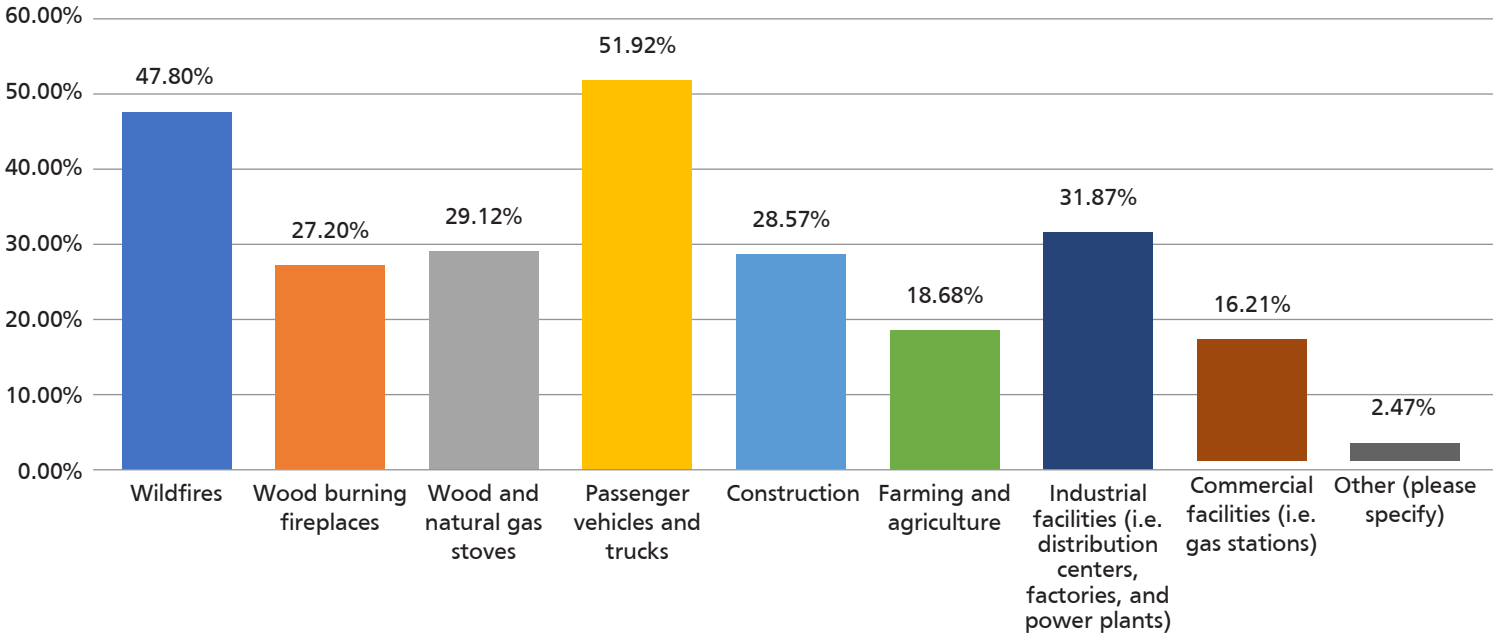


Figure 7. Air Quality Impact Priorities for LIDACs



The second survey question asked respondents how they would prioritize different co-benefits associated with air pollution reduction in their communities. The respondents were prompted to select up to four co-benefit priorities that were used to filter the remainder of the survey questions so that the respondents would only see questions based on their chosen priorities. If a respondent selected lower energy bills as one of their four priorities, they would be prompted to answer a question about strategies for reducing energy costs later in the survey. If a respondent selected three main priorities, they would only be prompted to answer three more questions pertaining to the priorities they selected. Overall, the top two emerging priorities were improved public health (56%) and lower energy bills (52%) which were also top priorities for LIDACs.

Figure 8. Co-Benefit Priorities

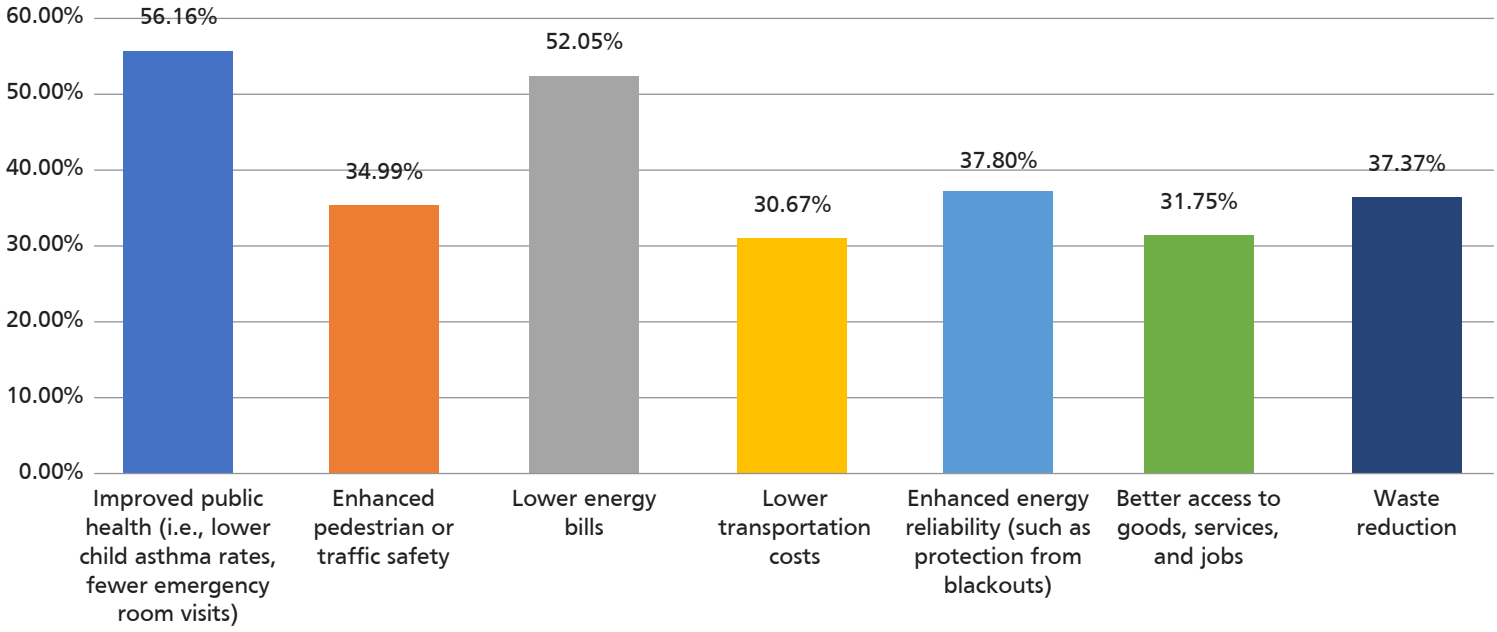
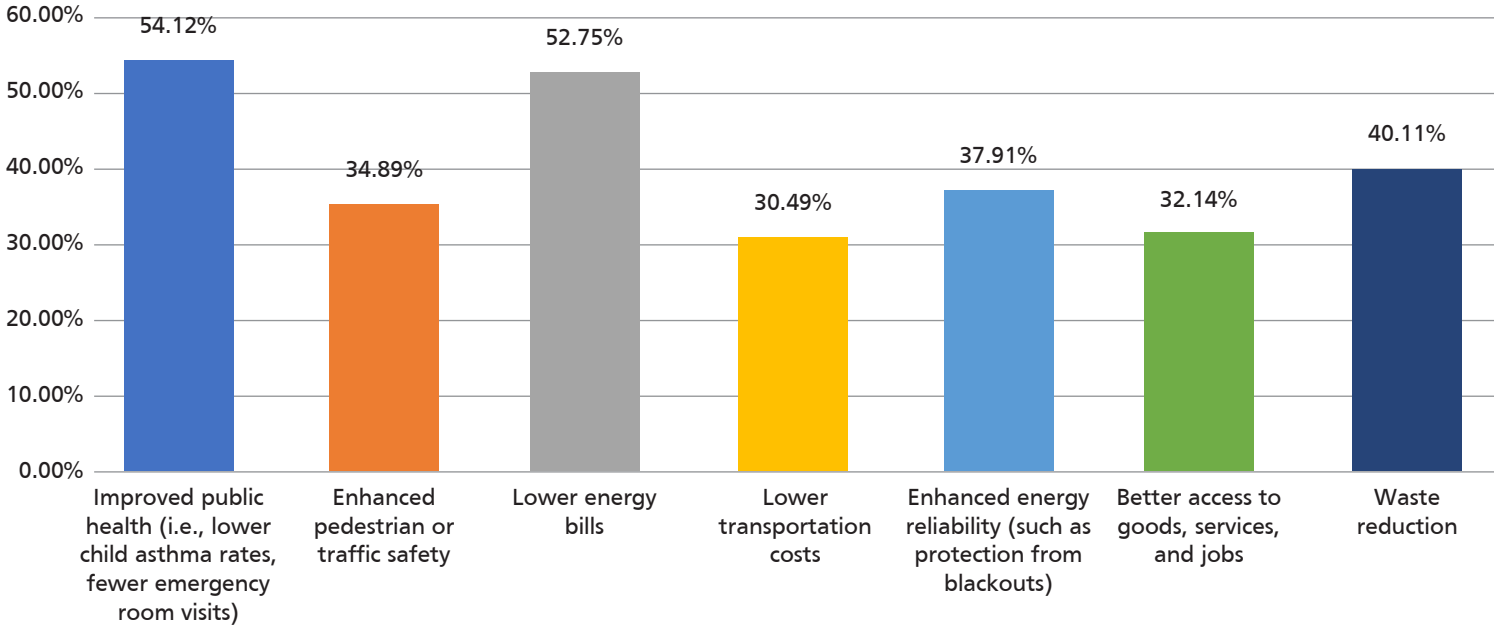


Figure 9. Co-Benefit Priorities for LIDACs



Public Health and Safety

When asked how to improve public health and community safety, respondents indicated strong support for making walking and bicycling safer, planting trees, and replacing vehicles and equipment with electric alternatives. Only 40% prioritized replacing natural gas appliances with electric appliances. Other responses indicated a desire for improved public transportation, the elimination of wood-burning stoves and fireplaces, improved forest management to reduce the risk of wildfires, establishing volunteer programs to clean streets and trails, and improved building weatherization.

When comparing responses from LIDACs, the results differed slightly with more support for planting trees and making walking and bicycling safer. There was slightly less support for replacing vehicles and equipment with electric alternatives. There was also less support for prioritizing the replacement of natural gas appliances with electric alternatives.

Transportation

Of the respondents who prioritized increasing the safety of walking and biking, the majority favored separating bike lanes from traffic through protected bike lanes, pedestrian signals, crossings at intersections, and slowing traffic in pedestrian areas. Less than 40% of respondents prioritized planter strips to buffer sidewalks from streets, and well-lit streets. Other responses included suggestions to narrow streets as a traffic calming strategy.

When asked about community priorities for reducing transportation costs, a large majority (69%) of respondents prioritized making public transportation a more viable option through expanded and more frequent service. There was relatively equal support for other options such as affordable access to electric bicycles, the expansion of safe pedestrian and bicycle infrastructure, improved sanitation and safety in public transportation, and affordable access to EVs. Other responses indicated an interest in electric carshare programs, as well as a concern that EVs are too expensive for community members to purchase on their own. When reviewing the LIDAC survey responses, there was a slightly higher prioritization of affordable access to EVs.

Energy

When asked about priorities for reducing energy costs, over 75% of respondents indicated affordable solar energy and storage as a priority. A majority of respondents also favored updated heating, ventilation, and air conditioning (HVAC) or air filtration systems, and improved home weatherproofing for insulation. Around 40% of respondents were interested in replacing natural gas appliances with electric appliances. Open-ended responses highlighted a need to enforce protections for tenants with landlords who are unwilling to upgrade appliances for energy efficiency. There were no significant differences between the overall survey responses and the LIDAC survey responses.

Enhanced energy reliability can provide protection from blackouts caused by extreme weather events such as extreme heat and wildfires which result in poor air quality. When asked about community priorities for improving energy reliability, over 70% of respondents prioritized better forest management to reduce the risk of wildfire power shutdowns. Survey respondents also highly prioritized improved energy efficiency to reduce overburdening the energy grid, solar battery backup systems at homes, and making utility infrastructure more resilient to storms, heat, and fire. LIDAC survey respondents also prioritized solar battery backup systems for residential units.

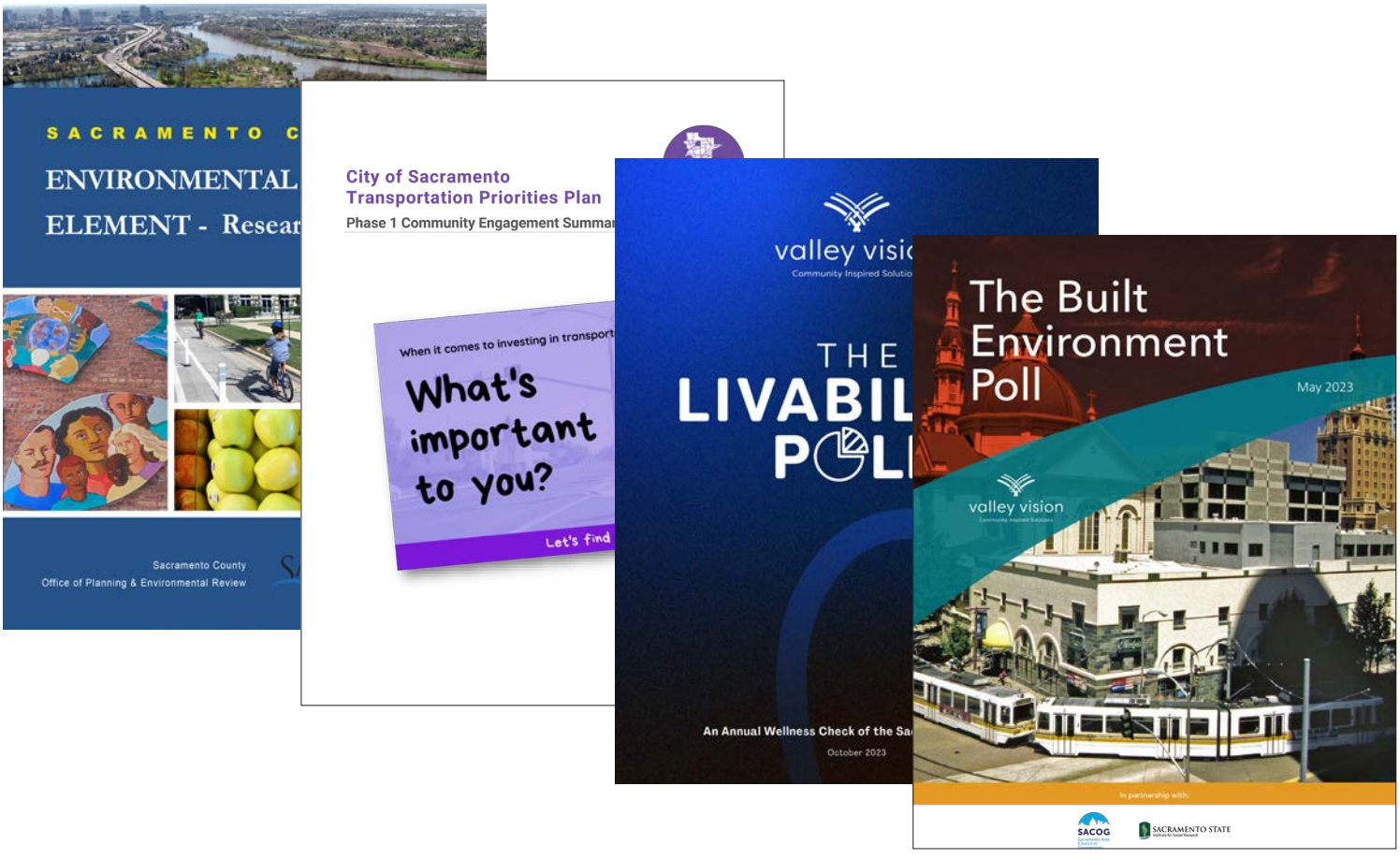
Waste

When asked about priorities for reducing waste in their communities, over 50% of respondents were in favor of prioritizing the expansion and enhancement of food waste recovery and recycling programs, waste-to-energy programs, and installing low-flow water fixtures and water-efficient appliances. Around 46% of respondents also prioritized the installation of drought-resistant landscaping on residential, commercial, and public lands. Open-ended responses indicated a desire for more education around local waste programs and a decreased utilization of single-use plastics. There was an even distribution of priorities among the LIDAC responses with wide support for most waste reduction strategies with only a slightly higher prioritization of waste-to-energy programs.

Accessibility

Of the respondents who chose improved access to goods, jobs, and services as a priority for their community, over 60% were in favor of developing more housing near jobs, shopping centers, and public transportation. A majority of respondents were also in favor of making public transportation a more viable option through expanded and more frequent service. Around 45% were in favor of prioritizing improved sanitation and safety measures to increase public transportation ridership. Fewer respondents prioritized expanding bicycling infrastructure, enhancing pedestrian safety, and creating additional EV charging stations. Open-ended responses highlighted the need for tenant protections in areas with new residential development to prevent an increase in livability costs. The survey results also indicated the importance of installing EV chargers in locations with sufficient use and access. Of the LIDAC survey responses, there was a slightly higher percentage of respondents who favored the increased development of housing near jobs, shopping centers, and public transportation.

Regional Plan Review



Various jurisdictions in the Sacramento region recently conducted considerable community outreach for their respective climate action plans and plan updates, among other sustainability plans for transportation and livability improvements. To supplement primary data collection for this Plan, the planning team conducted a review of planning documents provided by the OAC and partners. In total, the planning team reviewed 13 plans and related documents completed by municipalities from Sacramento and Yolo counties between 2016 to 2023 (see Appendix D for the complete list of plans and data collection methodologies). Transportation, public health, housing, and energy priorities are summarized based on frequency within the reviewed documents. Superscript is used to denote the source document and can be cross-referenced using Table 3 from Appendix D. Findings from the document review are consistent with the community benefits survey results unless otherwise stated.

Transportation Priorities

Strategies to reduce VMT through public transit must address two community concerns: accessibility and safety. Though most of the previous outreach indicates that residents would like to use public transit as an alternative to personal vehicle use, many potential users cite a need to expand inner- and intra-city connections and increase transit frequency before they view riding the bus or the light rail as viable options over personal vehicle use.[7,9,12] Transit agencies would need to address negative perceptions of safety due to low ridership and perceived uncleanliness on transit and at transit stations.[9] Implementing tracking technology to provide real-time updates for bus arrivals would improve travel efficiency and perceptions of safety at bus stops and transit stations.[9]

There is also considerable community support for sustainable modes of transportation, particularly active modes, though concerns over safety can deter community members from riding bicycles. Community outreach results from the region indicate that the expansion of protective infrastructure such as bike lanes and improved connectivity are necessary conditions for residents choosing to replace their local car trips with walking or bicycling.[6,7,8,11,12] These barriers are particularly present in LIDACs, which are the least likely to have access to low-stress bikeways or walkways and are disproportionately impacted by bicycle and pedestrian collisions.[6,9] Pedestrian and safety improvements are vital for safer and more connected communities.

With respect to EV adoption, residents most often cite a lack of charging infrastructure and financial barriers to purchasing and maintaining EVs as the greatest impediments to driving EVs.[3,7] Further, EVs may improve air quality and reduce climate-change-inducing emissions, but they do not address vehicle congestion nor transit needs for lower income residents.[8] Likewise, the results of the community benefits survey indicate residents are more supportive of public transit improvements, electric bicycle access, and improved pedestrian safety rather than efforts to make EVs more affordable. This was even more pronounced among non-English speaking residents and those with incomes less than $59,000.

Public Health Priorities

Improved air quality is often cited as the most important co-benefit of GHG reduction. In the documents reviewed, vehicle exhaust emerges as the source that elicits the most concern from represented communities. This is inconsistent with the community benefits survey results which found broad concern for both mobile sources and wildfire smoke. This difference may be explained by the lack of available documentation capturing community concerns from rural and mountainous counties in the region that are more susceptible to wildfire.

Residents identified tree canopy as a public health benefit and expressed support for increasing tree canopy to improve air quality. Communities understand that tree canopy can: i) mitigate the effects of vehicle exhaust,[6,9] ii) be used as an adaptation strategy to extreme heat and new precipitation patterns,[7,12] iii) encourage bicycling and walking through improved thermal comfort,[7,8] and iv) be used for neighborhood beautification. While there is widespread support for tree plantings, prior outreach identifies disparities in mature tree canopy between wealthier and less wealthy neighborhoods in the region,[6,7,9,12] and older, more established developments versus new developments.[3] As such, communities see tree planting as a strategy to address climate equity and help lower income communities adapt to extreme weather events.[6,7,9,12] For example, given that environmental justice (EJ) communities in Sacramento County often have higher percentages of people who walk and bike to work,[6] improving the comfort of these residents during their summertime commutes, combined with addressing disparate canopy coverage, is critical.

Though increased tree canopy is widely supported by community members, residents are aware of barriers to implementing successful tree-planting programs and associated inequities. Tree survival rates, appropriate species selection, and maintenance are factors that should be considered when implementing tree-planting programs.[7,13] Questions about who will maintain and irrigate the trees and who will pay for maintenance are typical.[7,13] In addition, water shortages in California due to drought lead to water restrictions that are often misunderstood. From an equity standpoint, streets in lower income, urban areas frequently do not have sufficient space to plant new street trees.[7] Addressing tree canopy and equity concerns in these areas may require additional capital investment or land use improvements to encourage healthy root structures and healthy trees.

Housing and Energy Priorities

Affordable housing was often cited as one of the most pressing concerns facing Sacramento's residents,[1,2,3] especially for Black and Latino residents, who often disproportionately spend a greater amount of their income on housing.[2] While there is community support for more transit-oriented development,[3] longtime residents expressed concerns regarding anticipated increases in traffic, parked cars, and financial strain on limited neighborhood resources.[1,3] These data points, which were also supported by community benefits survey respondents, provide evidence that infill development and increased residential density near transit would be an effective strategy to address housing concerns.

For those who own or rent their property, there was support for building electrification and home insulation to reduce energy costs as long as the improvements did not limit functionality. Residents are generally in favor of electric appliances and installing rooftop solar panels where appropriate should local governments provide financial incentives to do so,[7,12] especially for lower income households.[7] Weatherization improvements to reduce energy costs received similar support and are identified as an opportunity to assist lower income residents in adapting to climate change.[7,12] Although supported by the community, concerns still exist over the accessibility of rebate programs, and the lack of incentive for landlords to pursue residential building electrification or weatherization for renter energy savings.[7]

Stakeholder Interviews

As a supplement to the community benefits survey and to serve as a further ground truthing mechanism with which to compare findings, the planning team conducted interviews with 27 representatives from 23 different CBO's, local governmental agencies, and other community groups (See Appendix D for the full list of organizations and the list of interview questions). The planning team started with the OAC members and asked for suggestions to identify additional further contacts. One recommendation from a community member also prompted the team to reach out to organizations serving unhoused communities in the region.

Community Stakeholder Priorities

Key Considerations to Maximize the Impact of Grant Funding:

1. Achieve economic and social equity goals through GHG reduction strategies.
2. Utilize community education and community-centric planning to shape behaviors and achieve sustainable emissions reduction.

Responses from the interviews show that community members feel burdened by each new survey that they are asked to complete and are often frustrated with what they perceive as a lack of action after they provide their input for various civic planning efforts. As one respondent expressed, communities are "tired of being asked what they want." They would like to see more decision making based on the concerns and priorities they share with each new community survey or engagement event. Other interviewees corroborated this sentiment, and while identifying priority strategies according to the organizations they represent, stressed that cost effectiveness should determine where the region invests first. Respondents generally described two important considerations for maximizing the impact of grant funding: i) achieving economic- and social-equity goals through GHG reduction strategies and ii) utilizing community education and community-centric planning to shape behaviors and achieve sustainable emissions reduction.

Respondents identified the value of co-benefits associated with emissions reduction strategies; not only do they want to see efficient emissions reduction, but they also want to see value added through reduced energy costs, better access to transportation, cleaner air, public education on sustainability, and access to recreation. For example, connecting residents to jobs and public amenities through improved public transportation or pedestrian infrastructure could reduce VMT while also providing economic and social benefits to isolated communities that cannot afford to buy an electric or ZEV. As one respondent stressed, "it is not merely reducing local pollution from vehicle exhaust that adequately addresses environmental injustice, but rather providing affordable and efficient clean transportation as a means to access better economic opportunities." Community members consider cleaner air from reduced vehicle exhaust to be a good first step but using climate funding to intentionally achieve economic equity through sustainable public infrastructure in underserved neighborhoods, is considered a better approach.

Stakeholder interviews allowed for a more nuanced understanding of regional priorities. When asked which sources of air pollution most impact communities, pollution from vehicle exhaust and wildfire smoke were most concerning, but concern for wildfire smoke and exposure was especially pronounced in mountain and valley-rural areas as well as among lower income residents who are more likely to work outdoors or use alternative mobility besides personal vehicle use. This is slightly inconsistent with the community benefits survey results which found that lower income residents are slightly less concerned about wildfire smoke, though this difference is potentially explained by the number of respondents living in urban versus mountain and valley-rural areas. Forest fuel treatments are a popular strategy especially favored by mountain and valley-rural area residents, while urban area residents were less likely to prioritize this strategy. Concern for air pollution from vehicle exhaust is more pronounced for lower income residents who often live closer to freeways and busy roads.

These community conversations reinforce the idea that without two-way communication between the planning team and community members, there is no guarantee that community concerns and priorities will be adequately considered in the development of a proposed project. Community engagement is necessary for a project to successfully and equitably move toward implementation. Respondents stress both the need to understand how communities will use new public infrastructure or programs as well as conduct culturally sensitive outreach to educate residents on how to take advantage of new infrastructure or programs. Also critical is the need for educational opportunities to empower members of under-resourced communities to take advantage of new clean jobs in fields such as building and vehicle electrification.

Equitable Implementation

Many stakeholders expressed concerns regarding the equitable implementation of regional climate action and made recommendations that can be categorized by the following: i) increasing community utilization of program benefits through education and financial assistance, ii) addressing community need amid competing priorities to maximize GHG reductions, and iii) improving housing affordability through changes to the built environment while minimizing displacement.

Recommendations for Equitable Implementation:

1. Use education and financial assistance to improve access.
2. Address community-specific needs amid competing priorities to maximize GHG reductions.
3. Improve housing affordability while addressing displacement.

While a myriad of factors may prevent residents in the Sacramento region from accessing the benefits of new climate programs, the lack of community education and financial barriers seem the most prevalent. It can be hard for residents to understand technical language in climate planning documents and fully grasp their direct benefits. LIDACs need educational campaigns with straightforward messaging to inform community members of the co-benefits of these climate solutions. If community members are unaware of public climate funding or programming, they would have no opportunity to access the funds or programming. Similarly, small businesses, farms, and owner-operators may not have the staff or time to pursue grant opportunities and other resources available to larger organizations and are thus excluded from regional programs. For those that are aware of beneficial climate programs, financial barriers may preclude their participation. For example, as one interviewee stated, "many lower income users will still need subsidies to access public EV charging stations, regardless of their availability or convenience." Another difficulty community members face is having the upfront capital to take advantage of rebate programs.

Multiple respondents acknowledged that GHG reduction is not a primary concern for lower income or under-resourced residents who may lack access to basic goods and services, reliable transportation or are struggling with high energy costs. Articulating proposed projects and programs in terms of GHG reductions rather than direct benefits may lead some residents to feel alienated and not pursue opportunities available to them; proposed projects should clearly present direct benefits to residents and how the project will address residential concerns. Planning teams should pursue projects that both reduce emissions and address identified community needs. These types of projects will see higher adoption rates and greater emission reductions in the long term.

An example of a project that reduces emissions and addresses community needs in urban areas is transit-oriented development coupled with infill development. These projects are popular according to the community benefits survey results and address multiple priorities: the local housing affordability crisis; better access to jobs, goods, and services; and reduced emissions through reduced VMT. However, many organizations representing lower income communities expressed concern over the threat of gentrification. As one respondent explained, "we don't need more housing for wealthy people and opportunities for real estate developers; build homes for people who actually live here." Being pushed out of central neighborhoods increases costs and barriers to accessing jobs, goods, and services thus exacerbating burdens on lower income residents.

An example of a project that addresses community needs in valley-rural and mountain areas is forest fuel treatments. Stakeholders noted that with smaller populations, rural and mountain area priorities are often left unfunded or underfunded. However, projects that reduce wildfires and wildfire smoke exposure benefit the entire Sacramento region. Smoke from wildfires in northern counties spreads to densely populated urban areas depending on wind direction and geographic characteristics. Additionally, unhoused populations, those living in inadequate housing, and those who lack access to a personal vehicle are more vulnerable to wildfire smoke due to increased exposure. Community members living with pre-existing health conditions, older adults, and children are also more vulnerable due to heightened sensitivity. Projects that mitigate wildfire smoke reduce GHG emissions, address community needs, and provide improved public health for the entire Sacramento region.

An additional housing-related concern expressed by multiple respondents is the lack of incentive for landlords to pursue residential building electrification or improve insulation in non-owner-occupied buildings when the energy savings are primarily seen by the tenants. The open-ended responses from the community benefits survey corroborate this concern. Stakeholders recommend that jurisdictions pursuing these programs find a way to support renters, especially since they disproportionately have lower incomes when compared to homeowners in the region.

Summary

Strategies for GHG mitigation that address public health and affordability concerns in the transportation, energy, and housing sectors receive broad community support. Projects that meet community needs and produce tangible co-benefits to vulnerable communities should be prioritized. In addition to reducing GHG emissions, climate projects must be planned in coordination with the community to increase the likelihood of successful implementation. Culturally sensitive outreach and educational campaigns should be used to reach as many community members as possible. Achieving social and economic equity while transitioning to greener and more resilient communities in the face of climate change will require intentional and ongoing community engagement to ensure that community priorities are centered during the implementation of regional climate projects and programs.

REFERENCES

[1] *The full list of organizations represented on the OAC is available in Appendix D*

[2] *The White House. 2021. Justice40. Available online at: https://www.whitehouse.gov/environmentaljustice/justice40/*

Chapter 5. Identifying Low-Income and Disadvantaged Communities

Prosperity and pollution burden are not evenly distributed within the capital region. The consequences of past decisions are evident in the air we breathe and the communities in which we live. To ensure that the Plan provides fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, LIDACs were identified to ensure their meaningful participation, and benefits from the measures are realized in these communities. This forwards not only the Justice40 initiative, which directs that at least 40% of benefits from federal investments to flow to identified LIDACs,[1] but also state and local goals for environmental justice and equity.

This chapter identifies LIDACs in the Sacramento-Roseville CSA and discusses their commonalities and differences. This information will guide decision making, ensuring that the most burdened communities receive co-benefits from measure implementation. The next chapter estimates the direct and indirect benefits to LIDACs from GHG emissions reduction measures as well as mitigation of any potential disbenefits.

LIDAC Screening Methodology

The Sacramento-Roseville CSA includes seven counties with a population of over 2,500,000, and the larger metropolitan areas of Sacramento and Yuba City-Marysville.[2] LIDACs have been identified based on the EPA's CPRG guidance:[1]

- **CEJST:** Any community identified as disadvantaged by the Climate and Economic Justice Screening Tool;
- **EJScreen:** Any census block group (CBG) that has a Supplemental Index at or above the 90th percentile on a state or national scale in EPA's Environmental Justice Screening and Mapping Tool (EJScreen); and/or,
- **Tribal Lands:** Any geographic area within federally recognized tribal lands.[1,3]

Additionally, the following California state definitions of disadvantaged or over-burdened communities were also included:

- **SB 535 (De León, 2012):** Includes census tracts with a CalEnviroScreen score above the 75th percentile in CalEnviroScreen Version 3.0 or 4.0,[4] census tracts with "high amounts of pollution and low populations," and federally recognized tribal lands.[5]
- **AB 617 (Garcia, 2017):** Includes communities identified by CARB and the Sac Metro Air District as particularly burdened by air pollution.[6] The 10 locally nominated communities on the Sac Metro Air District's existing list of priority communities are considered LIDACs in this analysis.

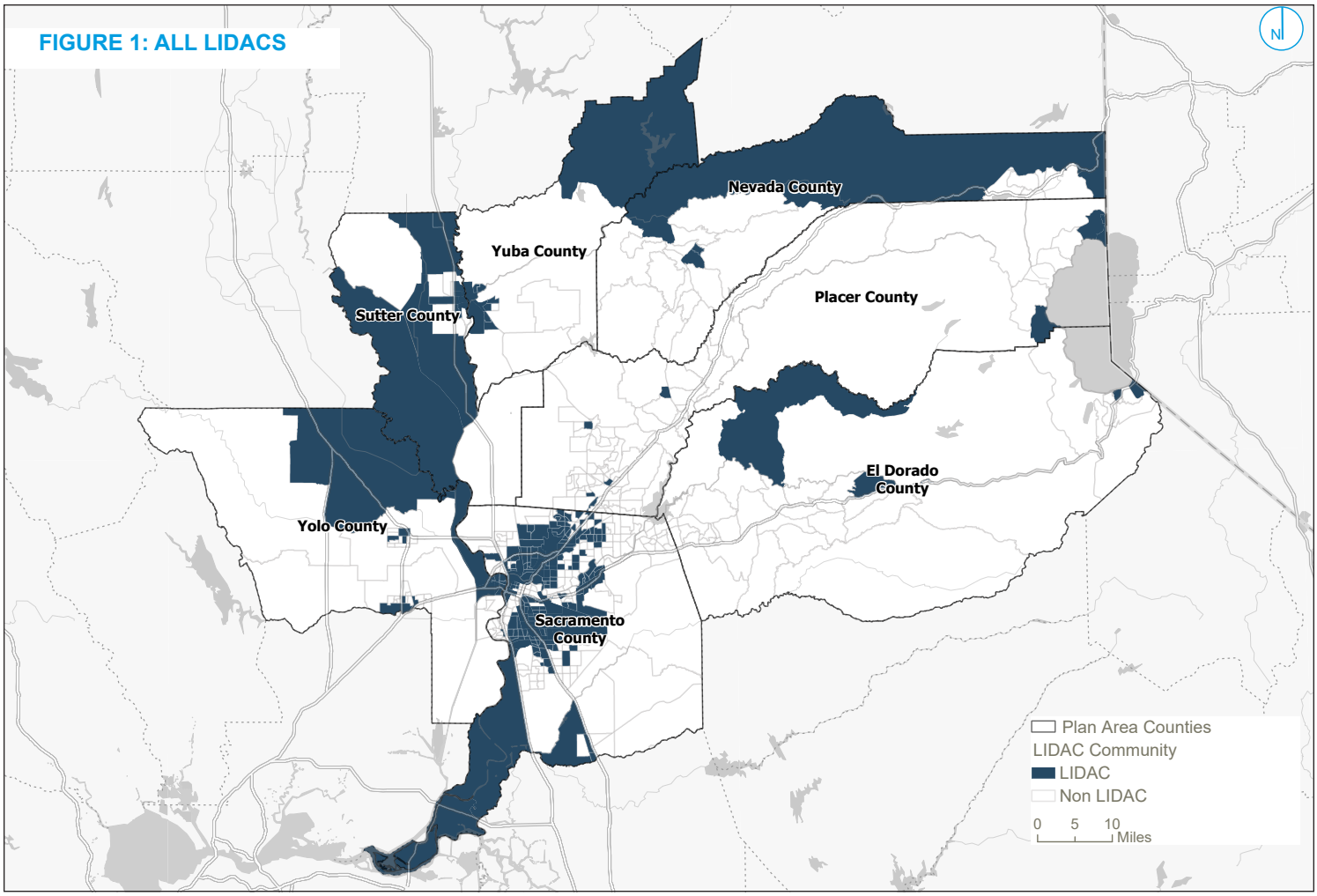
A detailed description of each screening tool and disadvantaged community definition is provided in Appendix E along with a description of the method used to identify the LIDACs. For the purposes of this Plan, LIDACs are identified through both CEJST as well as the supplemental data from EJScreen. As shown through a comparison of Figure 1 (showing all LIDACs) and Figure 2 (showing CEJST LIDACs), the addition of California state-specific disadvantaged communities data is generally consistent with the federal LIDAC definition.

In general, the Sacramento-Roseville CSA LIDACs are particularly vulnerable to climate impacts and risks including flood risk and wildfire risk. This Plan aims to deliver equitable GHG reductions in LIDACs while also improving public health, promoting economic development, creating jobs, building resiliency, building energy-efficient housing, and increasing sustainable transportation options.

LIDAC Analysis

The Sacramento-Roseville CSA LIDACs are shown in Figure 1. A complete list of LIDAC census tracts in the Sacramento-Roseville CSA is provided in Appendix F. The communities defined as a LIDAC and the community characteristics that led to a LIDAC classification are discussed below. Communities are also grouped by geographic region.

FIGURE 1: ALL LIDACS



General Results

Within the Sacramento-Roseville CSA, there are locations that contain multiple LIDACs that are referred to as "clusters" of LIDACs. Areas where clustering occurs includes the northwest and southeast portions of Sacramento County, the area surrounding Yuba City-Marysville, and City of West Sacramento. LIDACs tend to encompass a smaller geographic area, and it is common for clusters of LIDACs to occur near more heavily populated areas. The remainder of this section discusses LIDACs identified by each individual tool.

Table 1 provides the percentage of communities in each county that are classified as a LIDAC.

Table 1: Percent of Census Tracts Classified as a LIDAC by County

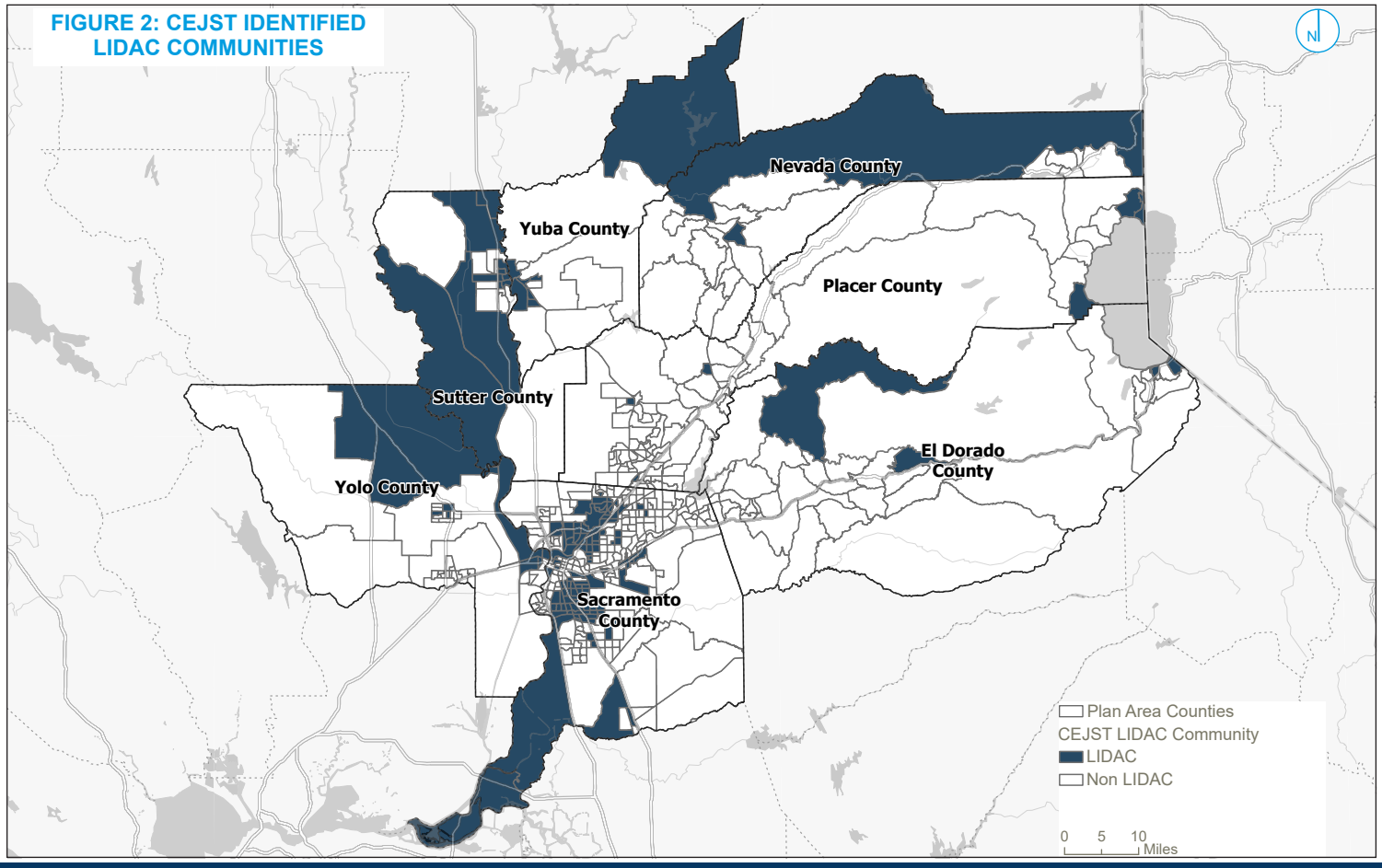
County	DAC in CEJST[1]	>90th Percentile EJScreen Supplemental Index[2]	SB 535 Community (CalEnviroScreen)[1]	Intersects Tribal Land[2]	AB 617[3]
Sacramento	34%	48%	18%	<1%	11%
Placer	7%	4%	0%	4%	–
Yolo	20%	23%	10%	2%	–
El Dorado	9%	0%	0%	4%	–
Sutter	52%	43%	24%	0%	–
Yuba	50%	47%	21%	11%	–
Nevada	10%	4%	0%	0%	–
Total Sacramento-Roseville CSA	**27%**	**33%**	**13%**	**2%**	**6%**

Notes:
1. Tool is based on 2010 census geographies
2. Tool is based on 2020 census geographies
3. AB 617 communities are only identified in Sacramento County

CEJST

Figure 2 shows the 27% of communities that are classified as a LIDAC due to identification as a disadvantaged community in CEJST. The location of LIDACs identified by CEJST reflects the general trends observed for all LIDACs: clustering of LIDACs in more urban areas, and multiple rural LIDACs.

FIGURE 2: CEJST IDENTIFIED LIDAC COMMUNITIES



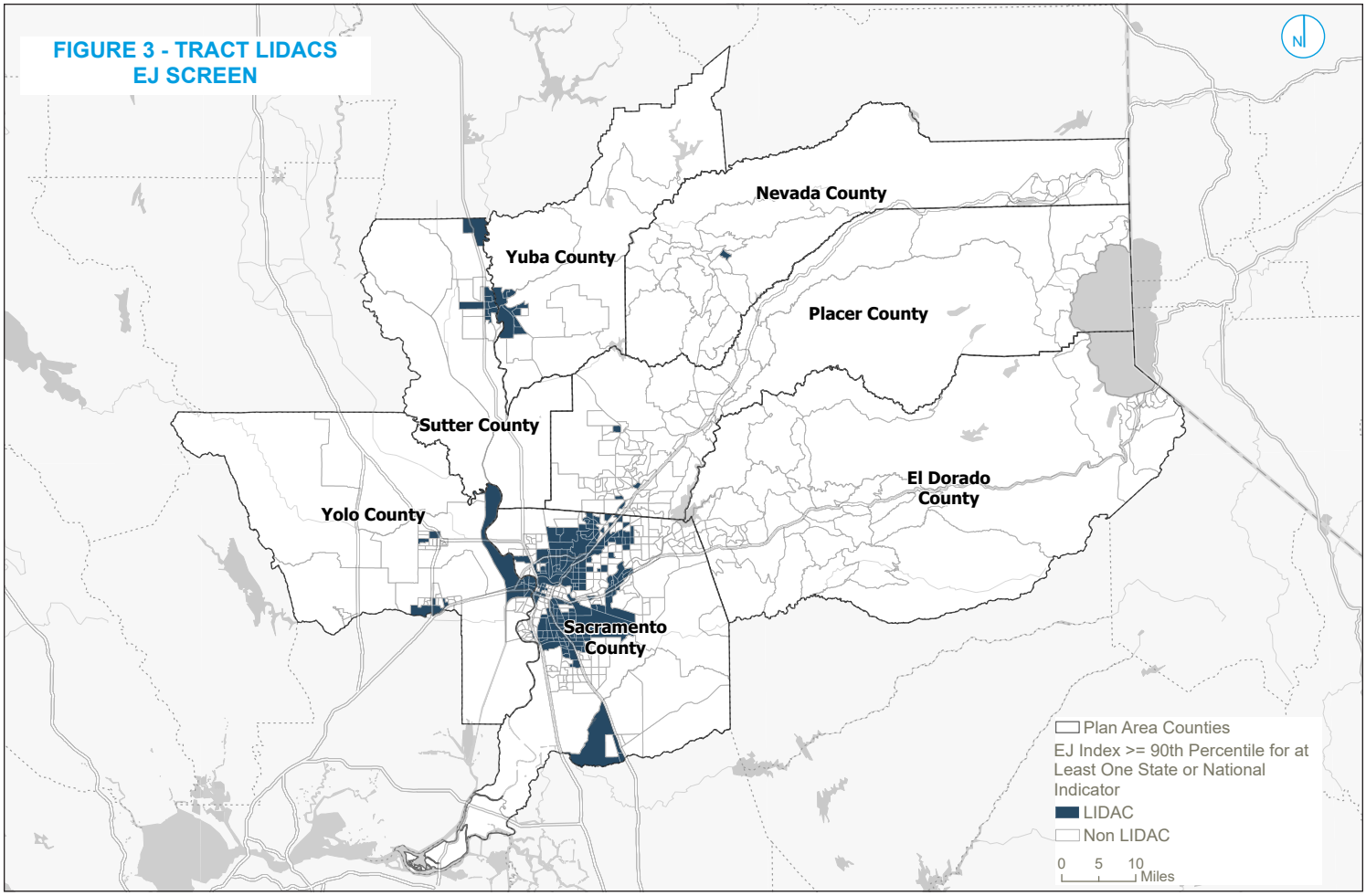
The inclusion of the larger, more rural communities as LIDACs in CEJST is due to CEJST considering climate change related indicators that are often based on a community's exposure to natural hazards. These climate change related indicators are not present in EJScreen or CalEnviroScreen suggesting that CEJST is the most likely of the three tools to include larger, rural communities as LIDACs.

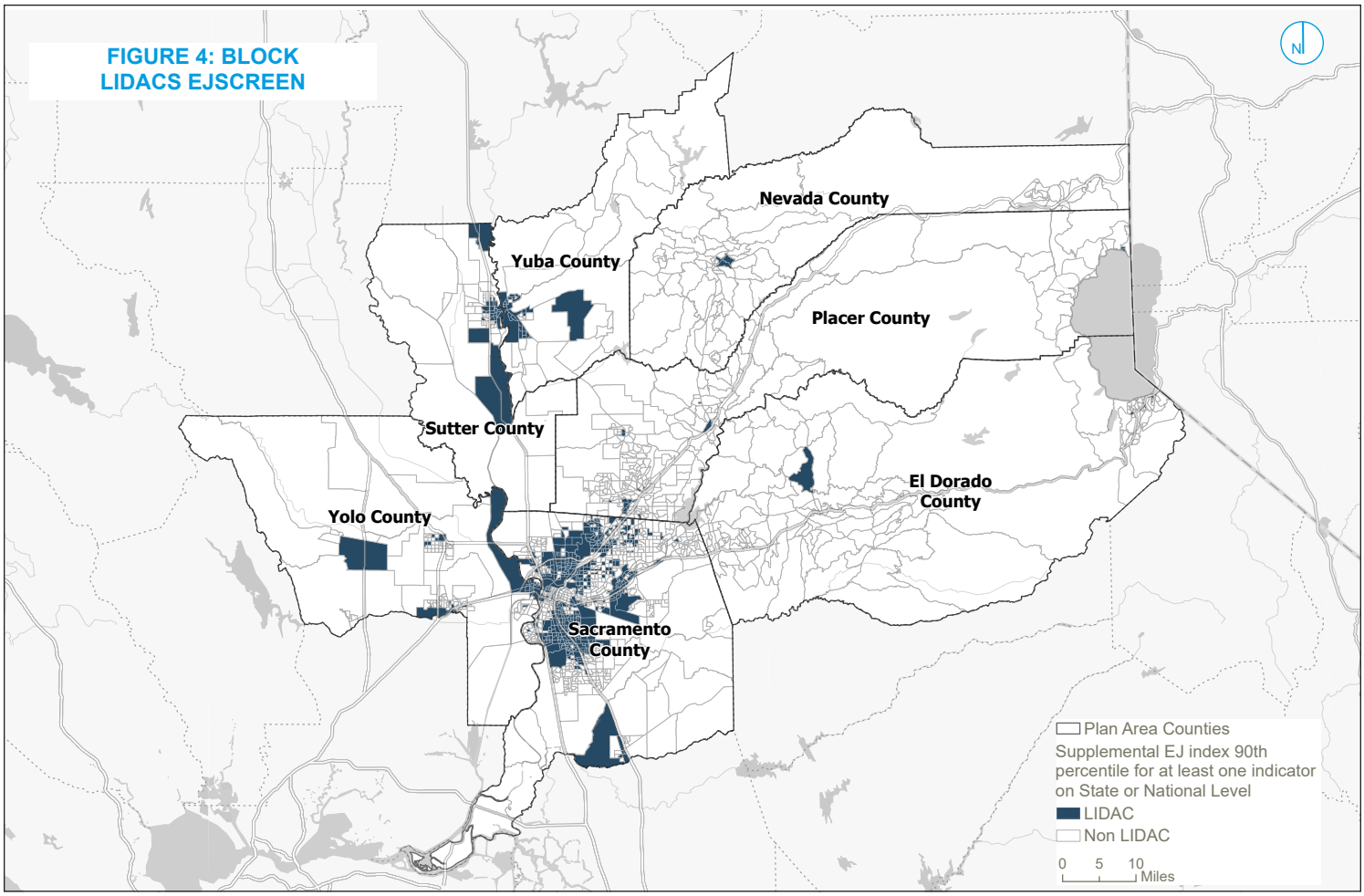
EJScreen

Figure 3 shows the 33% of census tracts in the Sacramento-Roseville CSA identified as LIDACs in EJScreen. EJScreen is also the only tool used in this study that provides higher-resolution CBG data (Figure 4). There are a total of 1,773 CBGs in the Sacramento-Roseville CSA with 32% of those CBGs identified as a LIDAC. This value is comparable to the overall percentage of census tracts (33%) identified as LIDACs in EJScreen.

When comparing the CBGs identified as LIDACs to the census tracts identified as LIDACs (Figures 3 and 4) there are slight differences in the exact location of the LIDACs. For example, there are larger CBGs in central Yuba County and central Yolo County that are identified as LIDACs; however, the census tracts that encompass these CBGs are not classified as LIDACs. This occurs when the averaged Supplemental Index data of all CBGs in a tract does not exceed the 90th percentile, which is why the corresponding census tract is not considered a LIDAC.

Although EJScreen can identify a LIDAC on the CBG level, the remainder of this analysis focuses on census tract level geography for two main reasons. First, CBG data describes smaller areas which leads to uncertainty. Expanding the analysis to a larger population area that covers multiple CBGs, such as a census tract, helps to reduce the uncertainty associated with these estimates.[7] Second, census tract data is comparable across all tools used in the analysis since it is the highest resolution of data used in CEJST and CalEnviroScreen. A list of all CBGs identified as LIDACs is provided in Appendix F.

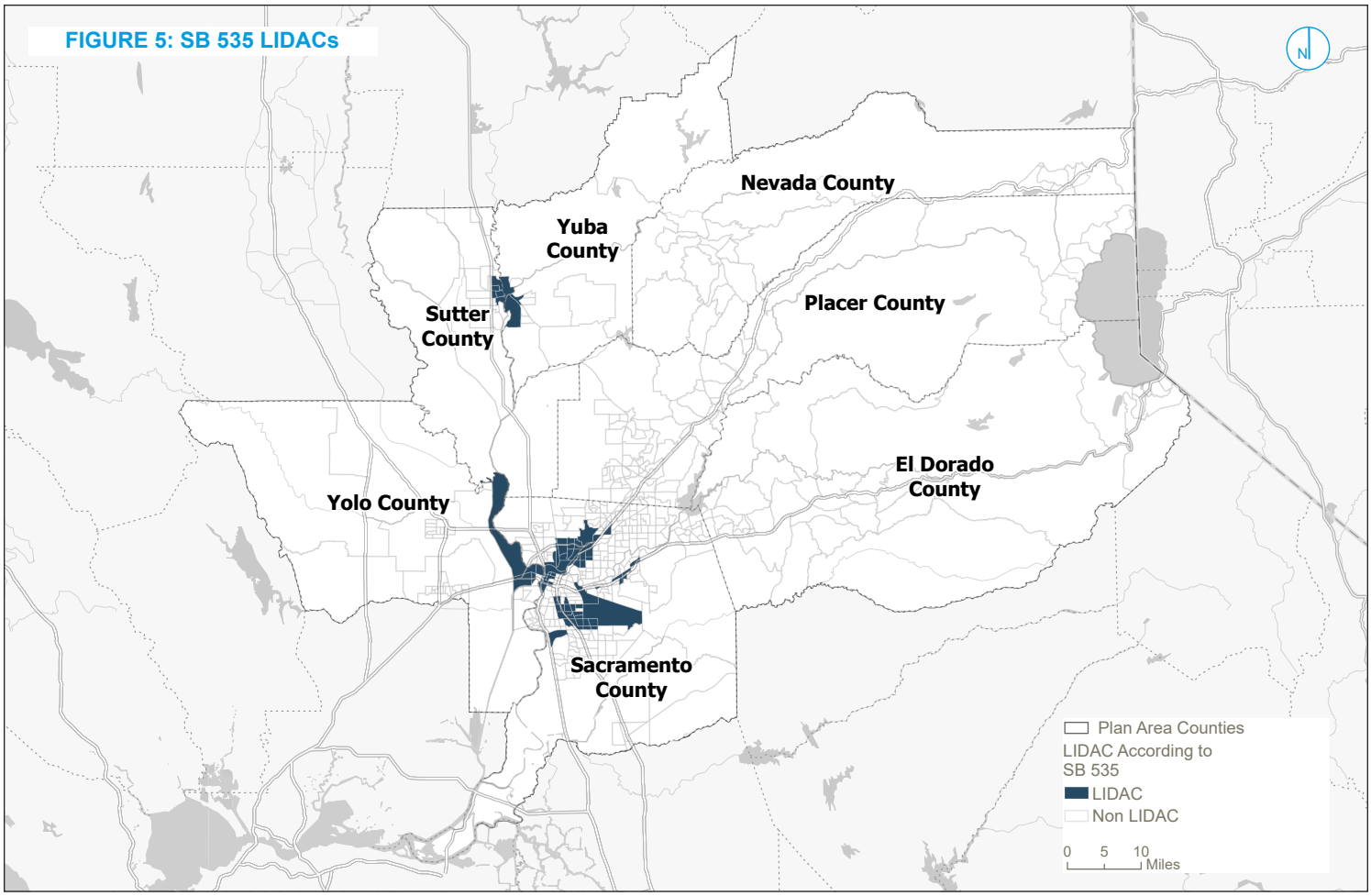




SB 535 (CalEnviroScreen)

Figure 5 shows that 13% of communities in the Sacramento-Roseville CSA are classified as LIDACs by SB 535. This is a lower percentage compared to CEJST (27%) and EJScreen (33%) partially because SB 535 considers a community a LIDAC based on a state percentile scale. Industrial areas in coastal California are likely to have higher concentrations of communities that meet these criteria compared to the communities in the Sacramento-Roseville CSA.

LIDACs identified by SB 535 tend to be near Sacramento or Yuba City. Three counties, Placer County, El Dorado County, and Nevada County, do not have LIDACs identified by SB 535. The trends that lead to communities being classified as LIDACs in CalEnviroScreen are discussed further below.



Tribal Communities

There are five federally recognized tribal lands located in five of the counties in the Sacramento-Roseville CSA (Figure 6). A total of nine census tracts (based on 2020 geography) intersect with a federally recognized tribal area. Table 2 describes the location of the federally recognized tribal lands in the Sacramento-Roseville CSA. It is important to note that the location of federally recognized tribal lands may not reflect the lands that are culturally significant to members of tribal communities, or where members may live or work. Meaningful community engagement with members of tribal communities helps determine what areas in the Sacramento-Roseville CSA hold significance for members of tribal communities, and meaningful community engagement is especially necessary to determine benefits from GHG reduction measures for tribal communities.

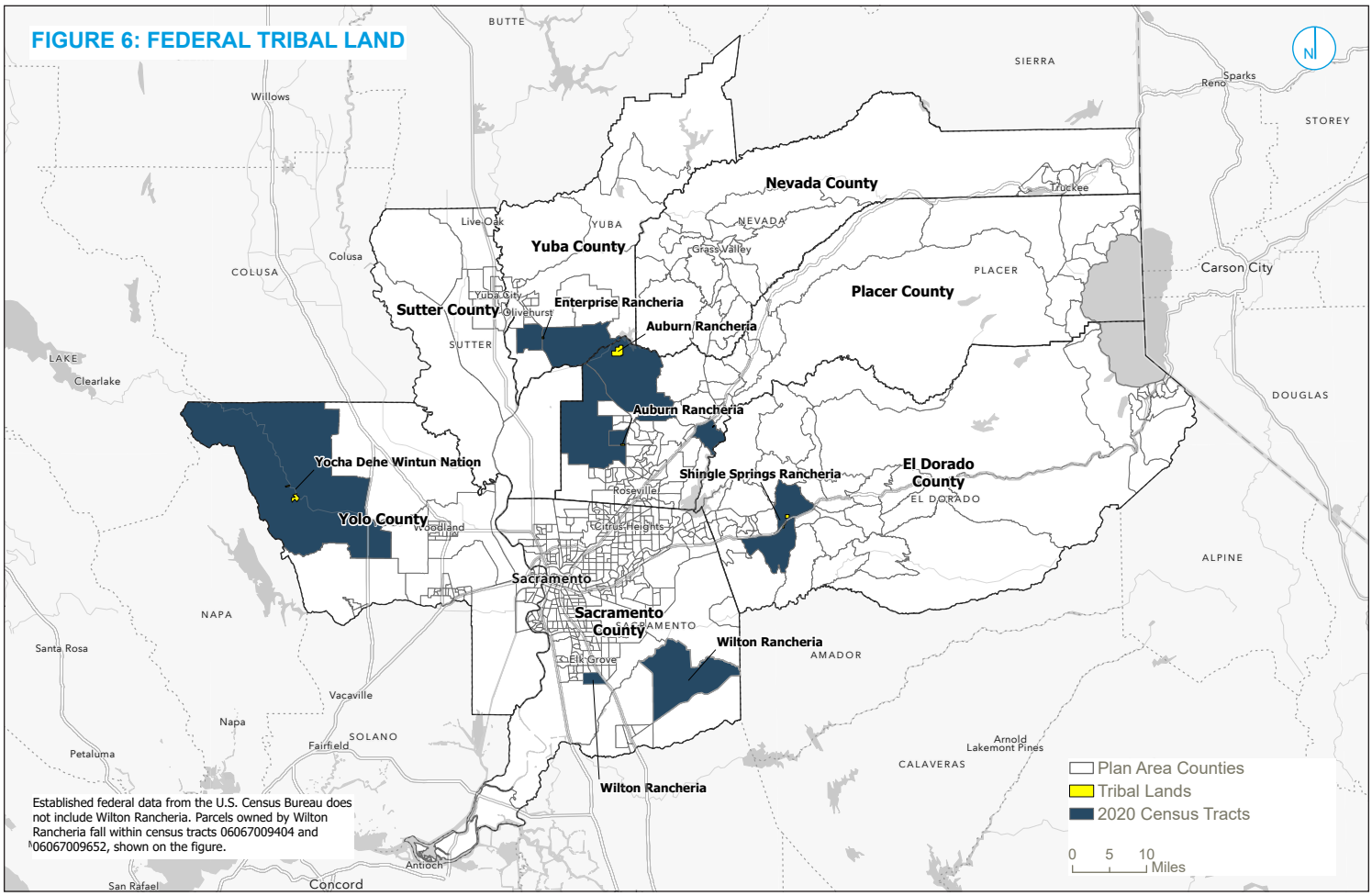
Table 2: Location and Population of Federally Recognized Tribal Lands in the Sacramento-Roseville CSA

Name	County	2020 Census Tract(s)[2]
Wilton Rancheria	Sacramento County	06067009652
Auburn Rancheria[4,5]	Placer County	06061023200, 06061021328, 06061021304, 06061020502
Yocha Dehe Wintun Nation[3]	Yolo County	06113011500
Shingle Springs Rancheria	El Dorado County	06017030804, 06017030902
Enterprise Rancheria[6]	Yuba County	06115040800, 06115040702

Notes:

1. All population estimates discussed below are based on data from the American Census Survey (ACS) 2018-2022 5-year Report.[8]
2. Based on 2020 census geographies.
3. Formerly known as Rumsey Indian Rancheria.
4. Also known as the United Auburn Indian Community.
5. The Auburn Indian Restoration Act was passed in 1994 which led to the restoration of the Tribe's federal recognition and acquisition of land in Placer County establishing a new reservation and investing in entertainment destinations including Thunder Valley Casino Resort and The Venue.
6. The tribal community is historically comprised of the Estom Yumeka Maidu Tribe alongside a General Council that sets the policies for the Enterprise Rancheria.

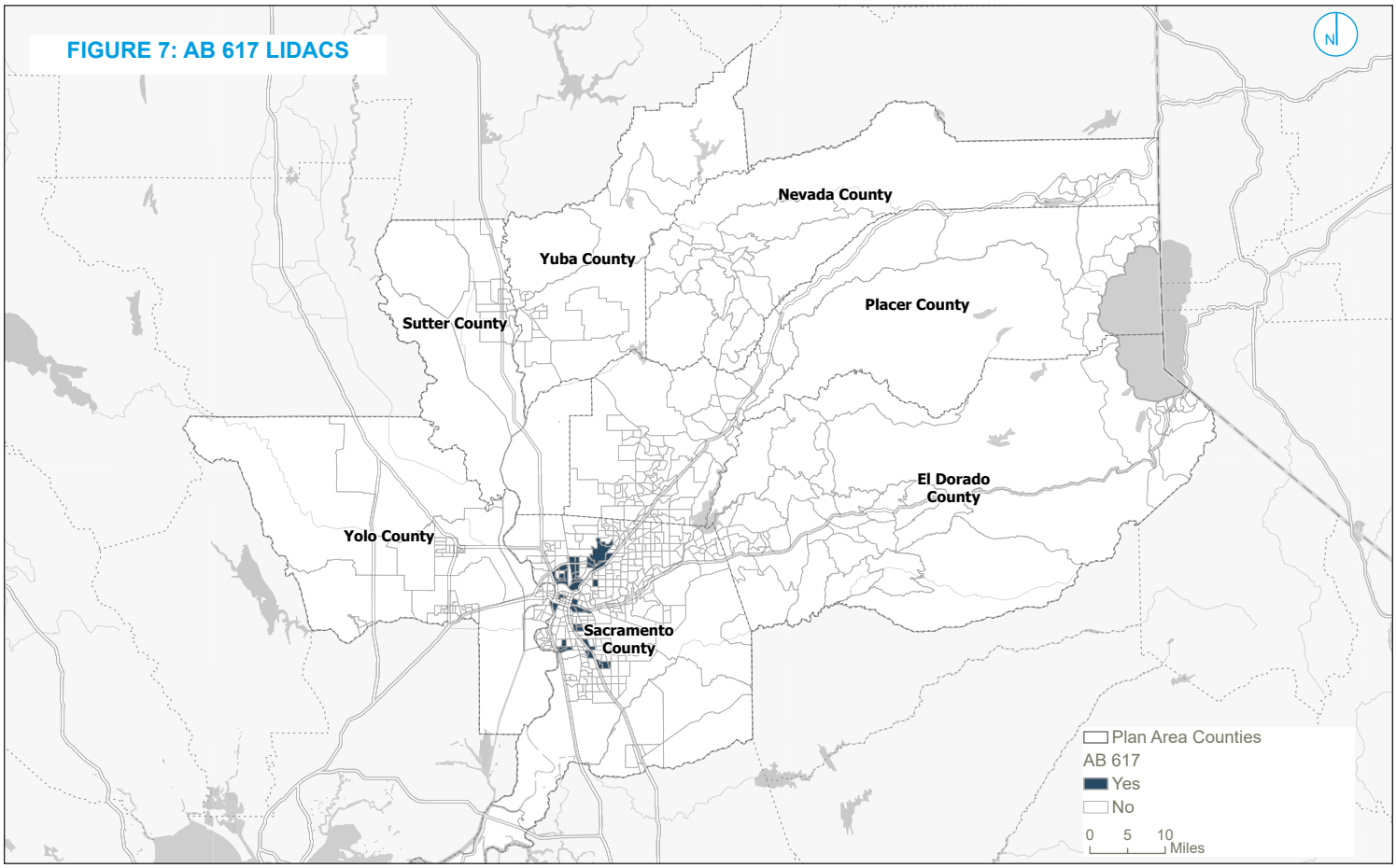
FIGURE 6: FEDERAL TRIBAL LAND



AB 617 Communities

Communities in the Sacramento-Roseville CSA identified as disproportionately exposed and impacted by air pollution by either the Sac Metro Air District or CARB are also included as LIDACs (Figure 7). Unlike other criteria used in this analysis that are based on individual environmental or demographic indicators, the AB 617 (Garcia, 2017) communities listed here are classified by CARB, the Sac Metro Air District, and local community members.[9] These LIDACs were only present in Sacramento County where 11% of communities are identified as LIDACs because of AB 617 (Table 1).

FIGURE 7: AB 617 LIDACS



LIDACs Within Similar Geographic Regions

A discussion of what burdens impact LIDACs can enhance community-identified concerns expressed during community engagement and can also inform whether specific benefits will effectively flow to LIDACs to mitigate existing burdens. Existing burdens were grouped into the following eight categories as discussed in Appendix E: workforce development, legacy pollution, health, transportation, water and wastewater, energy, climate change, and housing. Based on the results from community engagement for this Plan, the top two emerging priorities relate to improved public health and lower energy bills.

Table 3 illustrates how often a specific category exceeds the established threshold and triggers a community to be classified as a LIDAC at the county level. Table 4 shows how many categories are exceeded by individual LIDACs by county level. Understanding whether there are exceedances of multiple categories in one LIDAC can help provide information on which communities are the most impacted by potentially related EJ concerns. This is discussed further in the subsections below and shown visually in Figure 8. Additionally, Figures 9a-9h provided in Appendix G, show which LIDACs experience an exceedance of individual categories.

Table 3: Percent of Census Tracts Identified as a LIDAC for Each Indicator Category

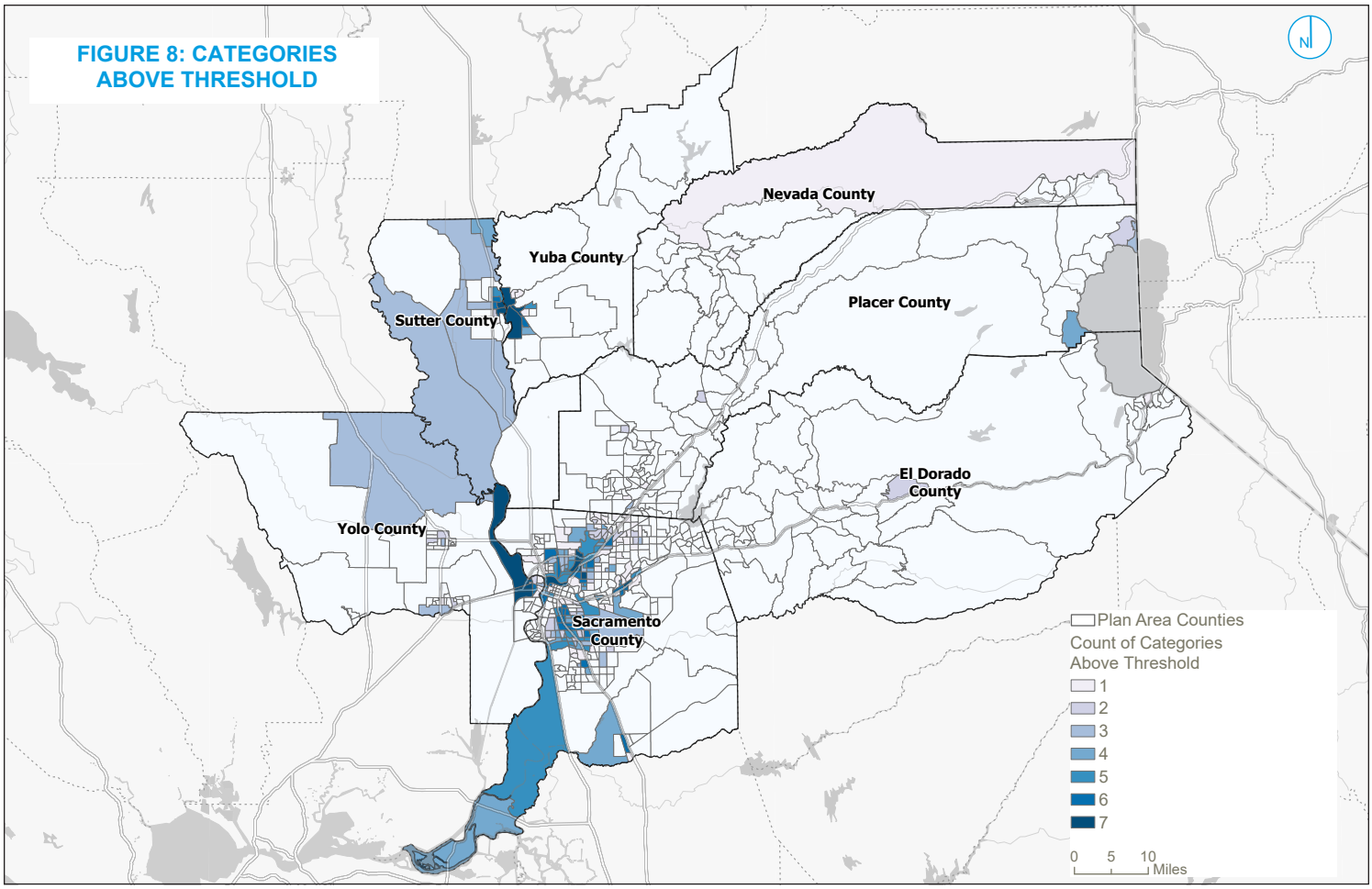
County	Climate Change[1]	Energy[1]	Health	Housing	Legacy Pollution	Transportation	Water and Wastewater	Workforce Development[2]
Sacramento	35%	–	93%	37%	74%	41%	38%	72%
Placer	100%	33%	38%	38%	25%	–	–	33%
Yolo	63%	–	60%	40%	87%	40%	33%	50%
El Dorado	100%	–	–	50%	–	–	–	25%
Sutter	82%	–	75%	50%	92%	58%	25%	45%
Yuba	100%	–	90%	40%	60%	50%	50%	71%
Nevada	100%	–	–	–	33%	–	–	50%
Total Sacramento-Roseville CSA	**48%**	**1%**	**85%**	**38%**	**71%**	**39%**	**35%**	**66%**

Notes:
1. Category is only available in CEJST.
2. Category is only available in CEJST and CalEnviroScreen.

Table 4: Number of Categories that Lead to LIDAC Classification

County	1-2 Categories Exceeded	3-4 Categories Exceeded	5 or More Categories Exceeded
Sacramento	38%	28%	35%
Placer	63%	38%	0%
Yolo	47%	27%	27%
El Dorado	75%	25%	0%
Sutter	17%	42%	42%
Yuba	40%	10%	50%
Nevada	100%	0%	0%
Total Sacramento-Roseville CSA	**40%**	**27%**	**33%**

To ensure consistency with community engagement that was conducted as part of this Plan, the Sacramento-Roseville CSA LIDACs are grouped into four categories: urban, suburban, valley-rural, and mountain-rural. The following section provides a more detailed discussion of each of these LIDAC groups in the Sacramento-Roseville CSA.



Urban LIDACs

The central city in Sacramento is the only urban LIDAC in the Sacramento-Roseville CSA and contains multiple LIDACs. This smaller geographic area is bound by the Sacramento River on the west, the American River to the north, Alhambra Boulevard to the east, and Broadway to the south.

Urban LIDACs in the central city tend to be classified as LIDACs due to multiple categories, most notably health, legacy pollution, and workforce development. Some urban communities are classified as LIDACs due to seven of the eight possible categories indicating that these communities face numerous environmental and demographic burdens (Figure 8). Many of the individual indicators that contribute to a LIDAC classification are related to air quality. Air toxics cancer risk, air toxics respiratory hazard index, particulate matter 2.5 microns or less ($PM_{2.5}$), and ozone are all indicators that lead to communities in the central city being classified as LIDACs. A total of 11% of Sacramento County communities, including some in downtown Sacramento, are also considered LIDACs due to classification as a priority AB 617 community.

Many of these communities also face workforce development related burdens including linguistic isolation, low income, and high school non-attainment. The high number of burdens in urban LIDACs suggests that implementation of multiple GHG reduction measures would benefit urban LIDACs in the Sacramento-Roseville CSA.

Suburban LIDACs

Suburban communities in the Sacramento-Roseville CSA include communities near Roseville (south Placer County and western El Dorado County), in Yolo County near West Sacramento, and in parts of Sacramento County spanning from Elk Grove to the northern border of the county.

Most LIDACs in Sacramento County are considered suburban LIDACs. Suburban LIDACs in Sacramento County face similar burdens to the urban LIDACs, specifically exceedances of health and legacy pollution related variables. Almost 100% of LIDACs in Sacramento County face burdens due to Health related indicators such as air toxics cancer risk or air toxics respiratory hazard index. Legacy pollution related indicators contribute to the LIDAC classification of nearly 75% Sacramento County LIDACs with 40% of tracts identified as LIDACs due to ozone. Some suburban LIDACs in Sacramento County are also considered priority AB 617 communities demonstrating that air quality concerns in the Sacramento-Roseville CSA affect both urban and suburban LIDACs. About 70% of LIDACs in Sacramento County that are suburban or urban LIDACs are classified as LIDACs due to a workforce development related indicator, further demonstrating the potential demographic burdens in the county. Two additional communities near Elk Grove are considered suburban LIDACs due to overlap with Wilton Rancheria.

Suburban LIDACs in Yolo County also face burdens related to health and legacy pollution. An additional legacy pollution related indicator that leads to LIDAC classification is the proximity to a risk management plan facility suggesting that there are polluting facilities near suburban LIDACs in Yolo County. Portions of Placer County and El Dorado County are considered suburban, but do not have many suburban LIDACs. El Dorado County does not have any areas classified as suburban LIDACs. There are four suburban LIDACs in the western part of Placer County due to indicators related to climate change, energy, and legacy pollution. While some of these communities are identified as low income, they do not face as many workforce development related burdens as suburban LIDACs in Sacramento County and Yolo County.

The total number of categories that influence a LIDAC classification is another key difference between suburban LIDACs in Placer County, and those in Sacramento County and Yolo County. Figure 8 shows that the suburban LIDACs in Placer County are classified as LIDACs due to one to three different categories suggesting that specific benefits may be more likely to reduce burdens in these LIDACs. Multiple suburban LIDACs in Sacramento County and Yolo County face burdens related to four or more categories. There are also areas with clusters of suburban LIDACs in Sacramento south of downtown, and northeast of downtown.

Mountain-Rural LIDACs

Multiple parts of the Sacramento-Roseville CSA intersect with the Sierra Nevada mountains and are considered mountain-rural communities. Mountain-rural communities are geographically large, sparsely populated, and include the areas of eastern El Dorado County, eastern Placer County, eastern Nevada County, and northern Yuba County. Mountain-rural communities are less likely to be classified as LIDACs compared to the urban and suburban areas of the Sacramento-Roseville CSA.

All mountain-rural LIDACs classified as such due to EJ screening tools experience an exceedance of a Climate Change related indicator. Climate change related indicators include the wildfire risk, expected agricultural loss rate, the expected building loss rate, and the expected population loss rate. The latter three of these indicators are all based on susceptibility to 14 natural hazards common in mountainous environments including avalanches, ice storms, wildfire, and winter weather.[7] This is consistent with community concerns identified through community engagement, where over 70% of valley-rural and mountain area respondents expressed concern for wildfires and wildfire smoke exposure.

Therefore, benefits focused on building resilience to these climate change related indicators could effectively assist mountain-rural LIDACs when exposed to a natural hazard. Other common categories that lead to mountain-rural communities being classified as LIDACs are workforce development and housing. The presence of second homes and short-term rental properties may exacerbate some of the workforce development and housing related indicators by increasing the cost of housing and decreasing affordability in these areas. One area of western Placer County is considered a mountain-rural LIDAC due to overlap with the Auburn Rancheria.

Valley-Rural LIDACs

Valley-rural communities in the Sacramento-Roseville CSA are located west of the Sierra Nevada mountains on the outskirts of the Sacramento metro area and the Sacramento-San Joaquin River Delta. All communities in Sutter County, and most communities in Yolo County and Yuba County are considered valley-rural communities. Small portions of the four other counties in the Sacramento-Roseville CSA, excluding Nevada County, are also considered valley-rural communities.

The Auburn Rancheria is considered a LIDAC located on the western end of Placer County, as well as the Shingle Springs Rancheria located on the western end of El Dorado County. The Enterprise Rancheria in Yuba County and the Yocha Dehe Wintun Nation in Yolo County are other federally recognized tribes located in valley-rural LIDACs.

In addition, the Delta in southwest Sacramento County and the Yuba City-Marysville area, located on the border of Yuba County and Sutter County, are valley-rural LIDACs. Climate change, health, and legacy pollution are the categories that most commonly lead to a LIDAC classification in this area. The most common individual indicators leading to a LIDAC classification in the Yuba-Sutter area are $PM_{2.5}$, air toxics respiratory hazard index, poverty, unemployment, cardiovascular disease, and proximity to a risk management plan facility. Yuba County is also the county in the Sacramento-Roseville CSA with the highest number of communities classified as a LIDAC due to water and wastewater related indicators (50%). The Yuba-Sutter area is one of the areas in the Sacramento-Roseville CSA with the highest number of LIDACs facing multiple burdens (Figure 8). Specifically, 73% of LIDACs in these valley-rural counties are overburdened by at least three different categories.

In Yolo County, legacy pollution, climate change, and health related indicators are all factors that influence the classification of valley-rural LIDACs. About 47% of LIDACs are classified as such due to exceedances of one or two categories with the other 53% of communities facing impacts from three or more categories. Communities that face impacts from a higher number of categories in Yolo County are in the City of West Sacramento and unincorporated Knights Landing. These communities are likely to benefit from a greater variety of GHG reduction measures since they face a wider variety of impacts.

LIDAC Conclusions

Multiple communities are classified as LIDACs in the Sacramento-Roseville CSA due to burdens that fall into a variety of different categories. Key takeaways from identifying LIDACs in the Sacramento-Roseville CSA are:

- Clusters of multiple communities classified as LIDACs exist near Sacramento, Yuba City-Marysville, and communities along the Sacramento River spanning urban, suburban, and valley-rural geographies.
- Mountain-rural LIDACs tend to be classified as LIDACs due to one or two different categories. Specifically, the climate change category affects all mountain-rural communities classified as a LIDAC by CEJST.
- The highest concentration of LIDACs that are overburdened by multiple indicators are located near Sacramento and Yuba City-Marysville. These communities may be classified as a LIDAC due to indicators in five or more different categories.

While this analysis points to trends that are present in LIDACs, each LIDAC is a unique community whose residents have their own individual lived experiences. The most effective way to understand the needs of a community is to conduct meaningful engagement with the residents living within that community. The results of the LIDAC identification analysis and insight from community engagement efforts help inform the flow of benefits to LIDACs in the Sacramento-Roseville CSA.

REFERENCES

[1] *USEPA. Accessed December 18, 2023. Climate Pollution Reduction Grants: LIDAC Benefits Analysis. Available at: https://www.epa.gov system/files/documents/2023-08/Low%20Income%20%20Disadvantaged%20Communities%20Benefits%20Analysis.pdf*

[2] *The seven counties included in the Sacramento Roseville CSA are Sacramento, Yolo, Sutter, Yuba, Nevada, Placer, and El Dorado Counties. Sac Metro Air District Air District. 2017. About Us. Available at: https://www.airquality.org/about-us#:~:text=Sac%20Metro%20Air%2 District%20is,Counties%20up%20to%20the%20Sierra*

[3] *CPRG guidance clarifies that tribal lands include "Alaska Native Allotments (EPA Metadata Record), Alaska Native Villages (EPA Metadata Record), American Indian Reservations (EPA Metadata Record), American Indian Off-reservation Trust Lands (EPA Metadata Record), Oklahoma Tribal Statistical Areas (EPA Metadata Record)".*

[4] *The CalEnviroScreen score combines pollution burden with population characteristics to come up with a single score based on a total of 21 statewide indicators. OEHHA. October 2021. CalEnviroScreen 4.0 Technical Documentation. Available at: https://oehha.ca.gov/media downloads/calenviroscreen/report/calenviroscreen40reportf2021.pdf*

[5] *OEHHA. May 2022. SB 535 Disadvantaged Communities. Available at: https://oehha.ca.gov/calenviroscreen/sb535*

[6] *CARB. 2023. Community Air Protection Program: About. Available at: https://ww2.arb.ca.gov/capp/about*

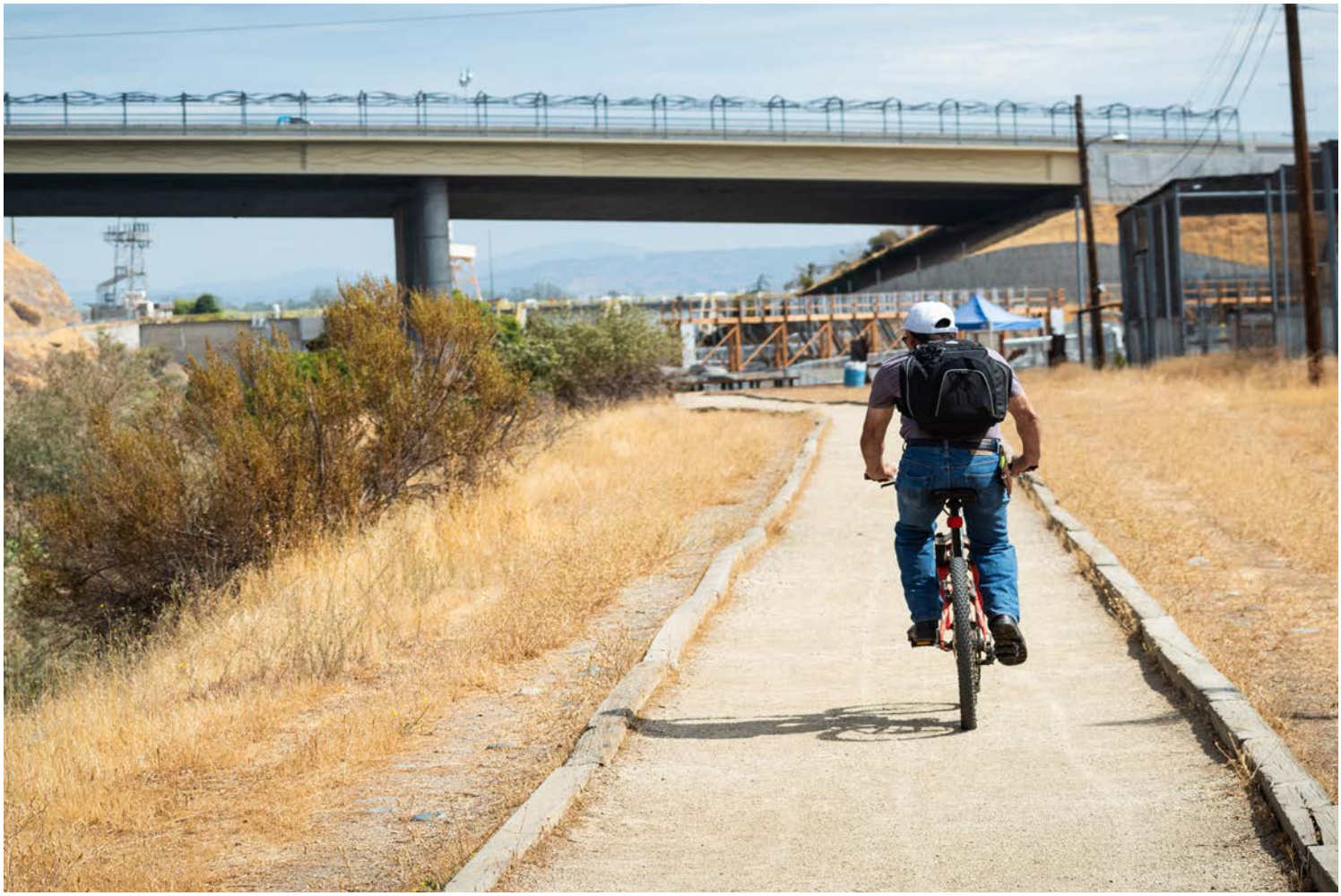
[7] *USEPA. January 9, 2024. Limitations and Caveats in Using EJScreen. Available at: https://www.epa.gov/ejscreen/limitations-and-caveats using-ejscreen#:~:text=EJScreen%20cannot%20provide%20data%20on,complete%20picture%20of%20a%20location.*

[8] *US Census Bureau. 2018-2022 ACS 5-year Results. My Tribal Area. Available at: https://www.census.gov/tribal/*

[9] *Sac Metro Air District Air Quality Management District. Accessed January 24, 2024. Community Air Monitoring. Available at: https://www airquality.org/Air-Quality-Health/Community-Air-Protection/Community-Air-Monitoring*

Chapter 6. Low-Income and Disadvantaged Community Benefits Analysis

Advancing Health and Equity



The landscape of human health has changed greatly since the start of the Industrial Revolution. In the 1700s, the principal causes of death were transmittable diseases such as tuberculosis and malaria. Today, leading causes of death are chronic, "lifestyle" illnesses such as heart disease and cancer. The burning of fossil fuels for energy has profoundly impacted human health in two particularly powerful pathways: (1) the generation of air pollution, causing primary and secondary health damage; (2) and the widespread use of vehicles and equipment that reduce or eliminate the need for daily physical activity. Lack of physical activity is a stressor that increases systemic inflammation which underlies the development of chronic disease.

The environments where people are born, live, learn, work, play, worship, and age affect a wide range of health outcomes. Health outcomes are strongly tied to neighborhood environments and community conditions. The social determinants of health include housing, transportation, and neighborhoods; racism, discrimination, and violence; education, job opportunities, and income; access to nutritious foods and physical activity opportunities; language and linguistic isolation; and polluted air and water.[1]

The social determinants of health also contribute to wide health disparities and inequities. Conditions that support health, such as access to education, good job opportunities, and clean air and water, vary drastically by neighborhood.[2] For example, in low-income communities, where walking outdoors may be considered dangerous, and few or no playgrounds exist for children, and streets are hot and without shade, achieving daily physical activity is difficult, and raises the risk of health conditions like heart disease, type 2 diabetes, and obesity. These factors lower life expectancy relative to people who do have access to safe walking environments. In these areas, not only are the residents exposed to higher levels of negative environmental factors, but because of the chronic stressors inherent in a life with limited resources, they are less resilient to environmental influences on health. Chronic or repeated challenges that individuals experience as stressful cause chronically elevated or fluctuating stress hormone and neural responses, leading to the development of heart disease, type 2 diabetes, chronic pain, fatigue, and other conditions.[3] This increases community vulnerability to both transmittable and chronic illness.

The good news is that collectively, the GHG reduction measures in this Plan offer a tremendous opportunity to reverse the trends and burdens of obesity, chronic illness, and health inequity. They offer a chance to move away from treating chronic illnesses with a medical approach – such as medications and surgery – and to instead confronting the underlying causes of illness by creating a more health-supportive environment. Nearly all of the GHG reduction measures in this Plan have significant health co-benefits that manifest on a regional, local, or individual basis. These are detailed in the sections describing each measure. An additional advantage is that these health co-benefits will be experienced faster than the climate mitigation benefits – and usually more locally, in the communities that have been most harmed.

Perhaps the biggest health payoff in this Plan is in the land use and transportation measures. Growing research finds consensus around how built environments that facilitate shorter vehicle trips and active modes of transportation tend to have lower rates of obesity, heart disease, and costs due to illnesses related to these conditions. Reducing VMT per capita in a region diminishes acute health impacts (injuries and deaths due to vehicle collisions) as well as chronic health impacts (obesity, hypertension, type 2 diabetes, and heart disease).[4]

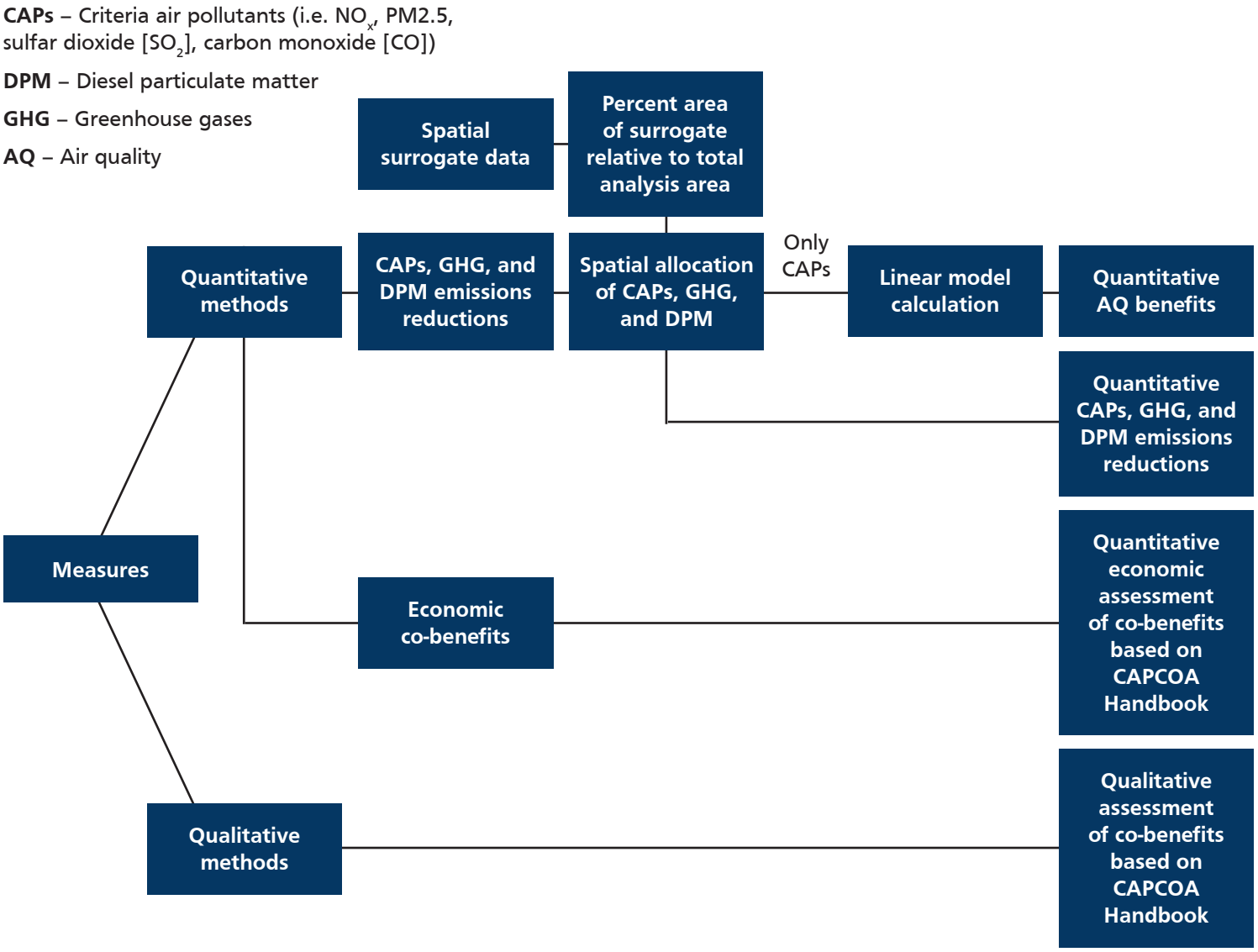
Tremendous health co-benefits are also realized with the reductions in air pollution emissions. Fine particulates can alter not only respiratory and cardiovascular systems, but also metabolism, gestation, and the nervous system. Air pollutants have greater impacts on vulnerable populations,[5] and can exacerbate existing chronic illnesses. Fine particulate emissions are locally concentrated, and sources of fine particulates are likely to have more impact on vulnerable communities than in communities more representative of the average population of the region. While modeling for this Plan focused on the regional scale, the localized benefits are discussed qualitatively in the measures.

The vision of this Plan is to reduce GHG emissions while delivering other important advantages, including better respiratory health; improved physical fitness; less emotional stress; cleaner air; a quieter environment; fewer traffic injuries and deaths; and greater access to food, health care, and other essentials for healthy living. Reducing GHG emissions in the most disadvantaged communities can bring health co-benefits to where they are needed most, while also delivering improved health on a larger, regional scale. Once implemented, these GHG reduction measures will move the region toward a healthier, more equitable future.

Methodology for LIDAC Benefits Analysis

GHG emissions reduction measures selected for implementation are anticipated to alleviate the risks and impacts of climate change and provide additional co-benefits. Benefits identified in low-income and disadvantaged communities (LIDAC) were evaluated following the EPA's CPRG Technical Reference Document for Benefits Analyses: Low-Income and Disadvantaged Communities[6] and the CAPCOA Handbook.[7] Figure 1 shows a diagram of the methodology used to evaluate these benefits, with more details provided in Appendix H. Quantified LIDAC benefits include the amount of air pollutants and GHG reductions and the economic co-benefits of these reductions. Since exact project locations for measures implementation are not known, spatial surrogates were used to help identify likely areas of implementation. Qualitative co-benefits are estimated based on the CAPCOA Handbook guidelines.

Figure 1: Methodology Diagram



LIDAC benefits will vary depending on how much the community is already burdened and the extent to which measures can be implemented in or near the community. When measures can be implemented in a LIDAC, those benefits are referred to as "direct benefits." When measures can be implemented near a LIDAC, those benefits are referred to as "indirect benefits." In addition, potential mitigation methods are discussed where localized disbenefits to LIDACs are likely to occur.

Proportion of Community Members in a LIDAC

Estimated LIDAC benefits can be compared to the percent of population that live in a LIDAC to evaluate if the estimated benefits would be equal, less, or greater than among all people in the Sacramento-Roseville CSA. Table 1 shows the percentage of the population that lives in a LIDAC in each county in the Sacramento-Roseville CSA. Across the Sacramento-Roseville CSA, 62% of the people live in an area defined as a LIDAC. This baseline value of 62% is the percentage of benefits that LIDACs would enjoy if benefits were evenly shared by all people in the Sacramento-Roseville CSA.

Table 1. Percent of People Living in a LIDAC for Each County

County	Percent of Population Living in a LIDAC
Sacramento	74%
Placer	27%
Yolo	63%
El Dorado	23%
Sutter	88%
Yuba	84%
Nevada	49%
Total Sacramento-Roseville CSA	**62%**

Summary for Direct Emission Benefits in LIDACs

Table 2 lists each GHG emissions reduction measure, and the percentage of direct benefits anticipated to occur in LIDACs. Table 2 shows those measures with the highest proportion of direct LIDAC emission benefits first and measures are shown in order of decreasing direct LIDAC emission benefits.

Measures that reduce emissions in LIDACs by more than 62%, the baseline for benefits, are anticipated to have more direct benefits that flow to LIDACs that supports Justice40 initiative goals. In general, the measures with the greatest direct benefits to LIDACs involve transportation-related initiatives that reduce VMT and reductions to energy consumption. The measures associated with the highest percentage of benefits to the LIDACs are related to Public Transit Improvements (TR-2, 86%) and Providing Bus Rapid Transit (TR-3, 86%), followed by Improved Land Use (BE-1, 85%), Transportation Demand Management Programs (TR-5, 82%) and ZEV Adoption (TR-1, 82%). In the Sacramento-Roseville CSA, communities adjacent to congested roadways, including the port and distribution centers, are often low-income or communities of color. These communities are exposed to the highest concentration of criteria and toxic air pollution from vehicles and equipment, leading to several demonstrated health impacts such as respiratory illnesses, higher likelihood of cancer development, and premature death.[8] The measures identified above mitigate emissions from transportation and should be prioritized to maximize and expedite direct benefits to the LIDACs.

Measures BE-9 (Reduce Wastewater Emissions), BE-7 (Reduce Solid Waste), and BE-10 (Require Edible Food Recovery Program Partnerships with Food Generators) are estimated to benefit non-LIDACs more than LIDACs. While direct emission reductions happen at the facilities, non-air quality benefits are realized, such as lower utility bills or improved food access. Additional efforts will also be needed during implementation of these measures to identify methods to increase direct LIDAC benefits from these measures. This would be particularly important to consider for the Delta communities in southwest Sacramento County, the Yuba-Sutter area, and Yolo County since these communities are currently over-burdened by water and wastewater impacts, as shown in Appendix H.

Table 2. Percent Reduction in GHG and Co-Pollutant Emissions in LIDACs

Plan Measure	CAPCOA Measure Name	Information to Estimate Where Emissions Reductions Would Occur (Data Source)	Percent Emissions Reduction at LIDACs[9]
TR-2: Public Transit Improvements	T-26. Increase Transit Service Frequency	Frequency of Transit Services per Sq Mi (DOT)	86%
	T-25. Extend Transit Network Coverage or Hours	Frequency of Transit Services per Sq Mi (DOT)	86%
	T-46. Provide Transit Shelters	Frequency of Transit Services per Sq Mi (DOT)	86%
TR-3: Provide Bus Rapid Transit	T-28. Provide Bus Rapid Transit	Frequency of Transit Services per Sq Mi (DOT)	86%
BE-1: Land Use Improvements	T-1. Increase Residential Density	Estimated Average Drive Time to Points of Interest (Min) (DOT)	85%
	T-55. Infill Development	Anticipated Growth in Green Zones (SACOG)	85%
TR-5: Transportation Demand Management Program	T-8. Provide Ridesharing Program	Traffic Proximity and Volume (EJScreen)	82%
	T-9. Implement Subsidized or discounted Transit Program	Traffic Proximity and Volume (EJScreen)	82%
	T-5. Implement Commute Trip Reduction Program (Voluntary)	Traffic Proximity and Volume (EJScreen)	82%
	T-6. Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)	Traffic Proximity and Volume (EJScreen)	82%
TR-1: ZEV Adoption and Charging Infrastructure	T-30a. Use of Cleaner-Fuel Vehicles (BEVs)	Traffic Proximity and Volume (EJScreen)	82%
	T-30b. Use of Cleaner-Fuel Vehicles (PHEVs)	Traffic Proximity and Volume (EJScreen)	82%
	T-14. Provide Electric Vehicle Charging Infrastructure	Non Gasoline Alternative Fueling Stations (HIFLD)	73%

Plan Measure	CAPCOA Measure Name	Information to Estimate Where Emissions Reductions Would Occur (Data Source)	Percent Emissions Reduction at LIDACs[9]
BE-2: Building Energy Efficiency Improvements	E-2. Require Energy Efficient Appliances	Electricity Consumption by County (CEC)	72%
BE-3: Increase Use of Renewable Energy in New and Existing Buildings	E-17. Renewable Surplus Buildings	Electricity Consumption by County (CEC)	72%
BE-9: Reduce Wastewater Emissions	E-19. Establish Methane Recovery in Wastewater Treatment Plants	Wastewater Discharge (EJScreen)	50%
BE-7: Reduce Solid Waste	S-1: Institute or Extend Recycling Services	Solid Waste (CalEnviroScreen)	46%
BE-10: Require Edible Food Recovery Program Partnerships with Food Generators	S-3. Require Edible Food Recovery Program Partnerships with Food Generators	Solid Waste (CalEnviroScreen)	46%

Indirect benefits were not quantified. Indirect benefits are anticipated to be similar to the direct benefits whereby indirect benefits that flow to LIDACs would primarily be related to reduced transportation and energy consumption. There are opportunities to increase indirect benefits to LIDACs associated with land use improvements, provided that improvements are managed carefully to prevent or minimize displacement. Similar to direct benefits from measures BE-9, BE-7, and BE-10, additional effort would be needed during implementation of these land use improvement measures to identify methods to increase indirect LIDAC benefits from these measures.

In some situations, there is the potential for measures to result in localized disbenefits to LIDACs. Specifically, land use improvements associated with measure BE-1 have the potential to increase displacement. Displacement concerns were also raised during the CPRG community engagement phase. To mitigate the potential for displacement of lower-income people from their communities, additional focus will be placed on affordable housing during the review and approval of land use improvement projects related to these measures.

In addition, there is the potential for localized increases in VMT and associated air pollution emissions in LIDACs for measures that increase vehicles in neighborhoods, such as TR-2: Public Transit Improvements and TR-7: Establish a School Bus Program. It is anticipated that associated VMT reductions from these programs would outweigh localized increases of emissions from buses. In addition, due to California's Innovative Clean Transit Regulation and robust funding for zero-emission school buses, it is likely that bus fleet expansion would be combined with TR-1: ZEV Adoption and Charging Infrastructure, ensuring clean and quiet vehicles providing critical access and mobility to LIDACs.

LIDAC Co-Benefits

This section provides a detailed description of the qualitative benefits and quantifiable benefits, when possible, for each of the 10 CAPCOA co-benefits identified in the CAPCOA Handbook.[7]

Improved Air Quality – Criteria Air Pollutants (CAPs)

Maximum air quality benefits in LIDACs for measures that could be quantified are shown in Table 3. In general, as these measures are adopted, they will have minimal impacts on future ambient air pollutant concentrations; however, the potential for more localized benefits is high given that air pollutant concentrations can be quite high near roadways. The measures associated with the highest percentage of air quality benefits to the LIDACs are related to the BE-1: Land Use Improvements and TR-1: ZEV Adoption and Charging Infrastructure.

Table 3. Maximum Air Pollutant Concentration Reductions by Measure in LIDACs

Sac Metro Measure	CAPCOA Measure Name	Maximum Projected Air Quality Concentration Reduction in LIDACs (%)			
		NO_x	CO	$PM_{2.5}$	SO_2
BE-1: Land Use Improvements	T-55. Infill Development	0.02%	0.02%	0.001%	0.01%
TR-1: ZEV Adoption and Charging Infrastructure	T-30a. Use of Cleaner-Fuel Vehicles (BEVs)	0.01%	0.01%	0.001%	0.01%
	T-30b. Use of Cleaner-Fuel Vehicles (PHEVs)	0.001%	0.001%	0.0001%	0.001%
	T-14. Provide Electric Vehicle Charging Infrastructure	0.002%	0.002%	0.0002%	0.001%
TR-5: Transportation Demand Management Program	T-8. Provide Ridesharing Program	0.001%	0.001%	0.0001%	0.001%
	T-9. Implement Subsidized or discounted Transit Program	0.0001%	0.0001%	0.0%	0.0%
TR-2: Public Transit Improvements	T-26. Increase Transit Service Frequency	0%	0%	0%	0%
	T-46. Provide Transit Shelters	0%	0%	0%	0%
	T-25. Extend Transit Network Coverage or Hours	0.002%	0.002%	0.0001%	0.001%
TR-3: Provide Bus Rapid Transit	T-28. Provide Bus Rapid Transit	0%	0.0001%	0%	0%

In addition to CAPs, there are other mobile source air toxics related to gas combustion and fueling that would be reduced through measure implementation. These include benzene, formaldehyde, butadiene, acetaldehyde, ethylbenzene, and others. These reductions would occur near gasoline dispensing facilities and areas with higher VMT, which tend to be in LIDACs.

Energy and Fuel Savings – Electricity, Natural Gas, Refrigerant, Propane, Gasoline, or Diesel Reductions

The proportion of energy and fuel savings benefits that flow to LIDACs is anticipated to be quite high as shown in Table 4. For those measures that can be spatially distributed, which are shown in Table 2, it is estimated that 71% of the energy savings from all measures combined (in megawatt hours) would flow to LIDACs. Energy-efficient measures can result in lower utility bills for residents, improved indoor air quality, and job opportunities for energy-efficient construction, maintenance, and technology installation. Further, energy costs were one of the top priorities identified by LIDACs during the community engagement phase. Similar to energy savings, it is estimated that 78% of the fuel reductions from both diesel and gasoline would flow to LIDACs. Some measures, such as increased transit and school bus programs, could potentially have a fuel increase (disbenefit) if not coupled with clean-fuel technologies.

While additional fuel reductions are anticipated from biomass energy, these benefits were not able to be estimated quantitatively for LIDACs. It is estimated that LIDACs in mountain-rural areas would benefit from biomass energy fuel reduction measured at levels similar to or perhaps higher than non-LIDACs, depending on the program implementation.

Table 4. Quantified Co-Benefits that Flow to LIDACs

Quantified Co-Benefit	Proportion of Benefits Flowing to LIDACs
Energy Saved (MWh)	71%
Fuel Reductions (diesel)	78%
Fuel Reductions (gas)	78%

VMT Reductions – Reductions in Vehicle Miles Traveled

The proportion of VMT reductions that flow to LIDACs is anticipated to be 78% for those measures that can be spatially distributed (as shown in Table 2). VMT reductions have additional co-benefits associated with air quality, pedestrian and traffic safety, and improved public health. Reducing VMT also has noise and physical activity benefits. The anticipated locations of maximum benefits are generally consistent with locations in LIDACs with existing transportation burdens.

Water Conservation – Water Use Reductions

Benefits of water conservation measure BE-8 were not able to be quantitatively estimated for LIDACs. It is estimated that direct benefits of these measures would not flow to LIDACs in most areas; however, indirect benefits of water conservation, such as lower utility bills through less water use and reduced application of chemical fertilizer due to turf removal, would increase for LIDACs.

Enhanced Pedestrian or Traffic Safety – Reduced Collisions; Pedestrian/Bicyclist Safety

Benefits of GHG emissions reduction measures related to pedestrian and traffic safety were not quantitatively estimated for LIDACs. It is estimated that GHG reduction measures that reduce VMT would enhance pedestrian and traffic safety proportional to locations of reduced VMT. Therefore, it is estimated that 78% of safety benefits associated with GHG reduction measures would flow to LIDACs.

Improved Public Health – Toxic Air Contaminant Reductions (Including Exposure); Increased Physical Activity; Improved Public Safety

While public health benefits were not quantitatively evaluated for LIDACs, it is anticipated that public health benefits associated with transportation improvements and reductions in VMT would flow to LIDACs. Exposure to gasoline and diesel emissions generates systemic inflammation and have damaging effects in the lungs, heart, blood vessels, and brain. Children, the elderly, people from lower-income communities, and people of color are most vulnerable. ZEV use can reduce emissions that cause deficits in lung function, asthma, high blood pressure, cancer, diabetes, cognitive difficulties, and premature death, among other health outcomes. Given that it is estimated in Table 4 that 78% of benefits from fuel reductions would occur in LIDACs, it is anticipated that current public health burdens would be reduced by a similar percentage. Although, localized public health benefits could be adversely impacted in the short-term due to construction activities from associated GHG emissions reduction measures, robust implementation of measure BE-5: Construction and Landscape Equipment Emission Reduction, will minimize health impacts due to construction.

Improved Ecosystem Health – Improved Biological Diversity and Soil and Water Quality

Much of the Plan's ecosystem benefits result from preserving and enhancing existing natural and working lands. While these are typically located outside of LIDACs, benefits from these measures such as reduced wildfire smoke incidents due to implementation of NW-1, will be advantageous for the whole region.

Ecosystem health would also be improved through NW-3: Increase Tree Canopy. Partners and stakeholders are encouraged to combine tree canopy expansion with active modes and transit shelter improvements and to focus canopy improvements in LIDACs.

Enhanced Energy Security – Systemwide Load Reduction; Local Energy Generation, Levelling Out Peaks

Benefits of GHG emissions reduction measures related to energy security were not quantitatively estimated for LIDACs. Use of renewable energy measures can increase LIDACs' access to clean energy sources. It could also compromise energy security if the transition to renewable energy sources does not have sufficient grid reliability. It is anticipated the energy security for LIDACs would be comparable to non-LIDACs. This area has been identified as a regional need and measures to specifically address energy security will be added to the future, updated Plan.

Enhanced Food Security – Stability of Food Systems; Improved Household Access to Food

Benefits of GHG emissions reduction measures related to food security were not quantitatively estimated for LIDAC communities. However, measure BE-10: Edible Food Recovery Program Partnerships with Food Generators can reduce agricultural emissions, lower the footprint of food distribution, prevent CH_4 emissions, decrease energy use from landfills, and mitigate food waste-related emissions. Lower-income communities often face challenges accessing nutritious food and edible food recovery programs redirect surplus food that would otherwise go to waste toward people in need, providing a source of fresh and healthy options. Most of the benefits from measures related to the food recovery program are anticipated to flow to LIDACs.

Social Equity – Address Existing Social Inequities (e.g., Housing/Anti-Displacement, Community Engagement, Availability of Disposable Income)

GHG reduction measures that focus on increasing renewable energy can improve energy equity by increasing lower-income communities' access to clean energy sources and improving opportunities for jobs and educational opportunities as part of the just transition. The proportion of new jobs that flow to LIDACs is anticipated to be 84% for those measures that can be spatially distributed (shown in Table 2) and this can be realized through implementation of training programs to prepare residents for future employment opportunities related to renewable energy. Potential localized disbenefits could include job displacement.

There are also social equity benefits for projects that increase housing opportunities in non-LIDAC areas. Measure BE-1: Land Use Improvements increases housing investment in non-LIDAC areas with low-VMT and higher resource access. Improving affordable housing opportunities in these areas gives the region's residents more choice in where they can live, work, and play.

A More Equitable Capital Region

Implementation of GHG emissions reduction measures will provide substantial co-benefits to communities in the Sacramento-Roseville CSA. This analysis assessed qualitative and quantifiable benefits for each GHG measure and, where feasible, estimated the percentage of benefits expected to impact LIDACs. This Plan was crafted with the understanding that some communities in the Sacramento region bear a disproportionate share of the negative environmental and social consequences resulting from industrial, governmental, and commercial operations or policies. The current state of affairs is the result of decades of policies and actions, such as the killing and removal of Indigenous peoples, Chinese exclusion, financial red lining, racial covenants, Japanese internment, gender and sex discrimination, and injustice. As these measures are implemented and new ones are added to the Plan, the steering committee and working groups are committed to ensuring all communities fairly benefit from these measures, and we will continue to engage with LIDACs to ensure that communities participate and benefit from the successful implementation of these GHG reduction measures.

REFERENCES

[1] *US Department of Health and Human Services. (Undated.) Social Determinants of Health. Available: https://health.gov/healthypeople priority-areas/social-determinants-health. Accessed: February 2024. https://health.gov/healthypeople/priority-areas/social-determinants health*

[2] *California Healthy Places Index. 2023. Healthy Places Index Guide. Available: https://phasocal.org/wp-content/uploads/2023/06/PHA_HPI Guidance_Report523_4.pdf. Accessed: February 2024.*

[3] *Mc Ewen BS. 2017. Allostatic Load and Overload, ScienceDirect. Available: https://www.sciencedirect.com/topics/neuroscience/allostatic load. Accessed: February 2024.*

[4] *UC Davis National Center for Sustainable Transportation. 2017. Cutting Greenhouse Gas Emissions is Only the Beginning: A Literature Review of the Co-Benefits of Reducing Vehicle Miles Traveled. Available:, https://ncst.ucdavis.edu/research-product/cutting-greenhouse-gas emissions-only-beginning-literature-review-co-benefits. Accessed: February 2024.*

[5] *California Air Resources Board. 2020. People at Risk. Available: https://ww2.arb.ca.gov/our-work/programs/people-risk/about. Accessed: February 2024.*

[6] *U.S. EPA Office of Air and Radiation. Climate Pollution Reduction Grants Program: Technical Reference Document for States, Municipalities, and Air Pollution Control Agencies. Benefits Analyses: Low-Income and Disadvantaged Communities. April 27, 2023. Available online at: https://www.epa.gov/system/files/documents/2023-05/LIDAC%20Technical%20Guidance%20-%20Final_2.pdf.*

[7] *California Air Pollution Control Officers Association (CAPCOA). Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. December 2021. Available online at: https://www.caleemod.com/documents handbook/full_handbook.pdf*

[8] *https://ww2.arb.ca.gov/resources/overview-diesel-exhaust-and-health*

[9] *The percentage of emissions reductions at LIDACs was calculated by summing the emissions reductions in LIDAC census block groups and dividing by the sum of emissions reductions in the Sacramento-Roseville CSA.*

[10] *California Air Pollution Control Officers Association (CAPCOA). Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing| Climate Vulnerabilities, and Advancing Health and Equity. December 2021. Available online at: https://www.caleemod.com/documents handbook/full_handbook.pdf*

Chapter 7. Next Steps for Implementation

The CPRG program facilitated a collaborative process between regional stakeholders to catalyze climate action in the capital region. The Sac Metro Air District, the CPRG steering committee, the OAC, and community stakeholders distilled years of work and formed a list of regional priorities that will provide benefits throughout the Sacramento region. Local partners identified commonalities within their existing climate, sustainability, and energy plans. Community stakeholders shared their priority actions for climate mitigation and resiliency through the community benefits survey. The 24 GHG reduction measures that were selected for this Plan address GHG emissions from the transportation, energy, waste management, water, and natural and working lands sectors. Partners will work together to reach the proposed scale of implementation of these measures by 2030, supporting not only our regional climate goals, but the nation's as well.

EPA's Goal for the CPRG Program: Support the equitable transition to a low-carbon economy.

Implementing the Priority Measures

Through this Plan, action on the measures will be accelerated moving forward, as several of these measures are already designated for action by the jurisdictions, agencies, and tribal partners that contributed. Ordinances requiring additional building energy efficiency and plans to transition to zero-emission fleets are being drafted and approved. The regional collaboration of the working groups, support, lessons learned, and scale of implementation can expedite this transition to a low-carbon economy and ensure our actions are cost effective and equitable. In addition, various complimentary initiatives to advance the economic resiliency and sustainability of the region are ongoing. The California Jobs First and We Prosper Together initiatives are funding strategies to strengthen and diversify local economies and develop industries in Sacramento that create high quality jobs for the transition to a low-carbon economy.

To that end, the collaboration formed to create this Plan will continue and be supported as the Sac Metro Air District drafts a more comprehensive plan and status update between 2024 and 2027. This project has created a multidisciplinary network of local and regional agencies, organizations, businesses, and associations that work to implement climate solutions and achieve climate goals in local communities and throughout the Sacramento region. The Sac Metro Air District will rely on existing and new partnerships to guarantee the continuation of community and stakeholder engagement during measure implementation and evaluation and serve as support for the six working groups that were formed to implement the priority measures.

Funding is another critical element for measure implementation. Beyond the CPRG Implementation Grants, the Plan has identified several federal and state opportunities for climate projects that each working group is considering. Given capacity limitations for local jurisdictions, agencies, and tribal partners, the Sac Metro Air District and working groups will be able to leverage their expertise to efficiently procure capital and operating funds to realize the vision of this Plan.

Realizing Reductions and Co-Benefits for Communities

The Sacramento region experiences extreme precipitation, extreme heat, drought, severe wildfires, poor air quality, and infrastructure damage due to our changing climate. The Plan addresses the most pressing climate issues faced in the capital region today. Ultimately, the implemented measures will reduce GHG emissions by increasing infill development over greenfield development, electrifying buildings and vehicles, reducing VMT and supporting sustainable active modes, sequestering CO_2, and maintaining resilient forests to reduce wildfire smoke exposure.

Stakeholders will monitor and evaluate each project and measure implemented under the CPRG program and provide feedback to partnering jurisdictions and the Sac Metro Air District on which projects and measures are performing as expected, and which ones need further assessment or modification. Each new project will also undergo environmental review to ensure compliance with CEQA and will need to address community and stakeholder concerns. Additionally, under the Community Air Protection Program, the AB 617 community in South Sacramento-Florin and nine other locally nominated communities disproportionately impacted by poor air quality in Sacramento, will be a focus for continued air pollution reduction. Continued communication between regional partners and the community increases the likelihood of project or measure adoption and success. The Sac Metro Air District will continue to monitor implementation and will be issuing a status report to EPA in 2027 on progress to date.

Broadening Our Perspective

Over the next few years, this Plan will be expanded to include new electric power sector measures with updated legislation and policies describing the authority to implement and monitoring and reporting mechanisms necessary to ensure that the measures are properly implemented. The updated Plan will include emissions projections, specific reduction targets, a communitywide benefits analysis, deeper community engagement with vulnerable communities, and workforce planning analyses that are reflective of the realities and travel patterns of a post-pandemic capital region. Implementation of the GHG mitigation measures contained in this Plan will move the capital region closer to carbon neutrality and more equitable and sustainable communities in the future.

Appendix A. Guidelines for Ongoing Emissions Tracking and Inventory Refinement

Developing a comprehensive, bottom-up regional emissions inventory by sector and county is time and resource intensive. For purposes of the Plan, a top-down approach was used to evaluate emissions for the sectors included in this inventory. Below are some aspects of the methodology that could be refined to develop a more accurate emission inventory.

- The USDA NASS agricultural data for 2019 was not available at the time of this analysis so 2017 values were used as a scaling surrogate.
- For the industrial sector emission calculations, the CARB Mandatory GHG Reporting Regulation program does not include facilities that emit less than 10,000 metric tons per year; therefore, industrial facilities emitting less than the threshold were not included in this sector.
- Enteric fermentation agricultural emissions were scaled with a singular aggregated livestock factor and do not consider animal (e.g., sheep) specific scalars.
- A California-wide default assumption for the percentage of area with tree coverage was assumed to be consistent across the counties in the Sacramento-Roseville CSA for the forestry sector sequestered emission calculations.
- CalRecycle's Recycling and Disposal Reporting System report did not have a complete dataset for landfill tonnage in 2019 for all counties; therefore, 2020 was used as a surrogate for all counties excluding Sutter, which had a complete dataset for 2021.
- The statewide recycling rate was assumed to be consistent across the Sacramento-Roseville CSA due to lack of county-specific data.
- CH_4 and N_2O emissions were not available for the off-road subsector from the EMFAC2021 Web Database; therefore, emissions are based solely on CO_2.
- Line-Haul Class I and passenger locomotives make up the mobile rail sector. Emissions for switcher locomotives by county were not available.
- Aircraft emissions are not included in the inventory. However, some airport emissions are captured in the inventory across various sectors: the off-road subsector (ground support equipment), the on-road subsector for vehicle fleets in the region servicing airports, the commercial sector for natural gas combustion, and the electricity consumption sector for airport facilities electrical consumption.

Appendix B. Inventory Methods and Assumptions by Sector

Residential Sector

Residential sector emissions were downscaled from the statewide inventory with unique metrics applicable to each subsector. Natural gas consumption was used as a metric to scale fuel combustion and fugitive emissions, as natural gas fuel combustion, compared to other fuel types like propane and wood, accounted for the majority of residential sector combustion-related emissions (>93%) in the California statewide inventory. The CEC's natural gas consumption by county data was used to downscale from state- to county-level emissions. Human population statistics for 2019 were used to downscale other subsector emissions such as landscape fertilizer usage and ODS. The residential sector methodology and data sources are summarized in Table 1.

Table 1. Residential Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Residential	Fuel Combustion, Transmission and Distribution Fugitives	Downscaled	Residential Natural Gas Consumption	Million Therms	CEC[1]
	Fertilizer Usage, ODS, Fuel Storage	Downscaled	2019 Population Data by County	Population Count	State of California Department of Finance[2]

Commercial Sector

Emissions were downscaled from the statewide inventory to the county level by unique subsectors. The subsectors included fuel combustion, commercial use of nitrogen fertilizer on turf, fuel storage, and the use of ODS substitutes. California's non-residential natural gas consumption by county from the CEC was used to downscale the fuel combustion-related emissions from the state level down to the target counties. The remaining three subsectors, which accounted for 43% of the commercial sector emissions, were downscaled using 2019 human population data. The commercial sector methodology and data sources are summarized in Table 2.

Table 2. Commercial Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Commercial	Fuel Combustion of Various Subsectors	Downscaled	Non-Residential Natural Gas Consumption	Million Therms	CEC[3]
	ODS, Fertilizer Usage, Fuel Storage of Various Subsectors	Downscaled	Population Data by County	Population Count	State of California Department of Finance[4]

Recycling and Waste Sector

Emissions were downscaled from the statewide inventory with metrics applicable to each subsector. California's 2020 landfill tonnage from CalRecycle's Recycling and Disposal Reporting System (RDRS) was leveraged to downscale the landfill and solid waste treatment subsectors. Data for landfill tonnage at the county level for 2019 was not available, so 2020 was used. The 2020 population data from the U.S. Census data for California and area counties was used to create scalar values for the wastewater treatment category. The recycling and waste sector methodology and data sources are summarized in Table 3.

Table 3. Recycling and Waste Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Recycling and Waste	Landfills, Solid Waste Treatment	Downscaled	Landfill Tonnage	Tons	CalRecycle's RDRS[5]
	Wastewater Treatment	Downscaled	Population Data by County	Population Count	State of California Census[6]

Agricultural Sector

Emissions were downscaled from the statewide inventory with subsector specific metrics. For agriculture energy use, CARB's OFFROAD2021 v1.0.5 model was used to derive by-county scalers based on fuel consumption from agricultural sector off-road equipment. The fuel usage was converted to energy consumption based on the fuel specific's energy content high heating value. The United States Department of Agriculture National Agricultural Statistics Service (USDA NASS) published California's 2017 agriculture cropland, livestock population, and rice production statistics at the county level. The 2017 USDA NASS data were used to downscale the other subsectors. The agricultural sector methodology and data sources are summarized in Table 4.

Table 4. Agriculture Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Agriculture	Equipment Energy Use	Downscaled	Energy Consumption (Fuel Usage x Fuel Higher Heating Value)	British Thermal Unit (BTU)	CARB's OFFROAD2021 v1.0.5 model[7]
	Residue Burning, Soil Management, Histosol Cultivation	Downscaled	Cropland Acreage	Acres	USDA NASS[8]
	Enteric Fermentation, Manure Management	Downscaled	Livestock Inventory	Count of Cattle, Hogs, Chickens	USDA NASS[9]
	Rice Cultivation	Downscaled	Rice Production	Hundredweight (CWT)	USDA NASS[10]

Industrial Sector

Emissions were gathered from the CARB's Mandatory Reporting GHG Report (MRR). The facility ZIP code was leveraged to identify and assign the emissions to the counties within the Sacramento-Roseville CSA. Not all industries within the Sacramento-Roseville CSA region are included because the industrial sector inventory focuses on major emitting facilities. For instance, the warehousing industry is a prominent business in the region, however warehousing emissions are not included in the industrial sector. Warehousing emissions associated with electricity use are included under the electricity sector; warehousing emissions associated with natural gas use are included under the commercial sector; and warehousing emissions associated with vehicles and equipment are included under the mobile sector. Similarly, any indirect electricity consumption in industrial sectors is captured under the non-residential portion of the electricity sector.

The MRR program represents approximately 80% of the total industrial sector GHG emissions included in the state's GHG inventory. The MRR program requires annual reporting of GHGs by industrial sources that emit more than 10,000 MT CO_2e, but also includes natural gas and petroleum fuel suppliers and marketers (storage and transport intermediate facilities), as well as electricity importers. Facilities with 2019 emissions reported under the EPA's GHG Reporting Program that are not covered by CARB's MRR have also been added to the dataset. The industrial sector methodology and data sources are summarized in Table 5.

Table 5. Industrial Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Industrial	Manufacturing, Petroleum Marketing, Petroleum Refining, Solvent & Chemicals, Transmission and Distribution, Academic Facilities	Bottom Up	Facility Reported Greenhouse Gas Emissions	MT CO_2e	CARB's Mandatory Reporting GHG Report (MRR)[12], complemented with EPA's Flight Tool[13]

Electricity Sector

The electricity sector includes emissions related to electricity usage within each of the Sacramento-Roseville CSA counties. EPA's 2019 Emissions & Generation Resource Integrated Database (eGRID) emission factors (in pounds CO_2e/megawatt-hour) for the California average grid mix were combined with electricity consumption by county to estimate the regional emissions. Electricity consumption quantities were obtained from the CEC. The electricity sector methodology and data sources are summarized in Table 6.

Table 6. Electricity Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Electric Power	Electricity Consumption	Bottom Up	Electricity Consumption	Gigawatt-hours	CEC[14] EPA's 2019 eGRID[15]

Mobile Sector

Emissions were gathered from CARB's various emissions tools. On-road vehicle GHG emissions were derived from the EMFAC2021 model for the Sacramento-Roseville CSA counties. Off-road equipment emissions at the county level were generated from EMFAC2021 for selected sectors including airport ground support, cargo handling equipment, construction and mining, forestry, industrial, lawn and garden, light commercial, military tactical support, oil drilling, portable equipment, recreational, and transport refrigeration units. Freight rail emissions by county were derived from CARB's rail emissions tool, while the passenger locomotive emissions (Amtrak) were provided by Capitol Corridor Joint Powers Authority for the entire region and segmented by county using Geographic Information System (GIS) mapping. Waterborne sources and emissions by county were derived from EMFAC2021 and cover commercial harbor craft and pleasure craft. The mobile sector methodology and data sources are summarized in Table 7.

Table 7. Mobile Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Mobile	On-Road, Off-Road, Waterborne	Bottom Up	GHG Emissions	MT CO_2e	CARB's EMFAC2021 [15]
	Rail (Freight & Passenger)	Bottom Up	GHG Emissions	MT CO_2e	CARB's Linehaul Class I Emissions Inventory Tool (2021)[17] Regional Amtrak Emissions[18]

Forestry Sector

Emissions were calculated using EPA's Local GHG Inventory Tool (LGGIT).[18] Net carbon sequestration estimates are based on the percentage of area with tree coverage, based on statistics from USDA Forest Service. Using the carbon sequestration factor from the LGGIT (in metric tons of CO_2 per hectare-year) and the estimated tree coverage area by county, the amount of CO_2 sequestered by trees for each of the counties in the Sacramento-Roseville CSA was estimated. The forestry methodology and data sources are summarized in Table 8.

Table 8. Forestry Sector Method and Data Sources

Sector	Subsector	Calculation Methodology	Activity or Downscaling Metric	Unit	Source
Urban Forestry (Carbon Sink)	None	Bottom Up	Area Coverage	Square kilometers	EPA LGGIT[24] USDA Forest Service's Urban Canopy GIS Data[25]

REFERENCES

1 *CEC Gas Consumption by County for 2019. http://www.ecdms.energy.ca.gov/gasbycounty.aspx*

2 *Population and Housing Estimates for Cities, Counties, and the State from State of California's Department of Finance (DOF). 2019 population statistics. https://dof.ca.gov/forecasting/demographics/estimates/estimates-e5-2010-2020/*

3 *CEC Gas Consumption by County for 2019. https://www.eia.gov/state/seds/seds-data-complete.php?sid=US*

4 *Population and Housing Estimates for Cities, Counties, and the State from State of California's Department of Finance (DOF). 2019 population statistics. https://dof.ca.gov/forecasting/demographics/estimates/estimates-e5-2010-2020/*

5 *CalRecycle's Recycling and Disposal Reporting System (RDRS). 2020 https://www2.calrecycle.ca.gov/RecyclingDisposalReporting/Reports OverallJurisdictionTonsForDisposal*

6 *California: 2020 Census. 2020. https://www.census.gov/library/stories/state-by-state/california-population-change-between-census-decade.html California: 2020 Census. 2020.*

7 *California ARB's OFFROAD2021 v1.0.5 model . 2019 https://arb.ca.gov/emfac/offroad/emissions-inventory/fbb6d1db4c4d51d0b8f3ce407a76075486e734b0*

8 *United States's Department of Agriculture's Agricultural Census. 2017. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1, Chapter_2_US_State_Level/*

9 *United States's Department of Agriculture's Agricultural Census. 2017. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1, Chapter_2_US_State_Level/*

10 *United States's Department of Agriculture's Agricultural Census. 2017. https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1, Chapter_2_US_State_Level/*

11 *CARB. MRR Program FAQ. 2023. ttps://ww2.arb.ca.gov/sites/default/files/classic/cc/reporting/ghg-rep/reported-data/2022mrrfaqs.pdf*

12 *CARB. Mandatory GHG Reporting – Reported Emissions. 2019. https://ww2.arb.ca.gov/mrr-data*

13 *EPA Flight: 2022 Greenhouse Gas Emissions from Large Facilities. 2019. Accessed online at EPA Flight Website*

14 *CEC. 2019 http://www.ecdms.energy.ca.gov/elecbycounty.aspx*

15 *EPA's 2019 Emissions & Generation Resource Integrated Database (eGRID). 2019 https://www.epa.gov/egrid/download-data*

16 *CARB's Emission Factor (EMFAC) 2021 Model. 2019. https://arb.ca.gov/emfac/emissions-inventory/fbb6d1db4c4d51d0b8f3ce407a76075486e734b0*

17 *MSEI Off-road Diesel Model and Documentation. 2019. https://ww2.arb.ca.gov/our-work/programs/msei/road-categories/road-diesel-models-and documentation*

18 *Capitol Corridor Joint Powers Authority. 2023. Email communication from James Allison. September 28.*

19 *EPA. Local Greenhouse Gas Inventory Tool. Accessed online September 2023 at https://www.epa.gov/statelocalenergy/download-local-greenhouse-gas inventory-tool*

20 *USDA Forest Service. Urban Canopy GIS Data. Accessed online September 2023 at https://www.fs.usda.gov/detail/r5/communityforests/?cid=fseprd647385*

Appendix C. GHG Reduction Measure Approach

Built Environment Measures

BE-1 Land Use Improvements
BE-2 Building Energy Efficiency Improvements
BE-3 Increase Use of Renewable Energy in New and Existing Buildings
BE-4 Building Decarbonization/Electrification
BE-5 Construction and Landscape Equipment Emission Reduction
BE-6 Install Cool Pavement
BE-7 Reduce Solid Waste
BE-8 Reduce Water Utility Emissions
BE-9 Reduce Wastewater Emissions
BE-10 Require Edible Food Recovery Program Partnerships with Food Generators

Transportation Measures

TR-1 ZEV Adoption and Charging Infrastructure
TR-2 Public Transit Improvements
TR-3 Provide Bus Rapid Transit
TR-4 Roadway Improvements for Multi-Modal Use and Access
TR-5 Transportation Demand Management Program
TR-6 Active Modes of Transportation for Youth
TR-7 Establish a School Bus Program
TR-8 Electric Bikeshare

Natural and Working Lands Measures

NW-1 Wildfire Resilience and Management
NW-2 Biomass Energy
NW-3 Increase Tree Canopy
NW-4 Carbon Sequestration Program/Carbon Farming
NW-5 GHG Local Offset Program
NW-6 Natural and Working Lands Equipment Emissions Reduction

Built Environment Measures

BE-1 – Land Use Improvements

Summary Description
This measure includes two parts:

- Increasing residential density, which results in shorter and fewer trips by single-occupancy vehicles, thus reducing GHG emissions.
- Infill housing development programs.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure T-1 "Increase Residential Density" and Sac Metro Air District (2023) for Measure T-55 "Infill Development."

1. Increase Residential Density: GHG reductions are calculated based on the estimated percent increase in residential density.
2. Infill Development: GHG reductions are estimated based on the reduction in VMT based on creating infill housing closer to the downtown area.

For increased residential density, emission reduction percentages are applied to EMFAC2021 emissions from the circa 2030 regional commuter vehicle fleet to estimate final emission reductions.

Inputs

T-1. Increase Residential Density	
Percent Increase in Residential Density	20%
T-55. Infill Development	
Decrease in VMT from Infill Housing	148 million VMT

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions by up to 12.39 short tons/year and DPM emissions by up to 0.01 short tons/year.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EMFAC 2021, California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory. Accessed online in January 2024 at: https://arb.ca.gov/emfac/

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

BE-2 – Building Energy Efficiency Improvements

Summary Description

This measure requires new and existing buildings to install ENERGY STAR-certified appliances that are more energy efficient than conventional appliances.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measure E-2 "Require Energy Efficient Appliances." GHG reductions are based on electricity reduction estimates for ENERGY STAR appliances compared to conventional appliances. Calculations assume that 40% of total electricity consumption is for building use; "high turnover restaurant" and "single family housing" were selected to represent commercial and residential land use types, respectively. The total measure reduction percentage is based on the percent electricity reduction by appliance type and the average distribution/ percentage of building electricity used by each appliance. Electricity carbon intensity was assumed for SMUD based on the CAPCOA Handbook.

Inputs

E-2. Require Energy Efficient Appliances	
Electricity for building use	40%
Level of participation	20%
Reduction in electricity from appliance replacements	5.86%

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

US Energy Information Administration - EIA: How much energy is consumed in U.S. buildings? 2023. Accessed online in January 2024 at: https://www.eia.gov/tools/faqs/faq.php?id=86&t=1

Electricity Consumption by County. 2016. Accessed online in January 2024 at: https://ecdms.energy.ca.gov/elecbycounty.aspx

BE-3 – Increase Use of Renewable Energy in New and Existing Buildings

Summary Description

This measure requires new and existing developments to install and generate surplus renewable energy onsite.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measure E-17 "Require Renewable Surplus Buildings." GHG reductions are based on surplus renewable energy (in MWh) from onsite renewable energy production. Calculations assume the new and existing buildings subject to this measure are all-electric and have no onsite fossil fuel consumption. If there is onsite fuel combustion of natural gas, propane, or other fuels, then the estimated GHG reduction would be lower. Electricity carbon intensity was assumed for SMUD based on the CAPCOA Handbook.

Inputs

E-17. Require Renewable Surplus Buildings	
Onsite surplus renewable energy production	250,000 MWh/yr

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EPA. 2020. Emission Factors for Greenhouse Gas Inventories. March. Accessed online in January 2024 at: https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf

BE-4 – Building Decarbonization/Electrification

Summary Description
This measure includes two parts:

- Deploying new commercial or residential developments that are all-electric with no natural gas usage.
- Limiting wood-burning devices and natural gas/propane fireplaces in new and existing residential developments.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure E-14 "Limit Wood Burning and Natural Gas/Propane Fireplaces in Residential Development" and E-15 "Require All-Electric Development."

1. Limit Wood-Burning Devices and Natural Gas/Propane Fireplaces: GHG reductions were estimated based on the use of electricity in electric heat pumps and electric fireplace inserts to replace fuel combustion emissions from wood-burning devices and natural gas/propane fireplaces.
2. All-Electric Development: GHG reduction was estimated based on the usage of electricity instead of natural gas. The energy use from commercial buildings was estimated by averaging across several land use types (general office building, high turnover sit down restaurant, regional shopping center, and research and development). The energy use from residential buildings was estimated from averaging across two land use types (single family housing and mid-rise apartments).

Wood, propane, and natural gas carbon intensities as well as burning device, fireplace type use, and distribution were provided by CalEEMod defaults. The carbon intensity for electricity was assumed for SMUD based on the CAPCOA Handbook.

Inputs

E-14. Limit Wood Burning	
Multi-family housing with no wood burning	1,500 dwelling units
Single-Family Housing With No Wood Burning	4,000 dwelling units
E-15. Require All-Electric Development	
All-electric new commercial buildings	50 million square feet
All-electric new residential buildings	75,000 residences

REFERENCES

CalEEMod. 2022.1. Accessed online in January 2024 at: http://www.caleemod.com

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EPA. 2020. Emission Factors for Greenhouse Gas Inventories. March. Accessed online in January 2024 at: https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf

BE-5 – Construction and Landscape Equipment Emissions Reduction

Summary Description
This measure includes three parts:

- Use of electric- or hybrid-powered construction equipment.
- Use of cleaner-fuel construction equipment.
- Replacing gas-powered landscape equipment with zero-emission equivalent equipment.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure C-1-A "Use Electric or Hybrid Powered Equipment," C-1-B "Use of Cleaner-Fuel Equipment," and LL-1 "Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment."

1. Use Electric- or Hybrid-Powered Equipment: GHG reductions are based on using electric construction equipment and applicable electric generators instead of conventional equipment.
2. Use of Cleaner-Fuel Construction Equipment: GHG reductions are based on using cleaner-fuel construction equipment instead of conventional equipment.
3. Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment: GHG reductions are based on using zero-emission lawn and garden and light commercial equipment instead of conventional equipment.

For all three measures, GHG reductions are based on the reductions estimated for similar construction equipment measures in the Sacramento Climate Action Plan for 2016. Emissions reduction percentages are applied to circa 2030 EMFAC2021 emissions for applicable equipment sectors. GHG reductions estimates consider emissions related to increased electricity usage by new electric equipment. Increased emissions from electric equipment are based on an electricity carbon intensity projection for SMUD from CAPCOA Handbook.

Inputs

C-1-A. Use Electric or Hybrid Construction Equipment	
Penetration	55%
C-1-B. Use of Cleaner-Fuel Construction Equipment	
Penetration	30%
LL-1. Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment	
Penetration	10%

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions by up to 498.76 short tons/year and DPM emissions by up to 19.56 short tons/year.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Sacramento County. 2016. Sacramento Climate Action Plan. Available at: https://planning.saccounty.gov/PlansandProjectsIn-Progress/Documents/Climate%20Action%20Plan/Final%20Climate%20Action%20Plan.pdf

CARB. 2023. Emission FACtor 2021 (EMFAC) Model Version 1.0.2. Available at: https://arb.ca.gov/emfac/emissions-inventory/

BE-6 – Install Cool Pavement

Summary Description
This measure includes installing cool pavement in place of dark pavements to reduce the electricity needed to provide cooling.

Emission Reduction Estimation Approach
The estimated GHG emission reductions are based on the CAPCOA Handbook Update methodology (Sac Metro Air District, 2023) for Measure E-21 "Install Cool Pavement." The GHG reduction was estimated based on energy savings associated with installing cool pavement offset by the increase in natural gas usage in the winter. Electricity carbon intensity was assumed for SMUD based on the CAPCOA Handbook and natural gas carbon intensity was conservatively assumed based on non-residential areas.

Inputs

E-21. Install Cool Pavement	
Amount of cool pavement installed	18,480,000 square feet [a]

[a] Based on the product of 350 lane-miles and an average lane width of 10 feet.

NO_x Reductions
This measure will annually reduce NO_x emissions by up to 0.05 short tons/year.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

California Code of Regulations. 2023. Cal. Code Regs. tit. 14 § 1273.01. Accessed January 2024. Accessed online in January 2024 at: https://casetext.com/regulation/california-code-of-regulations/title-14-natural-resources/division-15-department-of-forestry-and-fire-protection/chapter-7-fire-protection/subchapter-2-state-minimum-fire-safe-regulations/article-2-ingress-and-egress/section-127301-width

BE-7 – Reduce Solid Waste

Summary Description
This measure includes two parts:

- Increasing recycling services to reduce the volume of landfilled waste.
- Implementing an organics diversion program to reduce the volume of organic waste sent to landfills.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure S-1 "Institute or Extend Recycling Services" and S-2 "Implement Organics Diversion Program." The basis for emission reductions for each part is summarized below:

1. Institute or Extend Recycling Services: GHG reductions are based on increased recycling instead of landfilling.
2. Implement Organics Diversion Program: GHG reductions are based on increased composting instead of landfilling.

The waste profile for Single Family and Multi-Family residents was obtained from the CAPCOA Handbook. The EPA (2023) WARM was used to estimate GHG emissions and potential emission reductions from increased recycling or composting instead of landfilling.

Inputs

S-1. Institute or Extend Recycling Services	
Increase in recycled mixed paper, glass, mixed electronics, and mixed plastic	15%
S-2. Implement Organics Diversion Program	
Increase in composted food waste, yard trimmings, and mixed organics	15%

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EPA WARM model. 2023. Accessed online in January 2024 at: https://www.epa.gov/warm/versions-waste-reduction-model-warm#15

Population of each Sacramento-Roseville CSA County. 2022. Accessed online in January 2024 at: https://www.california-demographics.com/counties_by_population

Mixed paper recycled baseline. 2022. Accessed online in January 2024 at: https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/paper-and-paperboard-material-specific-data

BE-8 – Reduce Water Utility Emissions

Summary Description

This measure includes three parts. Reducing water utility emissions through:

- Low-flow water fixtures.
- Landscapes that are water efficient.
- Reducing or avoiding turf grass in landscapes and lawns.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measure W-4 "Require Low-Flow Fixtures," W-5 "Design Water-Efficient Landscapes," and W-6 "Reduce Turf in Landscapes and Lawns."

1. Require Low-Flow Water Fixtures: GHG reductions are based on mitigating water usage associated with low-flow water fixtures.
2. Design Water-Efficient Landscapes: GHG reductions are based on mitigating water usage by replacing traditional landscape areas with water-efficient landscapes.
3. Reduce Turf in Landscapes and Lawns: GHG reductions are based on mitigating water usage by replacing or reducing turf grass in landscapes and lawns.

GHG reductions were estimated based on CAPCOA Handbook guidance estimates of water usage-related electricity reductions from each measure. Electricity carbon intensity was assumed for SMUD based on the CAPCOA Handbook.

Inputs

W-4. Require Low-Flow Fixtures	
Existing indoor water use	9.5 billion gallons/yr[a]
Water savings	60%
W-5. Design Water-Efficient Landscapes	
Landscape area	1,000 square feet/project
Special landscape area	500 square feet/project
Projects	5,000
W-6. Reduce Turf Grass in Landscapes and Lawns	
Area of turf to be removed	200,000 square feet
Total turf area	300,000 square feet

[a] Assumed 48 gallons per day per capita of residential water use with 20% penetration

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Model Water Efficiency Landscape Ordinance Appendix A. Accessed online in January 2024 at: https://govt.westlaw.com/calregs/Document/IBCE97A755B6E11EC9451000D3A7C4BC3?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default)&bhcp=1

BE-9 – Reduce Wastewater Emissions

Summary Description

This measure would capture CH_4 from existing wastewater treatment plants and combust it to prevent its escape into the atmosphere.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measure E-19 "Establish Methane Recovery in Wastewater Treatment Plants." Calculations assume that wastewater is treated at facilities with primary treatment, and that the captured CH_4 is flared. If the heat from the captured CH_4 combustion is used to generate electricity for onsite energy needs, then the estimated GHG reduction may be higher. The percentage of total wastewater treated per day affected by this measure is assumed to be 15% for the entire region based on the City of Sacramento's Climate Action Plan which includes a 15% GHG reduction goal.

Inputs

E-19. Establish CH_4 Recovery in Wastewater Treatment Plants	
Total wastewater affected by measure	15%
Wastewater treated in the Sacramento-Roseville CSA	600 million liters/day

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

BE-10 – Require Edible Food Recovery Program Partnerships with Food Generators

Summary Description

This measure involves partnering with food service establishments, wholesale providers, and retail sources with food recovery programs to collect edible foods which would otherwise be sent to landfills.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook Update (Sac Metro Air District, 2023) methodology for Measure S-3 "Require Edible Food Recovery Program Partnerships with Food Generators." GHG reductions are based on the avoided emissions from the decomposition of edible food in landfills, by recovering and redistributing the food for consumption. Emission reduction calculations account for the increase in GHG emissions from transportation vehicles and refrigeration equipment used in the food recovery process. Calculations assume the use of gasoline-refrigerated vans, large walk-in commercial refrigerators with solid doors, default refrigerant charge size, and default leak rates based on the CAPCOA Update. Electricity carbon intensity was assumed for SMUD based on the CAPCOA Handbook.

Inputs

S-3. Require Edible Food Recovery Program Partnerships with Food Generators	
Delivery vehicles	100
Average miles per delivery vehicle	7,300 miles/yr
Refrigeration units	100
Refrigeration compartment per refrigeration unit	960 cubic feet
Edible food recovered per year	2,500,000 lb/yr

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

Transportation Measures

TR-1 – ZEV Adoption and Charging Infrastructure

Summary Description
This measure includes two parts:

- Providing EV charging infrastructure to decrease PHEV gasoline mileage.
- Use of cleaner-fuel vehicles, including BEVs and PHEVs.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measures T-14 "Provide Electric Vehicle Charging Infrastructure" and T-30 "Use of Cleaner-Fuel Vehicles.

1. Provide EV Charging Infrastructure: GHG reductions are based on the increase in electric mode mileage share from PHEVs with availability of chargers offset by emissions from increased energy demand.
2. Use of Cleaner-Fuel Vehicles: GHG reductions for BEVs and PHEVs are calculated based on the replacement of conventional fuel vehicles with these cleaner fuel vehicle options.

Emissions reduction percentages are applied to base emissions for a circa 2030 light-duty vehicle fleet based on EMFAC2021. GHG reductions estimates consider emissions related to increased electricity usage by EVs. Increased emissions from vehicle electric charging are based on an electricity carbon intensity projection for SMUD from CAPCOA Handbook.

Inputs

T-14. Provide Electric Vehicle Charging Infrastructure	
Chargers installed	6,500
Total vehicles accessing chargers per day	12,175
T-30. Use of Cleaner-Fuel Vehicles	
Vehicle fleet converted for each potential type	15%

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions by up to 245.42 short tons/year and DPM emissions by up to 0.22 short tons/year.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Sacramento County. 2016. Sacramento Climate Action Plan. Available at: https://planning.saccounty.gov/PlansandProjectsIn-Progress/Documents/Climate%20Action%20Plan/Final%20Climate%20Action%20Plan.pdf

CARB. 2023. Emission FACtor 2021 (EMFAC) Model Version 1.0.2. Available at: https://arb.ca.gov/emfac/emissions-inventory/

TR-2 – Public Transit Improvements

Summary Description
This measure includes three parts:

- Expansion of local transit network coverage or hours to encourage the use of transit.
- Increasing public transit service frequency to improve the user experience and attractiveness of transit service.
- Providing transit bus shelters to improve comfort and safety while waiting for the bus.
- Providing transit shelters with real-time arrival information to improve comfort and safety while waiting for the bus.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure T-25 "Extend Transit Network Coverage or Hours" and T-26 "Increase Transit Service Frequency" and Sac Metro Air District (2023) methodology for Measure T-46 "Provide Transit Shelters."

1. Extend Transit Network Coverage or Hours: GHG reductions are calculated based on increase in transit service hours associated with displacing some passenger car and passenger truck commutes.
2. Increase Transit Service Frequency: GHG reductions are estimated based on a percentage increase in transit frequency and level of implementation across transit routes displacing some passenger-car and passenger-truck commutes.
3. Provide Transit Shelters: GHG reductions are estimated based on percent increase in bus transit trips, due to providing bus shelters and real-time arrival information, to replace some passenger-car and passenger-truck trips.

Emissions reduction percentages are applied to EMFAC2021 emissions from the circa 2030 regional commuter vehicle fleet to estimate final emission reductions.

Inputs

T-25. Extend Transit Network Coverage or Hours	
Total transit service hours before expansion	4,549
Total transit service hours after expansion	8,399
T-26. Increase Transit Service Frequency	
Increase in transit frequency	30%
Level of implementation	90%
T-46. Provide Transit Shelters	
Transit stops with new bus shelters and benches	48
Average boardings per day at each transit station with added amenities	100
Average boardings per day across the transit agency	26,250

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions by up to 0.54 short tons/year and increase DPM emissions by up to 0.28 short tons/year if diesel-fueled buses are used.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Sacramento Area Council of Governments (SACOG). 2016. Metropolitan Transportation Plan/Sustainable Communities Strategy. Available at: https://www.sacog.org/sites/main/files/file-attachments/mtpscs_complete.pdf

CARB. 2023. Emission FACtor 2021 (EMFAC) Model Version 1.0.2. Available at: https://arb.ca.gov/emfac/emissions-inventory

Sacramento Regional Transit District Fact Sheet. Available at: https://www.sacrt.com/documents/RT%20Fact%20Sheets/RT%20Fact%20Sheet.pdf

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

TR-3 – Provide Bus Rapid Transit

Summary Description
This measure includes the implementation of a BRT system to encourage the use of transit.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure T-28 "Provide Bus Rapid Transit." The GHG reduction is based on the light-duty VMT reduction associated with increased bus use, accounting for increased bus activity and emissions. The affected vehicle fleet is assumed to include passenger cars and passenger trucks for the projected circa 2030 GHG emissions sourced from EMFAC2021.

Inputs

T-28. Provide BRT	
Increase in transit frequency due to BRT	125%
Level of implementation	20%

NO_x and DPM Emission Reductions
This measure will annually increase NO_x emissions by up to 0.54 short tons/year and increase DPM emissions by up to 0.28 short tons/year.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EMFAC. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory Accessed online in January 2024 at: https://arb.ca.gov/emfac/

Sacramento Area Council of Governments (SACOG). 2016. Metropolitan Transportation Plan/Sustainable Communities Strategy. Available at: https://www.sacog.org/sites/main/files/file-attachments/mtpscs_complete.pdf

TR-4 – Roadway Improvements for Multi-Modal Use and Access

Summary Description
This measure includes three parts:

- Increasing sidewalk coverage to improve pedestrian access.
- Constructing new and improving existing bike boulevards.
- Increasing the length and interconnectivity of bike networks.

Emission Reduction Estimation Approach
The emission reductions are based on the CAPCOA Handbook methodology for Measure T-18 "Provide Pedestrian Network Improvements," T-19B "Construct or Improve Bike Boulevard," and T-20 "Expand Bikeway Network."

1. Provide Pedestrian Network Improvements: The GHG reduction is based on VMT reduction associated with enhanced pedestrian access and associated displacement of light-duty VMT.
2. Construct or Improve Bike Boulevard: The GHG reduction is based on VMT reduction associated with increased bicycle use and associated displacement of light-duty VMT.
3. Expand Bikeway Network: The GHG reduction is based on VMT reduction associated with increased bicycle use and associated displacement of light-duty VMT.

Emissions reduction percentages are applied to EMFAC2021 emissions from the circa 2030 regional commuter vehicle fleet to estimate GHG emission reductions.

Inputs

T-18. Provide Pedestrian Network Improvements	
Additional sidewalks	15%
T-19B. Construct or Improve Bike Boulevard	
Additional bicycle boulevards	20%
T-20. Expand Bikeway Network	
Additional bike lanes	45%

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions by up to 11.86 short tons/year and DPM emissions by up to 0.01 short tons/year.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EMFAC. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory Accessed online in January 2024 at: https://arb.ca.gov/emfac/

Sacramento Area Council of Governments (SACOG). 2016. Metropolitan Transportation Plan/Sustainable Communities Strategy. Available at: https://www.sacog.org/sites/main/files/file-attachments/mtpscs_complete.pdf

TR-5 – Transportation Demand Management Program

Summary Description

This measure includes the implementation of various programs to reduce use of single-occupancy vehicles:

- Implementing a voluntary or mandatory CTR program.
- Implementing ridesharing programs to encourage carpooled vehicle trips.
- Subsidized or discounted, or free transit passes for employees and/or residents. Reducing cost for choosing transit improves the competitiveness of transit against driving, thus decreasing single-occupancy trips.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measures T-5 "Implement CTR Program (Voluntary)," T-6 "Implement CTR Program (Mandatory Implementation and Monitoring)," T-8 "Provide Ridesharing Program," and T-9 "Implement Subsidized or Discounted Transit Program." The GHG reduction is based on VMT reductions associated with increased shifting away from single occupancy vehicle trips. GHG emissions are reduced for passenger cars and passenger trucks based on EMFAC2021, accounting for the estimated commuter traffic fraction from SACOG congestion trends.

Inputs

T-5. Implement CTR Program (Voluntary)	
Employees Eligible for Program	76%
Region-wide Penetration Rate	45.5%
T-6. Implement CTR Program (Mandatory Implementation and Monitoring)	
Employees Eligible for Program	76%
Region-wide Penetration Rate	45.5%
T-8. Provide Ridesharing Program	
Employees Eligible for Program	30%
Region-wide Penetration Rate	45.5%
T-9. Implement Subsidized or Discounted Transit Program	
Fare Reduction	75%
Individuals Eligible for Subsidy	30%
VMT Reduced from Opted-In Individuals	100%
Region-wide Penetration Rate	45.5%

NO_x and DPM Emission Reductions

This measure will annually reduce NO_x emissions by up to 172.84 short tons/year and reduce DPM emissions by up to 0.15 short tons/year if diesel buses are used.

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

EMFAC. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory Accessed online in January 2024 at: https://arb.ca.gov/emfac/

SACOG. 2016. Metropolitan Transportation Plan/Sustainable Communities Strategy. Accessed online in January 2024 at: https://www.sacog.org/sites/main/files/file-attachments/mtpscs_complete.pdf

TR-6 – Active Modes of Transportation for Youth

Summary Description
This measure includes the implementation of active modes of transportation for the youth including new sidewalks, bike lanes, off-street pathways, and street crossings.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook Update methodology (Sac Metro Air District, 2023) for Measure T-56 "Active Modes of Transportation for Youth." The GHG reduction is based on the light-duty VMT reduction associated with increased modes of transportation for youth within two miles of the school. The affected vehicle fleet is assumed to include passenger cars, passenger trucks, and motorcycles for the projected circa 2030 GHG emissions sourced from EMFAC2021.

Inputs

T-56. Active Modes of Transportation for Youth	
Students within 2 miles who are driven to school after project implementation	20%

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions by up to 10.34 short tons/year and reduce DPM emissions by up to 0.01 short tons/year.

REFERENCES

EMFAC. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory Accessed online in January 2024 at: https://arb.ca.gov/emfac/

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

TR-7 – Establish a School Bus Program

Summary Description
This measure includes establishing or expanding a school bus program to provide transportation to school for students.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook Update (Sac Metro Air District, 2023) methodology for Measure T-40 "Establish a School Bus Program." The GHG reduction is based on the light-duty VMT reduction associated with increased school bus use through a school bus program, accounting for increased bus activity and emissions. The affected vehicle fleet is assumed to include passenger cars, passenger trucks, and motorcycles for the projected circa 2030 GHG emissions sourced from EMFAC2021.

Inputs

T-40. Establish a School Bus Program	
Students across the school who begin riding the bus as a result of the program	50%
Students served by bus system (regardless of whether they ride)	100%
Target average student occupancy of school buses	25

NO_x Reductions
This measure will annually reduce NO_x emissions by up to 3.20 short tons/year.

REFERENCES

EMFAC. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory Accessed online in January 2024 at: https://arb.ca.gov/emfac/

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

TR-8 – Electric Bikeshare

Summary Description

This measure includes establishing electric bikeshare programs to increase ridership across the region, thereby reducing single-occupancy vehicle trips and VMT.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measure T-22-B "Transition Conventional to Electric Bikeshare." The GHG reduction is based on the light-duty VMT reduction associated with increased bikeshare usage due to increased ridership and accessibility. The affected vehicle fleet is assumed to include passenger cars, passenger trucks, and motorcycles in the Sacramento-Roseville CSA, circa 2030. GHG emissions are sourced from EMFAC2021.

Inputs

T-22-B. Transition Conventional to Electric Bikeshare	
Residences in plan/community with access to electric bikeshare program without measure	0%
Residences in plan/community with access to electric bikeshare program with measure	15%

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Available online at: https://www.caleemod.com/handbook/full_handbook.html

EMFAC. 2021. California Air Resources Board's EMFAC Model (v1.0.2) Emissions Inventory Accessed online in January 2024 at: https://arb.ca.gov/emfac/

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

Natural and Working Lands Measures

NW-1 – Wildfire Resilience and Management

Summary Description
This measure involves implementing fuel treatments in forests to reduce the severity and carbon emissions of wildfire events long term.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook Update methodology (Sac Metro Air District, 2023) for Measure N-7 "Wildfire Resilience and Management." GHG reductions are based on the difference between total carbon sequestered in treated versus untreated forest stands, as calculated using the calculation sheet provided with the CAPCOA Handbook Update (Sac Metro Air District, 2023a). Calculations assume a project duration of 50 years since long-term duration is necessary to realize GHG reductions.

The annual GHG reduction represents an average reduction per year, over the entire project duration. However, the average reduction is not expected every year since there would be an increase of carbon emissions short-term (from the use of fuel treatments and prescribed burns) and would result in carbon reductions long-term (from lower wildfire intensities in the long-term).

Inputs

N-7. Wildfire Resilience and Management	
Project duration	50 years
Total additional acres of mixed-conifer forest treated	4,000 acres
Total additional acres of Ponderosa forest treated	4,000 acres
Average mixed-conifer forest stand age	100 years
Average Ponderosa forest stand age	100 years

REFERENCES

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

Sac Metro Air District. 2023a. Measure NW-1 Calculation Sheet. Provided by Sac Metro Air District December 26, 2023.

NW-2 – Biomass Energy

Summary Description

This measure involves installing new biomass or biofuel electricity generation. Biofuels have lower life-cycle carbon intensity than fossil fuels.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook Update methodology (Sac Metro Air District, 2023) for Measure E-26 "Biomass Energy." The GHG reduction was estimated based on power generated by replacing typical California lifecycle electricity carbon intensity with biomass energy. California lifecycle electricity carbon intensity is based on the CAPCOA Handbook Update. GHG reductions are based on biomass electricity generation with the dedicated woody crops and forest residual fuel and capacity factor for wood biomass.

Inputs

E-26. Biomass Energy	
Dedicated Woody Crops	189.6/lb CO_2e/MWh
Forest Residues	374.8/lb CO_2e/MWh
Capacity Factor for Biomass Electricity Generation in the United States (Wood)	59%
Rated peak generation power	1 MW

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

NW-3 – Increase Tree Canopy

Summary Description

This measure would increase tree planting in urban and natural areas. Trees sequester carbon and directly reduce GHG emissions.

Emission Reduction Estimation Approach

The estimated reductions are based on the CAPCOA Handbook methodology for Measure N-2 "Expand Urban Tree Planting" and account for carbon sequestered by trees. Trees may also provide shade, which can reduce the UHI effect, and decrease energy (air conditioning) usage, depending on the project. Indirect potential reductions are not accounted for in this analysis.

The average carbon sequestration rate per acre of canopy was estimated using the i-Tree County Tool for the counties in the Sacramento-Roseville CSA. The acres of canopy were estimated as the product of the number of trees planted and canopy per tree. Canopy per tree was assumed to be the minimum shade cover value for 15 year-old trees (which ranges from 314 square feet to 962 square feet per tree), as provided in the Planning and Environmental Review Master Tree List from Sacramento County (2015).

Inputs

N-2. Expand Urban Tree Planting	
Number of trees	150,000
Canopy per tree	0.0072 acres/tree
Acres of canopy	1,081

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

i-Tree County Tool. Accessed online in January 2024 at: https://county.itreetools.org/

Sacramento County. 2015. Planning and Environmental Review Master Tree List (version 1-8-14). Accessed online in January 2024 at: https://planning.saccounty.gov/Programs/Documents/Tree%20Coordinator/Tree%2015-year%20shade%20values%201-8-14.pdf

NW-4 – Carbon Sequestration Program/Carbon Farming

Summary Description
This measure will establish a carbon sequestration and/or carbon farming project(s).

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook methodology for Measure M-1 "Establishing a Carbon Sequestration Project." GHG reductions are based on conservation practices associated with carbon farming including cropland to herbaceous cover, grazing lands, woody plantings, restoration of disturbed lands, and cropland management using the NRCS's COMET-planner tool.

After selecting a general conservation practice category, the tool allows the user to select a NRCS conservation practice standard to generate emission factors in MT CO_2e/yr-acre. An emission factor for each general conservation practice (i.e., cropland to herbaceous cover, grazing lands, woody plantings, restoration of disturbed lands, cropland management) was calculated by averaging emission factors across all applicable NRCS conservation practices. Project acreage for each general conservation practice was multiplied by the applicable average emission factor to estimate potential GHG reductions.

Inputs

M-1. Establishing a Carbon Sequestration Project	
Total carbon sequestration/carbon farming acreage	100,000[a]

[a] 20,000 acres each for the five general conservation practices

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Comet-Planner Tool. Accessed online in January 2024 at: http://www.comet-planner.com/

NW-5 – GHG Local Offset Program

Summary Description
This measure will reduce GHG emissions by funding and implementing GHG offset projects.

Emission Reduction Estimation Approach
This measure is based on CAPCOA Handbook Measure M-2 "Establish Offsite Mitigation." The estimated reductions are based on the verified projects included in CARB's GHG Local Offset Program. Potential project types include (i) livestock – installing biogas control system, (ii) mine CH_4 capture, (iii) ODS related projects, (iv) U.S forest projects, and (v) rice cultivation projects. Project-specific emissions reduction examples are available through the Climate Action Reserve Registry. Project reductions were taken from the Climate Reserve database for each project type based on the following hierarchy.

1. Projects in the Sacramento county area
2. Projects in California
3. Projects in the United States

Emission reductions were estimated for each project type as the average across all example project type-specific reductions (shown in the table below). Total potential emission reductions were estimated as the sum of the average emissions for each of the following project types: (i) livestock – installing biogas control system, (ii) ODS related projects, and (iii) U.S forest projects. Reductions for rice cultivation projects were not estimated as there are no rice cultivation projects available through the Climate Action Reserve. Mine CH_4 capture projects were not included as mine CH_4 capture projects are not expected to occur within the project area.

Inputs

Sample Projects from Climate Action Reserve Registry		
Project Description	**Project Type**	**Reduction in GHG Emissions from GHG Offset Protocols (MT CO_2e/project)**
Cottonwood Dairy Organic Waste Digestion Project	Livestock projects - Installing Biogas Control System	22,229
Fiscalini Farms Anaerobic Digester	Livestock projects - Installing Biogas Control System	3,372
Fiscalini Farms Anaerobic Digester	Livestock projects - Installing Biogas Control System	3,538
RemTec International ODS Destruction Domestic Project #2	ODS Projects	38,082
EOS ARB ODS 2014-2	ODS Projects	33,214
ClimeCo ODS Destruction 34	ODS Projects	127,338
Monte Rio Improved Forest Management Project	U.S. Forests	4,692
Montesol - Forest Carbon Partners Improved Forest Management Project	U.S. Forests	1,620
Rips Redwoods - Improved Forest Management	U.S. Forests	7,287

REFERENCES

CAPCOA. 2021. Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity. Accessed online in January 2024 at: https://www.caleemod.com/handbook/full_handbook.html

Climate Action Reserve Map of Projects 2023. Accessed online in January 2024 at: https://www.climateactionreserve.org/registry/map/

CARB Compliance Offset Protocols – Project Types. Accessed online in January 2024 at: https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/compliance-offset-protocols

NW-6 – Natural and Working Lands Equipment Emissions Reduction

Summary Description
This measure includes replacing natural and working lands fossil-fueled equipment with electric equipment.

Emission Reduction Estimation Approach
The estimated reductions are based on the CAPCOA Handbook Update methodology (Sac Metro Air District, 2023) for Measure MISC-1 "Use Electric or Hybrid Powered Equipment." GHG reductions are based on the reductions estimated for similar construction equipment measures in the Sacramento Climate Action Plan for 2016. Emissions reduction percentages are applied to circa 2030 EMFAC2021 emissions for applicable equipment including diesel agricultural tractors and diesel agricultural ATVs. GHG reductions estimates consider emissions related to increased electricity usage by new electric equipment. Increased emissions from electric equipment are based on an electricity carbon intensity projection for SMUD from the CAPCOA Handbook.

Inputs

M-6. Off-Road Equipment Efficiency in Natural Working Land Groups	
Penetrationof Electric Equipment	55%

NO_x and DPM Emission Reductions
This measure will annually reduce NO_x emissions up to 11.6 short tons/year and reduce DPM emissions up to 0.8 short tons/year.

REFERENCES

Sac Metro Air District. 2023. 2021 CAPCOA Handbook Update Task 1.2 Deliverable: Develop process and summaries for up to 10 quantification measures (Draft). Provided by Sac Metro Air District December 22, 2023. Available: https://caleemod.com/handbook/resources.html

Sacramento County. 2016. Sacramento Climate Action Plan. Available at: https://planning.saccounty.gov/PlansandProjectsIn-Progress/Documents/Climate%20Action%20Plan/Final%20Climate%20Action%20Plan.pdf

Appendix D. Supporting Materials and Documentation for Community Engagement

Table 1. OAC Organizations

OAC Organizations		
Aura Planning	Climate Emergency Mobilization Task Force	Placer Food Bank
Breathe California – Sacramento Region	County of Yolo	Placer Resource Conservation District
California State University, Sacramento	Environmental Council of Sacramento	Sacramento Area Bicycle Advocates
Carmichael Improvement District	Health Education Council	Sacramento Metro Advocates for Rail and Transit (SMART)
CivicWell	PEV Collaborative	Sierra Club
CivicThread	Placer County Public Health & Human Services	Sutter Buttes Regional Land Trust

Figure 1. Low Income and Disadvantaged Communities Map Viewer

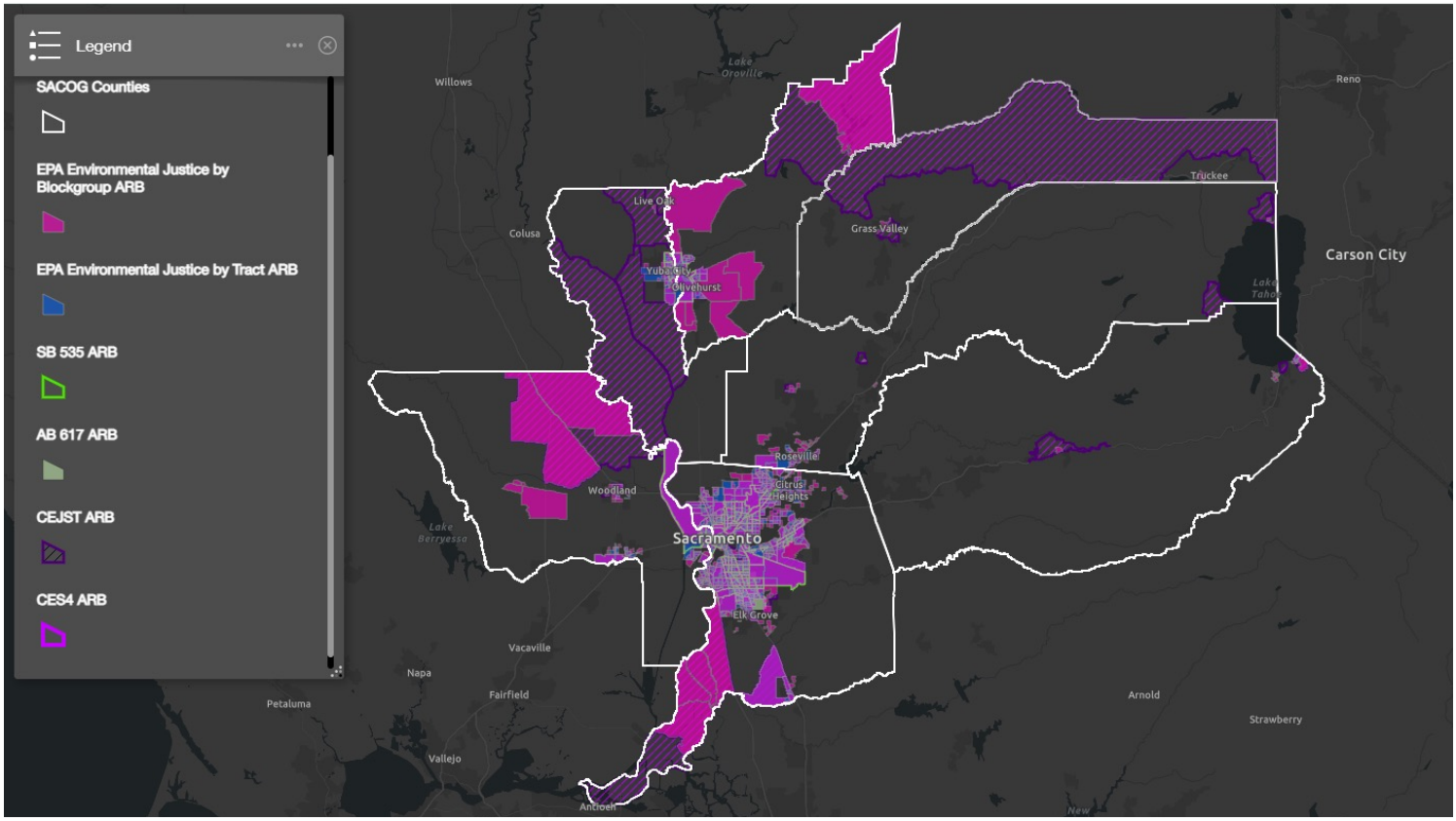


Figure 1. Low Income and Disadvantaged Communities Map Viewer with EJScreen, Senate Bill 535, Assembly Bill 617, CalEnviroScreen 4.0, and CEJST data.

Table 2. Stakeholder Interview Participants

Lead Agency/Chair – Sac Metro Air District	
Sector	**Organization**
CBOs	350 Sacramento*
	Aura Planning
	Breathe California
	CivicWell
	Climate Emergency Mobilization Task Force
	Environmental Council of Sacramento
	First Step Communities
	Health Education Council
	Latino Leadership Council*
	PEV Collaborative
	Sacramento Area Bicycle Advocates
	Sacramento Environmental Justice Coalition
	Sacramento Metro Advocates for Rail and Transit
	Sacramento Regional Coalition to End Homelessness
	Sierra Club
	Sierra Streams Institute
	Sutter Buttes Regional Land Trust
Government Organizations	Placer County Public Health and Human Services
	Placer County Resource Conservation District
	Sacramento Area Council of Governments (SACOG)*
	Yuba City Development Department
	Yuba County Resource Conservation District
Academia	California State University, Sacramento*

*Table 2. Stakeholder Interview Participants List. * Denotes that multiple representatives were present during the interview.*

Stakeholder Interview Questions

1. What are your organization's current priorities?
2. Who do you serve? (Demographics of community members, languages represented in the community, number of people engaged, which region or locations do you serve, etc.)
3. Given previous engagement work you have done with these communities, what has been communicated to you as a top priority regarding air quality, climate equity, or environmental justice?
4. The CPRG program could potentially fund a variety of projects (ex. EV charging infrastructure, building energy efficiency, tree plantings). What initiatives/programs/strategies would these communities most benefit from? What strategies or projects would you prioritize based on the community benefits they provide?

Table 3. Consulted Community Plans and Documents

Consulted Community Plans and Documents				
County	Reference #	Responsible Agency	Document/Plan (Year, if available)	Methodology
El Dorado, Placer, Sacramento, Sutter, Yolo, and Yuba	1	Sacramento Area Council of Governments	Blueprint 2025 Focus Groups (2023)	Focus Group
	2	Valley Vision	Livability Poll (2023)	Survey
	3	Valley Vision/SACOG	Built Environment Poll (2023)	Survey
Sacramento	4	Sacramento Regional Transit	Origin-Destination Survey (2023)	Survey
	5	Sacramento Regional Transit	Bus Stop Improvement Plan (2023)	Survey, Community Meetings
	6	County of Sacramento	Environmental Justice Element Research Document (2019)	Secondary Research Review
	7	City of Sacramento	Climate Action Plan Community Engagement Summary (2022)	Survey, Community Workshops, Other Direct Engagement
	8	City of Sacramento	Transportation Priorities Plan Phase I (2021)	Survey, Community Meetings
	9	City of Sacramento	Environmental Justice Factbook	Secondary Research Review
	10	City of Elk Grove	Climate Action Plan Update Survey (2023)	Survey
	11	City of Folsom	Active Transportation Plan (2022)	Community Events, Community Workshops, Stakeholder Group
Yolo	12	Yolo County	Climate Action and Adaptation Plan Survey (2023)	Survey
	13	City of Davis	Climate Action Plan Community Outreach Results (2016)	Survey, Community Workshops

Table 4. Outreach Log

Outreach Log		
Event/Location	**Date**	**Type of Outreach**
Roseville Fourth Friday Community Fair	10/27/2023	Tabling
Yuba County Library Trick or Treat in the Parking Lot	10/30/2023	Tabling
Meadowview Family Festival	11/4/2023	Tabling
California Swan Festival	11/11-12/2023	Tabling
Health Education Council Drive-Thru Food Distribution	10/18/2023 (every other Wednesday)	Print Materials
Martin Luther King, Jr. Library	11/4/2023	Print Materials

Community Benefits Survey Results

1. What sources of air pollution most impact you and your community? Please select all that apply.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Wildfires	50.32%	233	48%	174	49.09%	81
Wood burning fireplaces	25.70%	119	27%	99	25.45%	42
Wood and natural gas stoves	26.57%	123	29%	106	25.45%	42
Passenger vehicles and trucks	50.97%	236	52%	189	53.33%	88
Construction	27.21%	126	29%	104	21.82%	36
Farming and agriculture	17.71%	82	19%	68	12.12%	20
Industrial facilities (i.e., distribution centers, factories, and power plants)	28.73%	133	32%	116	30.91%	51
Commercial facilities (i.e., gas stations)	14.90%	69	16%	59	16.36%	27
Other (please specify)	3.89%	18	2%	9	5.45%	9
	Answered	**463**	**Answered**	**364**	**Answered**	**165**
	Skipped	**0**	**Skipped**	**0**	**Skipped**	**0**

2. How would you prioritize the following benefits of air pollution reduction in your community? Please select up to four answer choices. The remainder of the survey will focus on these benefits.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Improved public health (i.e., lower child asthma rates, fewer emergency room visits)	56.16%	260	54%	197	45.45%	75
Enhanced pedestrian or traffic safety	34.99%	162	35%	127	34.55%	57
Lower energy bills	52.05%	241	53%	192	50.30%	83
Lower transportation costs	30.67%	142	30%	111	34.55%	57
Enhanced energy reliability (such as protection from blackouts)	37.80%	175	38%	138	33.33%	55
Better access to goods, services, and jobs	31.75%	147	32%	117	38.79%	64
Waste reduction	37.37%	173	40%	146	34.55%	57
	Answered	**463**	**Answered**	**364**	**Answered**	**165**
	Skipped	**0**	**Skipped**	**0**	**Skipped**	**0**

3. To improve public health, which of the following would you prioritize for your home or neighborhood? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Replace natural gas appliances with electric appliances	42.91%	112	44.95%	89	30.67%	23
Plant more trees in neighborhoods	60.54%	158	63.13%	125	77.33%	58
Replace vehicles and equipment with electric or zero-emission technology	60.54%	158	59.09%	117	46.67%	35
Make walking and biking safer and more convenient	62.84%	164	64.65%	128	73.33%	55
Other (please specify)	11.49%	30	7.07%	14	10.67%	8
	Answered	**261**	**Answered**	**198**	**Answered**	**75**
	Skipped	**202**	**Skipped**	**166**	**Skipped**	**90**

4. To make biking and walking safer, which of the following would you prioritize for your neighborhood? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Protected bike lanes	60.49%	98	60.63%	77	61.40%	35
Slow down traffic in pedestrian areas	50.00%	81	51.18%	65	49.12%	28
Pedestrian signals at intersections and pedestrian crossings	55.56%	90	59.06%	75	47.37%	27
Planter strips to buffer sidewalks from streets	38.27%	62	38.58%	49	33.33%	19
Well-lit streets	35.19%	57	33.07%	42	40.35%	23
Other (please specify)	8.02%	13	7.87%	10	7.02%	4
	Answered	**162**	**Answered**	**127**	**Answered**	**57**
	Skipped	**301**	**Skipped**	**237**	**Skipped**	**108**

5. To lower energy costs, which of the following would you prioritize for your home or rental unit? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Home weatherproofing for improved insulation	55.19%	133	54.17%	104	55.42%	46
Updated Heating, Ventilation, and Air Conditioning (HVAC) / air filtration systems	65.98%	159	64.06%	123	69.88%	58
Affordable solar energy and storage	75.93%	183	76.04%	146	66.27%	55
Replace natural gas appliances with electric appliances	41.08%	99	43.75%	84	28.92%	24
Other (please specify)	2.07%	5	1.56%	3	1.20%	1
	Answered	**241**	**Answered**	**192**	**Answered**	**83**
	Skipped	**222**	**Skipped**	**172**	**Skipped**	**82**

6. To reduce waste, which of the following would you prioritize for your community? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Low-flow water fixtures and water efficient appliances	51.45%	89	53.42%	78	56.14%	32
Installation of drought resistant landscaping on residential, commercial, and public lands	46.82%	81	47.95%	70	52.63%	30
Expand and enhance food waste recovery programs	54.91%	95	53.42%	78	52.63%	30
Expand and enhance recycling programs	54.91%	95	53.42%	78	49.12%	28
Waste-to-energy programs	51.45%	89	55.48%	81	45.61%	26
Other (please specify)	5.20%	9	3.42%	5	5.26%	3
	Answered	**173**	**Answered**	**146**	**Answered**	**57**
	Skipped	**290**	**Skipped**	**218**	**Skipped**	**108**

7. To lower transportation costs, which of the following would you prioritize for your community? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Affordable access to electric vehicles	40.85%	58	43.24%	48	31.58%	18
Affordable access to electric bicycles	48.59%	69	52.25%	58	54.39%	31
Make public transit a more viable option through expanded and more frequent public transit service	69.01%	98	65.77%	73	57.89%	33
Make public transit a more viable option through improved sanitation and safety at stops and while riding	40.85%	58	38.74%	43	45.61%	26
Expand safe pedestrian and bicycle infrastructure	43.66%	62	41.44%	46	45.61%	26
Other (please specify)	4.93%	7	4.50%	5	0.00%	0
	Answered	**142**	**Answered**	**111**	**Answered**	**57**
	Skipped	**321**	**Skipped**	**253**	**Skipped**	**108**

8. To improve energy reliability, which of the following would you prioritize for your community? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Solar battery backup systems at homes	58.29%	102	60.87%	84	49.09%	27
Better management of forests to reduce chance of wildfire power shutdowns	70.86%	124	71.74%	99	67.27%	37
Improve energy efficiency to reduce overburdening the energy grid during hot days	66.86%	117	67.39%	93	70.91%	39
Make utility infrastructure more resilient to storms, heat, and fire	54.86%	96	55.07%	76	52.73%	29
Other (please specify)	4.57%	8	3.62%	5	5.45%	3
	Answered	**175**	**Answered**	**138**	**Answered**	**55**
	Skipped	**288**	**Skipped**	**226**	**Skipped**	**110**

9. To improve access to goods, jobs, and services, which of the following would you prioritize for your community? Please select up to three.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Develop more housing near jobs, shopping centers, and public transit	62.59%	92	65.81%	77	59.38%	38
Additional EV charging spaces	23.81%	35	23.08%	27	18.75%	12
Improve access to public transit through expanded and more frequent transit service	57.14%	84	57.26%	67	51.56%	33
Make public transit a more viable option through improved sanitation and safety at transit stops and while riding	45.58%	67	43.59%	51	46.88%	30
Expand bicycling infrastructure	28.57%	42	28.21%	33	29.69%	19
Enhance pedestrian safety	21.77%	32	20.51%	24	29.69%	19
Other (please specify)	4.08%	6	3.42%	4	1.56%	1
	Answered	**147**	**Answered**	**117**	**Answered**	**64**
	Skipped	**316**	**Skipped**	**247**	**Skipped**	**101**

10. Would you classify your neighborhood as urban, suburban, or rural?						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Urban	46.62%	214	51.39%	185	50.91%	84
Suburban	27.23%	125	24.44%	88	24.24%	40
Rural	16.12%	74	14.72%	53	15.76%	26
Prefer not to say	8.50%	39	8.06%	29	8.48%	14
Other (please specify)	1.53%	7	1.39%	5	0.61%	1
	Answered	**459**	**Answered**	**360**	**Answered**	**165**
	Skipped	**4**	**Skipped**	**4**	**Skipped**	**0**

11. Which of the following best describes your current housing situation?						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Homeowner	55.02%	252	56.67%	204	30%	50
Renter	34.06%	156	33.89%	122	56%	92
Prefer not to say	9.83%	45	8.61%	31	12%	19
Other (please specify)	1.09%	5	0.83%	3	2%	4
	Answered	**458**	**Answered**	**360**	**Answered**	**165**
	Skipped	**5**	**Skipped**	**4**	**Skipped**	**0**

12. How would you describe yourself? Please select all that apply.						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
American Indian or Alaska Native	5.43%	25	6.09%	22	9.09%	15
Asian or Asian American	11.09%	51	10.53%	38	13.33%	22
Black or African American	8.91%	41	6.65%	24	12.73%	21
Hispanic or Latino	13.70%	63	14.68%	53	21.21%	35
Middle Eastern or North African	3.70%	17	3.32%	12	4.24%	7
Native Hawaiian or Other Pacific Islander	6.09%	28	5.26%	19	6.06%	10
White or Caucasian	52.61%	242	55.96%	202	32.12%	53
Prefer not to say	6.52%	30	4.99%	18	5.45%	9
Other (please specify)	1.96%	9	1.39%	5	3.03%	5
	Answered	**460**	**Answered**	**361**	**Answered**	**165**
	Skipped	**3**	**Skipped**	**3**	**Skipped**	**0**

13. What was your total household income before taxes in 2022?						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Less than $40,000	14.81%	68	13.85%	50	41.46%	68
$40,000 to $59,000	15.90%	73	16.90%	61	44.51%	73
$60,000 to $79,900	15.69%	72	17.17%	62	6.10%	10
$80,000 to $99,999	17.43%	80	18.01%	65	6.10%	10
$100,000 to $150,000	15.69%	72	14.68%	53	0.00%	0
$150,000 or more	12.85%	59	12.74%	46	0.61%	1
Other (please specify)	7.63%	35	6.65%	24	1.22%	2
	Answered	**459**	**Answered**	**361**	**Answered**	**164**
	Skipped	**4**	**Skipped**	**3**	**Skipped**	**1**

14. What is your zip code?						
Answer Choices	**Overall Survey Responses**		**LIDAC Survey Responses**		**Lower Income and Non-English Survey Responses**	
Urban	34.34%	159	40.66%	148	25.45%	42
Suburban	36.50%	169	30.77%	112	43.64%	72
Valley-Rural	14.47%	67	17.58%	64	21.21%	35
Mountain	14.47%	67	10.99%	40	9.70%	16
	Answered	**462**	**Answered**	**364**	**Answered**	**165**
	Skipped	**0**	**Skipped**	**0**	**Skipped**	**0**

Appendix E. LIDAC Identification Methodology

This analysis uses CEJST, EJScreen, and CalEnviroScreen to identify LIDACs in a manner consistent with CPRG guidance and California-state definitions of disadvantaged and over-burdened communities.[1] A summary of each tool is described below, and the method used to group LIDACs based on similar burdens is then described.

Tools Used to Identify and Define LIDACs for the Sacramento-Roseville CSA

CEJST

CEJST is an interactive map developed by the White House Council on Environmental Quality to help federal agencies identify disadvantaged communities that are marginalized, underserved, and overburdened by pollution.[2] CEJST highlights disadvantaged census tracts in the U.S. and can be used to evaluate a community's need for environmental justice-related benefits.[3]

CEJST splits 31 individual indicators into eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The following criteria is used to classify a disadvantaged community in CEJST:

1. Located in a census tract at or above the threshold for one or more environmental, climate, or other burdens; and,
2. Located in a census tract at or above the threshold for an associated socioeconomic burden.
   a. Low-income status: The designated threshold is the 65th percentile of all communities.
   b. Workforce development: The socioeconomic indicators of interest are high school degree non-attainment, or whether 10% or more of adults 25 or older have not attained a high school degree; or,
3. Located in a census tract entirely surrounded by disadvantaged communities and is at or above the 50th percentile for low income; or,
4. Located in a census tract that is within the boundaries of federally recognized tribes including Alaska Native Villages.

EJ Screen

EJScreen is a widely used federal assessment tool for evaluating potential impacts to communities facing EJ-related concerns.[4] It provides a nationally consistent dataset and approach for combining environmental and demographic socioeconomic indicators used to assess potential exposure in vulnerable communities. This analysis uses the most recent version of the tool, EJScreen Version 2.2, which was released in June 2023.[5] Data is available on the census tract and CBG level using 2020 census geography.

EJScreen data includes environmental indicators, socioeconomic indicators, and a series of index values that combine 13 environmental indicators with socioeconomic indicators.[6] In this analysis, a community is identified as a LIDAC when the Supplemental Index is at or above the 90th percentile on a state or national level.[1] The Supplemental Index combines one of the 13 environmental indicators with the Supplemental Demographic Index, which averages five different socioeconomic factors into a single value using the following data:

- The environmental indicator percentile for a given area.
- A Supplemental Demographic Index for a given area, consisting of the average percent low-income population, percent unemployed, percent limited English speaking, percent less than high school education, and low life expectancy.

Supplemental Index results are intended to represent the average resident within the study area; however, the data used to calculate the index are based on a combination of census tract and CBG level data, which can be different geographic areas than the user-defined study area. In this way, the EJ Indexes represent the closest approximation to the average resident in the study area but are estimates only, with some imprecision.

CalEnviroScreen

CalEnviroScreen was developed by the California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA) to map and characterize populations that may be disproportionately impacted by pollution in California. CalEnviroScreen 4.0, which is the most recent version of the tool, uses environmental, health, and socioeconomic data to produce "scores" and associated index percentiles for most census tracts in the state. The CalEnviroScreen score encompasses 21 statewide indicators that are split into four categories: exposure indicators, environmental effects indicators, sensitive population indicators, and socioeconomic factor indicators.[16] The CalEnviroScreen score is calculated for each census tract, using 2010 census geographies, by multiplying the following:

- **Pollution Burden Characteristics:** the weighted average of exposures and environmental effects. Environmental effects consists of five different indicators while exposure consists of eight different indicators. The environmental effects component is weighted one-half of the exposures because the environmental effects variables are predicted to make a smaller contribution to pollution burden than the exposure variables.
- **Population Characteristics:** the average of sensitive population, which consists of three indicators, and socioeconomic factors, which consists of five indicators.

The CalEnviroScreen scores from each census tract are then compared on a state percentile scale. To identify a community as disadvantaged, CalEnviroScreen uses guidance from California SB 535 (De León, 2012) and AB 617 (Garcia, 2017).[5]

California SB 535

In 2012, California SB 535 (De León, 2012) established initial requirements for minimum funding levels to "disadvantaged communities" (DACs). The legislation also gives CalEPA the responsibility for identifying those communities, stating that CalEPA's designation of disadvantaged communities must be based on "geographic, socioeconomic, public health, and environmental hazard criteria.[8]" In May 2022, CalEPA revised the definition of DACs for the purposes of SB 535 to include the following:

1. Census tracts receiving the highest 25 percent of overall scores in CalEnviroScreen 4.0 (1,984 tracts).
2. Census tracts lacking overall scores in CalEnviroScreen 4.0 due to data gaps but receiving the highest 5% of CalEnviroScreen 4.0 cumulative pollution burden scores (19 tracts).
3. Census tracts identified in the 2017 DAC designation as disadvantaged, regardless of their scores in CalEnviroScreen 4.0 (307 tracts).
4. Lands under the control of federally recognized tribes.

California AB 617

In 2017, California AB 617 (C. Garcia, 2017) established the Community Air Protection Program to reduce exposure in communities most impacted by air pollution. AB 617 incorporates communities identified by CARB, the Sac Metro Air District, and local communities that are the "most impacted by air pollution." In this analysis, any community identified as disadvantaged under SB 535 or AB 617 is considered a LIDAC.

Method to Group LIDACs by Similar Burdens

In total, 45 unique indicators are considered by CEJST, EJScreen, and CalEnviroScreen. Some indicators, such as exposure to $PM_{2.5}$, show up in all three tools. To better understand which types of indicators are leading to the classification of LIDACs in the Sacramento-Roseville CSA, the 45 unique indicators are split into eight categories that mirror the categories used in CEJST. The eight categories of burdens include: workforce development, legacy pollution, health, transportation, water and wastewater, energy, climate change, and housing. Table A-1 illustrates how each of the 45 unique indicators were split into eight different categories.

Table A-1: Categories Used in the Sac Metro Air District LIDAC Classification by Indicator

Climate Change	Energy	Health	Housing	Legacy Pollution	Transportation	Water and Wastewater	Workforce Development
Expected Agricultural Loss Rate	Energy Burden	Air Toxics Cancer Risk	Housing Burden	Abandoned Mine Presence	Diesel PM exposure	Wastewater Discharge	Low Income
Expected Building Loss Rate		Air Toxics Respiratory Hazard	Lack of Green Space	Cleanup Sites	Traffic Proximity	Drinking Water Contamination	Poverty
Expected Population Loss Rate		Asthma	Lack of Indoor Plumbing	Formerly Used Defense Site Presence	Traffic Impacts	Leaking Underground Storage Tanks	High School Degree Non-Attainment
Flood Risk		Coronary Heart Disease	Lead Paint	Groundwater Threats	Travel Barriers	Impaired Water Bodies	Linguistic Isolation
Wildfire Risk		Cardiovascular Disease	Children's Lead Risk from Housing	Ozone			Low Median Household Income
		Diagnosed Diabetes		$PM_{2.5}$			Unemployment
		Low Birth Weight Infants		Proximity to Hazardous Waste Sites			
		Low Life Expectancy		Proximity to NPL/Superfund Sites			
		Pesticide Use		Proximity to RMP Facilities			
				Toxic Releases to Air			
				Toxic Releases from Facilities			

REFERENCES

[1] *USEPA. Accessed December 18, 2023. Climate Pollution Reduction Grants: LIDAC Benefits Analysis. Available at: https://www.epa.gov system/files/documents/2023-08/Low%20Income%20%20Disadvantaged%20Communities%20Benefits%20Analysis.pdf*

[2] *CEQ. Accessed January 24, 2024. Climate and Economic Justice Screening Tool. Available at: https://screeningtool.geoplatform.gov/en about and https://screeningtool.geoplatform.gov/en/methodology#5.46/38.072/-115.901*

[3] *CEJST classifies DACs on the census tract level based on 2010 census geography.*

[4] *USEPA. November 14, 2023. EJScreen: Environmental Justice Screening and Mapping Tool. Available at: https://www.epa.gov/ejscreen*

[5] *USEPA. September 19, 2023. EJScreen Change Log. Available at: https://www.epa.gov/ejscreen/ejscreen-change-log*

[6] *USEPA. October 4, 2023. Understanding EJScreen Results. Available at: https://www.epa.gov/ejscreen/understanding-ejscreen-results*

[7] *OEHHA. October 2021. CalEnviroScreen 4.0. Available at: https://oehha.ca.gov/media/downloads/calenviroscreen/report calenviroscreen40reportf2021.pdf*

[8] *https://calepa.ca.gov/envjustice/ghginvest/*

Appendix F. List of LIDAC Communities

List of Census Tracts (2010 Geography) Classified as a LIDAC in CEJST
February 2024

County	Tract ID
El Dorado	06017030302
El Dorado	06017030602
El Dorado	06017031302
El Dorado	06017031600
Nevada	06057000600
Nevada	06057000900
Placer	06061020106
Placer	06061020107
Placer	06061020901
Placer	06061021403
Placer	06061021603
Placer	06061022300
Sacramento	06067000600
Sacramento	06067000700
Sacramento	06067001101
Sacramento	06067001700
Sacramento	06067002000
Sacramento	06067002200
Sacramento	06067002800
Sacramento	06067003000
Sacramento	06067003101
Sacramento	06067003102
Sacramento	06067003202
Sacramento	06067003203
Sacramento	06067003204
Sacramento	06067003600
Sacramento	06067003700
Sacramento	06067003800
Sacramento	06067004100
Sacramento	06067004201
Sacramento	06067004202
Sacramento	06067004203
Sacramento	06067004300
Sacramento	06067004401
Sacramento	06067004402
Sacramento	06067004501

County	Tract ID
Sacramento	06067004502
Sacramento	06067004601
Sacramento	06067004602
Sacramento	06067000600
Sacramento	06067000700
Sacramento	06067001101
Sacramento	06067001700
Sacramento	06067002000
Sacramento	06067002200
Sacramento	06067002800
Sacramento	06067003000
Sacramento	06067003101
Sacramento	06067003102
Sacramento	06067003202
Sacramento	06067003203
Sacramento	06067003204
Sacramento	06067003600
Sacramento	06067003700
Sacramento	06067003800
Sacramento	06067004100
Sacramento	06067004201
Sacramento	06067004202
Sacramento	06067004203
Sacramento	06067004300
Sacramento	06067004401
Sacramento	06067004402
Sacramento	06067004501
Sacramento	06067004502
Sacramento	06067004601
Sacramento	06067004602
Sacramento	06067004701
Sacramento	06067004702
Sacramento	06067004801
Sacramento	06067004802
Sacramento	06067004903
Sacramento	06067004904
Sacramento	06067004905
Sacramento	06067004906
Sacramento	06067005001
Sacramento	06067005002
Sacramento	06067005101
Sacramento	06067005102

County	Tract ID
Sacramento	06067005205
Sacramento	06067005301
Sacramento	06067005502
Sacramento	06067005505
Sacramento	06067005506
Sacramento	06067005508
Sacramento	06067005509
Sacramento	06067005510
Sacramento	06067005601
Sacramento	06067005903
Sacramento	06067006003
Sacramento	06067006101
Sacramento	06067006102
Sacramento	06067006201
Sacramento	06067006202
Sacramento	06067006300
Sacramento	06067006400
Sacramento	06067006500
Sacramento	06067006600
Sacramento	06067006701
Sacramento	06067006702
Sacramento	06067006800
Sacramento	06067006900
Sacramento	06067007001
Sacramento	06067007004
Sacramento	06067007019
Sacramento	06067007202
Sacramento	06067007301
Sacramento	06067007402
Sacramento	06067007403
Sacramento	06067007406
Sacramento	06067007413
Sacramento	06067007414
Sacramento	06067007416
Sacramento	06067007422
Sacramento	06067007423
Sacramento	06067007424
Sacramento	06067007426
Sacramento	06067007429
Sacramento	06067007501
Sacramento	06067007503
Sacramento	06067007602

County	Tract ID
Sacramento	06067007701
Sacramento	06067008131
Sacramento	06067008139
Sacramento	06067008141
Sacramento	06067008911
Sacramento	06067009005
Sacramento	06067009006
Sacramento	06067009007
Sacramento	06067009008
Sacramento	06067009010
Sacramento	06067009105
Sacramento	06067009110
Sacramento	06067009314
Sacramento	06067009316
Sacramento	06067009318
Sacramento	06067009319
Sacramento	06067009320
Sacramento	06067009329
Sacramento	06067009501
Sacramento	06067009503
Sacramento	06067009601
Sacramento	06067009606
Sacramento	06067009611
Sacramento	06067009633
Sacramento	06067009634
Sacramento	06067009639
Sacramento	06067009800
Sacramento	06067009900
Sutter	06101050101
Sutter	06101050102
Sutter	06101050201
Sutter	06101050202
Sutter	06101050301
Sutter	06101050302
Sutter	06101050501
Sutter	06101050701
Sutter	06101050702
Sutter	06101050900
Sutter	06101051000
Yolo	06113010101
Yolo	06113010102
Yolo	06113010203

County	Tract ID
Yuba	06115040100
Yuba	06115040301
Yuba	06115040302
Yuba	06115040400
Yuba	06115040500
Yuba	06115040600
Yuba	06115041100

Appendix G. Figures 9A-9H

FIGURE 9A: CLIMATE CHANGE

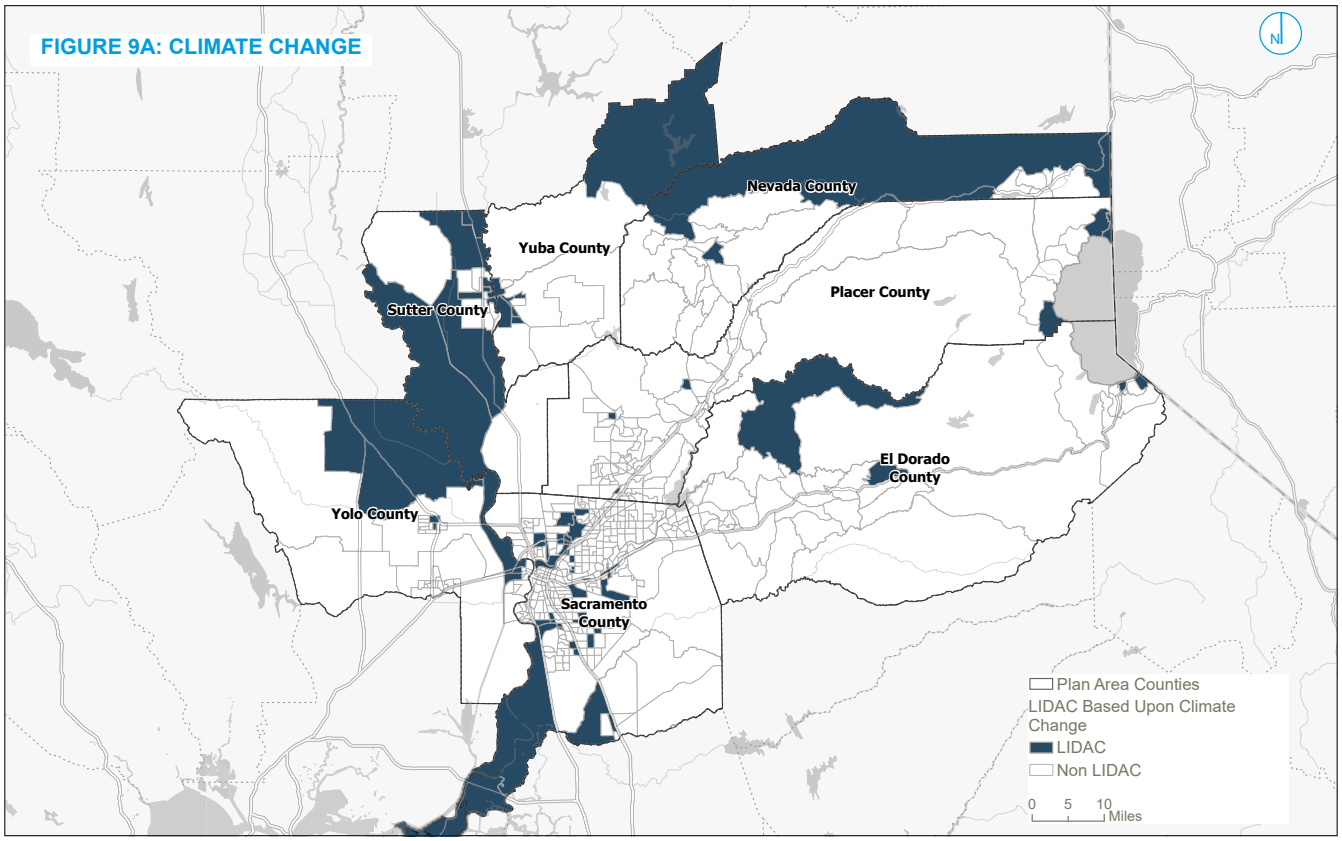


FIGURE 9B: ENERGY

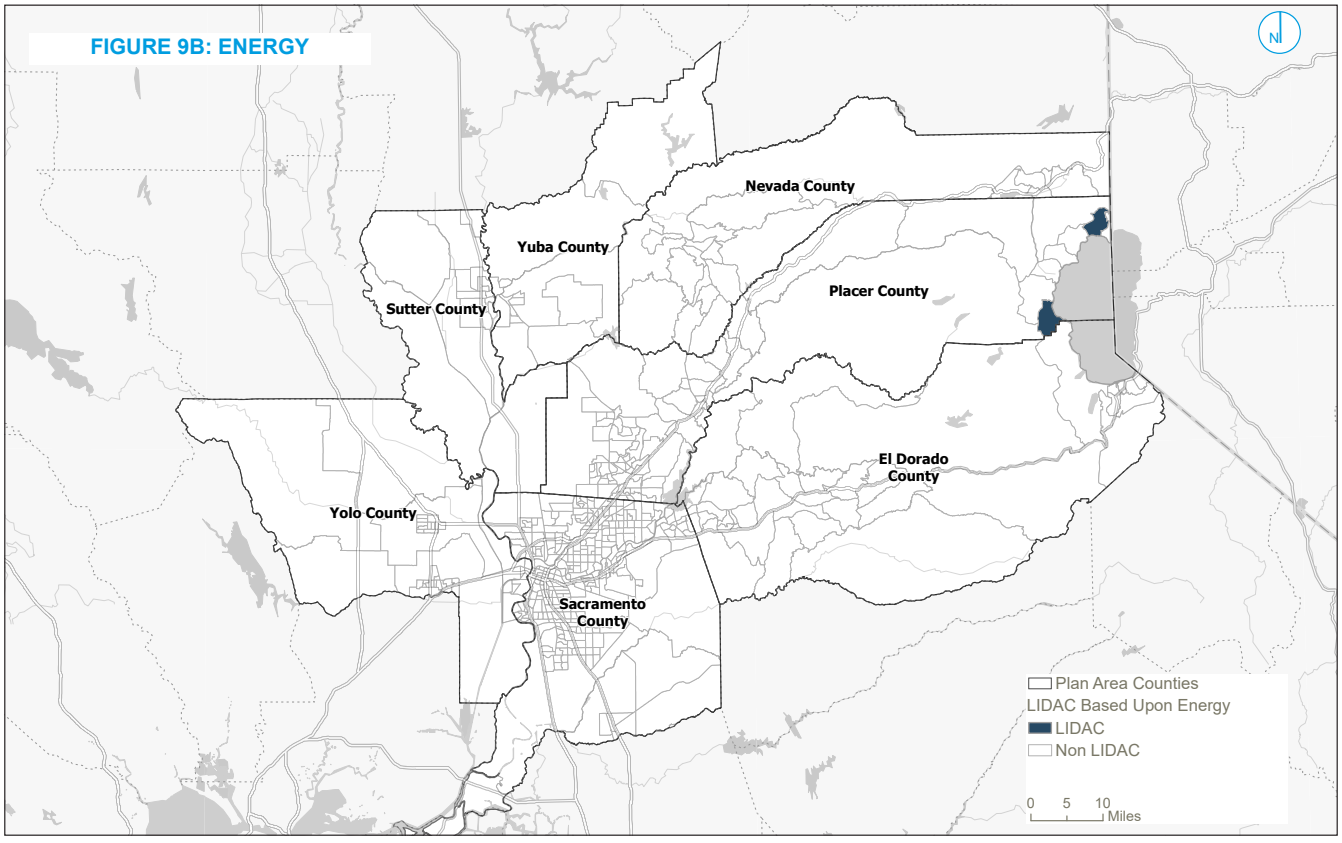


FIGURE 9C: HEALTH

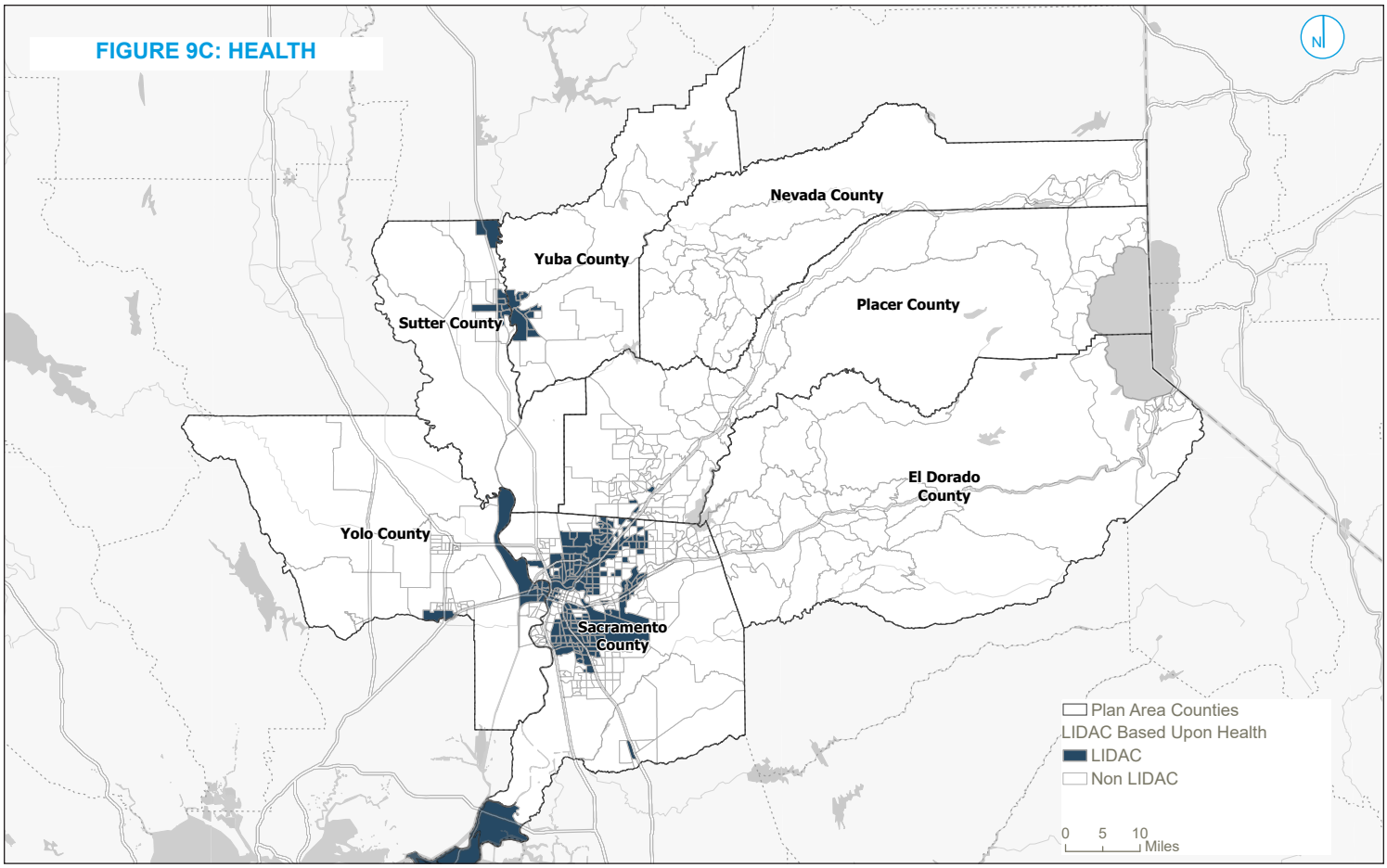


FIGURE 9D: HOUSING

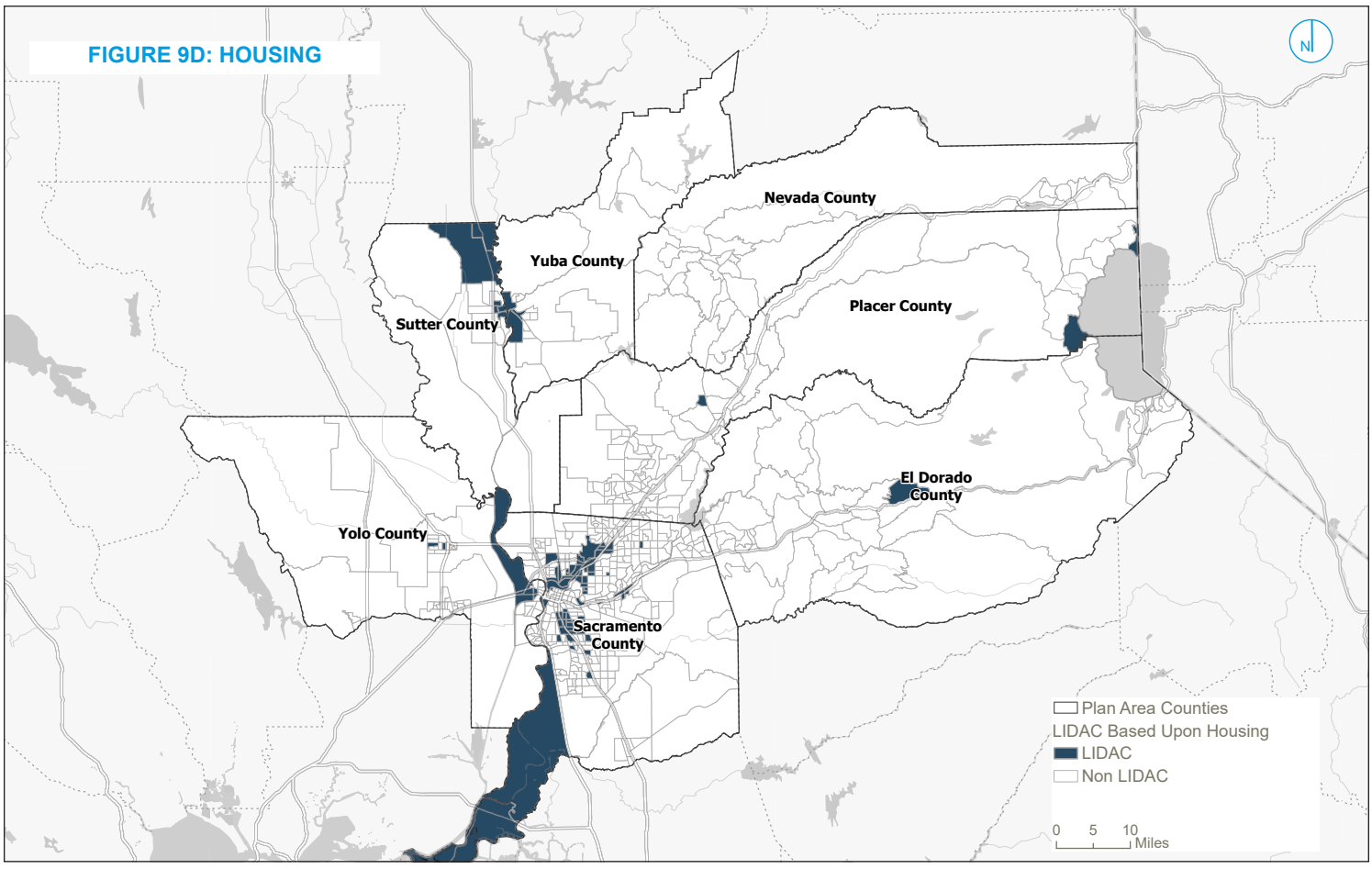


FIGURE 9E: LEGACY POLLUTION

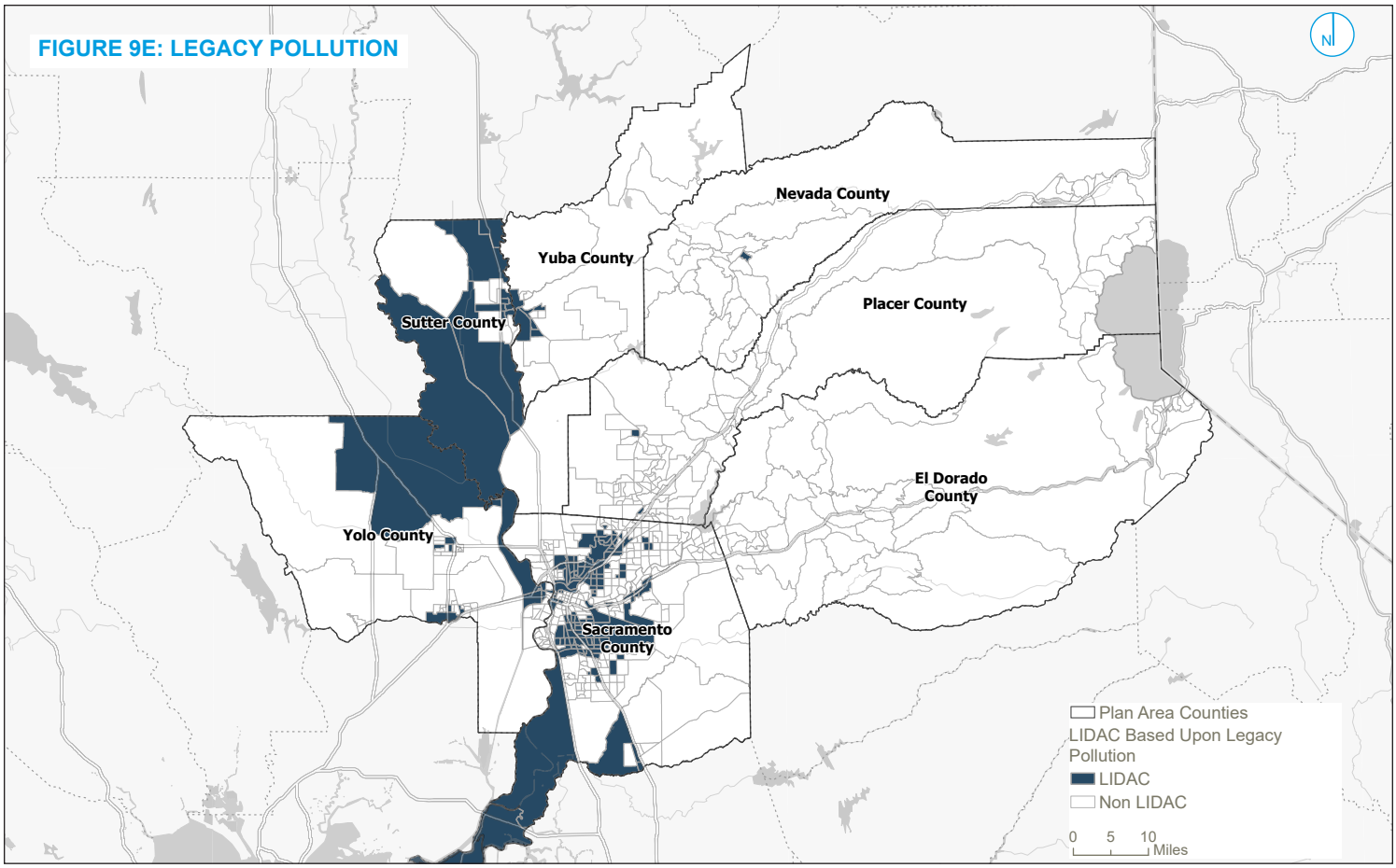


FIGURE 9F: TRANSPORTATION

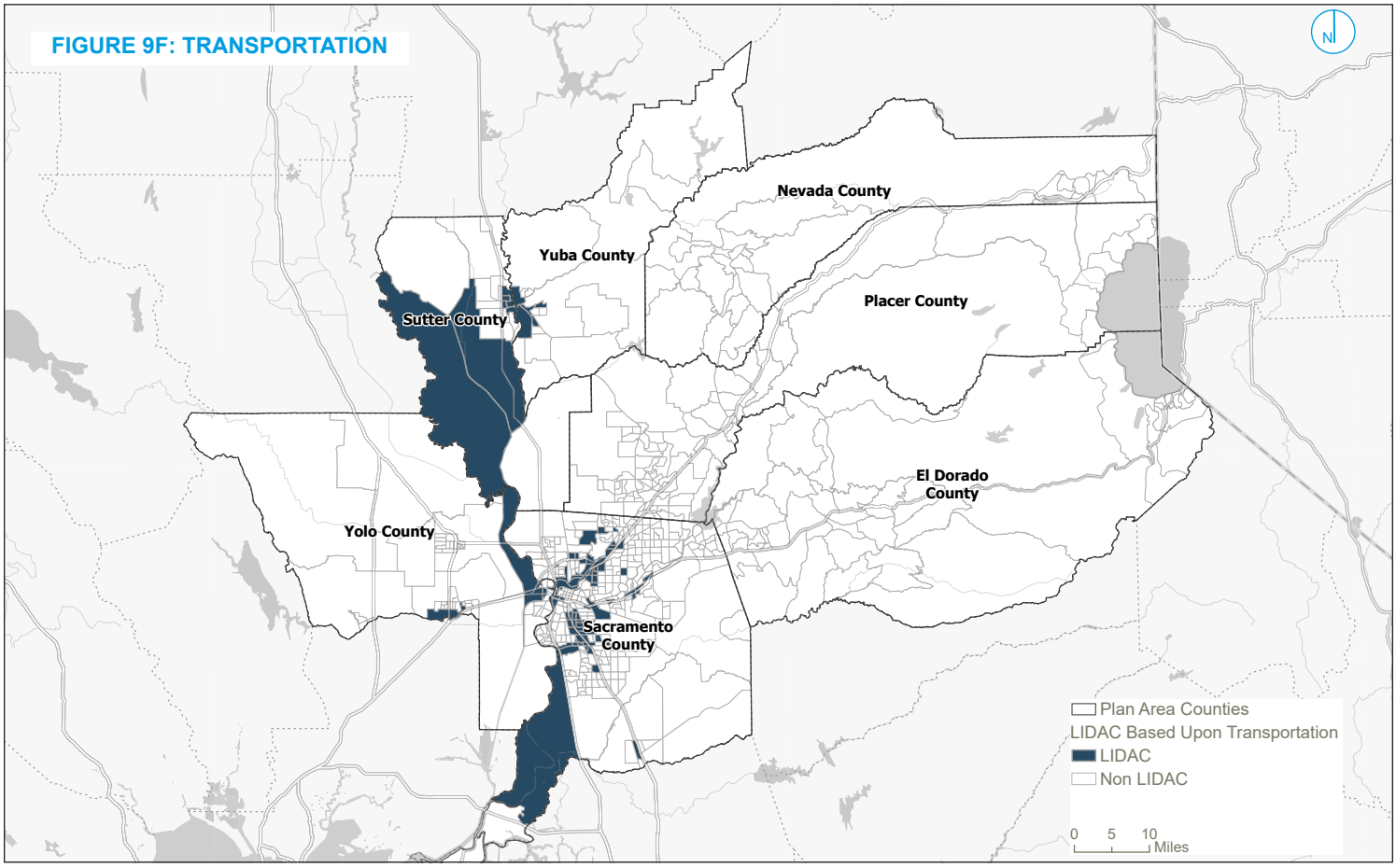


FIGURE 9G: WATER AND WASTEWATER

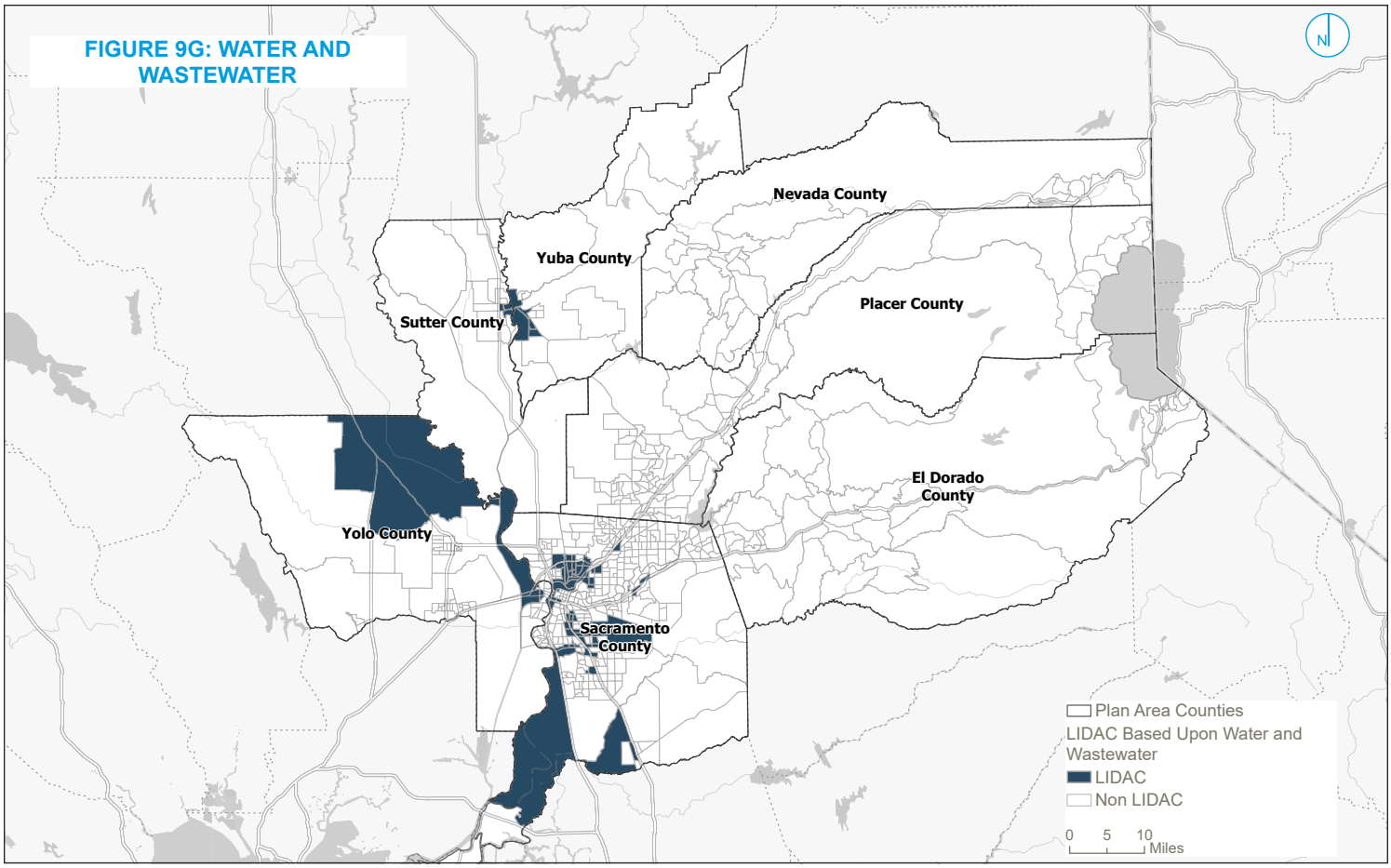
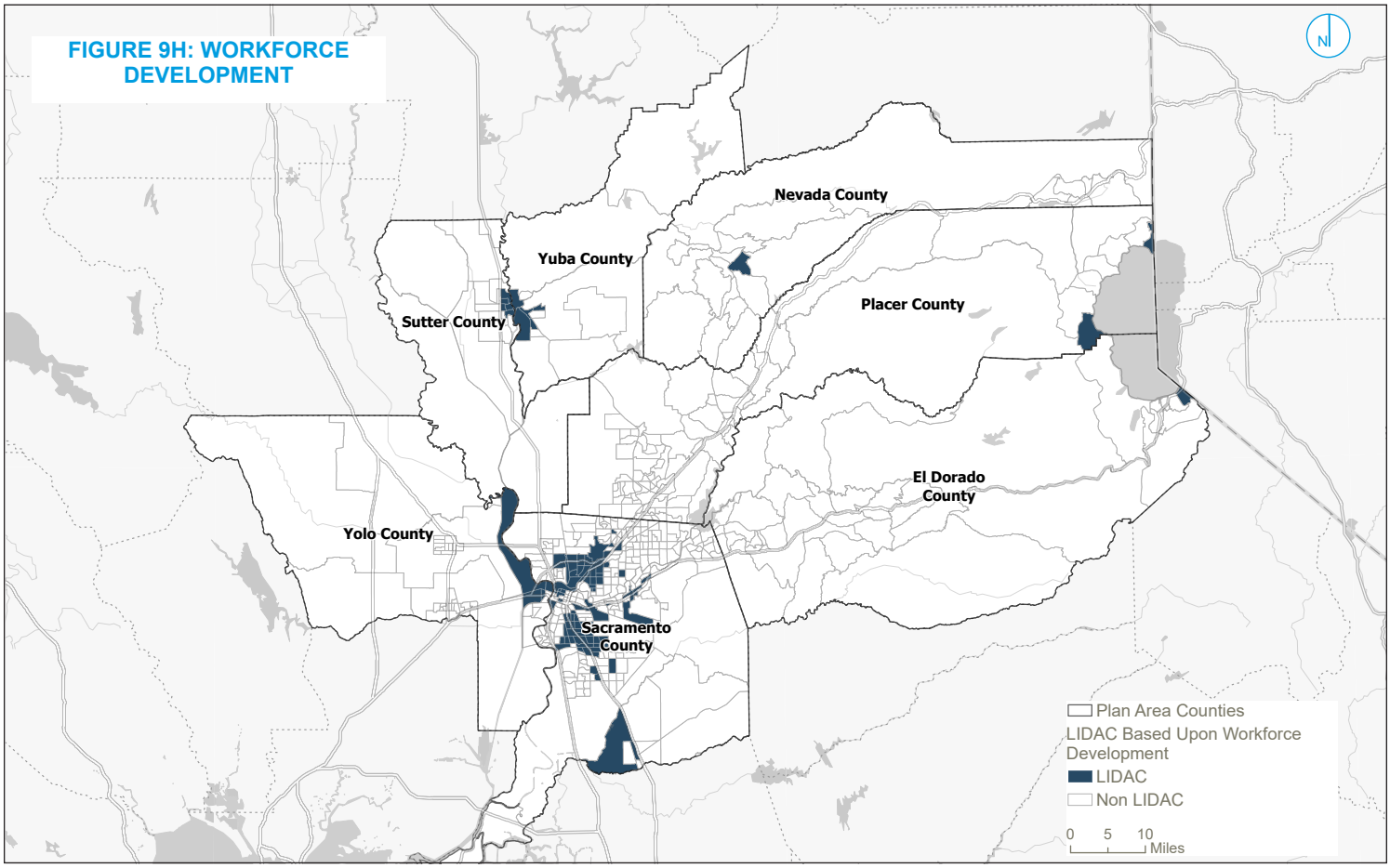


FIGURE 9H: WORKFORCE DEVELOPMENT



Appendix H. LIDAC Benefits Analysis Methodology

This methodology document outlines the approach for spatially allocating air quality and GHG benefits, quantifies and spatially allocates co-benefits, and describes qualitative benefits for lower-income and disadvantaged communities in the Sacramento region. The methodology outlined below is consistent with the EPA's CPRG Technical Reference Document for Benefits Analyses: Low-Income and Disadvantaged Communities and the CAPCOA Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity.

The overall approach is visualized in the Figure 1: Methodology Diagram and is summarized as:

1. Benefits were provided in both quantitative and qualitative estimates with descriptions.
2. Quantitative benefits were estimated for: CAPs, GHGs, and other air toxics. For census blocks in the project domain, the quantitative benefits consist of attribution of each census block to emission reductions, and CAPs account for air quality benefits for key air quality pollutants.
3. Economic co-benefits were quantified according to the CAPCOA Handbook and include estimates of economic benefits such as, but not limited to, number of jobs created and fuel savings.
4. Qualitative benefits were identified for each measure and described in aggregate for LIDACs.

Air Quality and GHG Benefits

Air Toxics

For air toxics, emissions reductions of DPM were analyzed over the project domain for six of the GHG reduction measures. To spatially allocate DPM to census blocks within the domain, EJScreen traffic proximity data were used. The spatial fraction assigned to each census block were calculated using the value of the traffic count indicator in each census block over the total in the domain. For each census block, the spatial fraction was multiplied by the domain-wide DPM emission reduction to obtain the census block-level DPM emissions reduction.

CAPs

For CAPs, emissions reductions were quantified for NO_x, carbon monoxide (CO), PM 10 microns or less (PM_{10}), PM 2.5 microns or less ($PM_{2.5}$), and SO_2. To quantify the emissions reductions per census block in the domain, spatial surrogate data was used for each CAPCOA measure for which CAPs emissions reductions were quantified. Table 1 shows the spatial surrogate data used for each measure. If the spatial surrogate resolution is smaller than the census block level, the resolution was scaled up by summing up spatial surrogate data within each census block. If the spatial surrogate resolution is larger than the census block level, the resolution was scaled down based on the population density, traffic volume, or one-to-one mapping. From the census block values, spatial fractions were calculated using the proportion of the census block value out of the sum of the domain values. The CAP emissions reductions for the total domain were multiplied by the spatial fraction for each census block to obtain the spatially allocated emissions reductions values across the domain.

Table 1: Spatial Surrogates for CAPs Reductions Per Measure

Plan Measure	CAPCOA Measure	Spatial Surrogate
ZEV Adoption and Charging Infrastructure	Provide Electric Vehicle Charging Infrastructure	Non Gasoline Alternative Fueling Stations (HIFLD)
	Use of Cleaner-Fuel Vehicles (BEVs)	Traffic Proximity and Volume (EJScreen)
	Use of Cleaner-Fuel Vehicles (PHEVs)	Traffic Proximity and Volume (EJScreen)
	Use of Cleaner-Fuel Vehicles (Gasoline Hybrid)	Traffic Proximity and Volume (EJScreen)
Public Transit Improvements	Extend Transit Network Coverage or Hours	Frequency of Transit Services per Sq Mi (DOT)
	Increase Transit Service Frequency	Frequency of Transit Services per Sq Mi (DOT)
Roadway Improvements for Multi-Modal Use and Access	Provide Pedestrian Network Improvement	N/A (qualitative analysis)
	Construct or Improve Bike Boulevard	N/A (qualitative analysis)
	Expand Bikeway Network	N/A (qualitative analysis)
VMT Reductions	Provide Bus Rapid Transit	Frequency of Transit Services per Sq Mi (DOT)
Construction Equipment Emissions Reduction	Use Electric- or Hybrid-Powered Equipment	N/A (qualitative analysis)
	Use of Cleaner-Fuel Equipment	N/A (qualitative analysis)
	Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment	N/A (qualitative analysis)
Transportation Demand Management Program	Provide Ridesharing Program	Traffic Proximity and Volume (EJScreen)
	Implement Subsidized or Discount Transit Program	Traffic Proximity and Volume (EJScreen)

CAP Air Quality Assessment

Once the emission reduction values for CAPs were attributed to each census block group using the approach described above, these estimates were used to calculate corresponding percentage reductions relative to the cumulative emissions for the same census block groups. An estimate for cumulative emissions was obtained from CARB's CEPAM emissions tool.[1] This tool provides emissions for a future year circa 2030 that were consistent with previous "Friant Ranch" modeling conducted for the Sac Metro Air District. The Friant Ranch photochemical modeling was performed for year 2035 and cumulative concentrations for key pollutants are readily available. The percentages of benefits derived for CBGs were applied directly to ambient air quality concentrations as a first approximation.

GHGs

Similar to CAPs and air toxics, GHG reductions across the domain were spatially allocated to CBGs for those measures that have available data to spatially allocate the benefits. The spatial surrogates used to allocate GHG reductions across the domain are shown in Table 2. The spatial surrogate data were used to derive percentages for CBGs, and the percentages were used to spatially allocate the total GHG reductions per measure.

Table 2: Spatial Surrogate Datasets for GHG Reduction Measures

Plan Measure	Spacial Surrogate
ZEV Adoption and Charging Infrastructure	Non Gasoline Alternative Fueling Stations (HIFLD)
Building Energy Efficiency Improvements	Electricity Consumption by County (CEC)
Increased Use of Renewable Energy in New and Existing Buildings	Electricity Consumption by County (CEC)
Building Decarbonization/Electrification	N/A (qualitative analysis)
Land Use Improvements	Estimated Average Drive Time to Points of Interest (min) (DOT)
Public Transit Improvements	Frequency of Transit Services per Sq. Mi. (DOT)
Reduce Solid Waste	Solid Waste (CalEnviroScreen)
Roadway Improvements for Multi-Modal Use and Access	N/A (qualitative analysis)
VMT Reduction	Frequency of Transit Services per Sq. Mi. (DOT)
Increase Tree Canopy	N/A (qualitative analysis)
Carbon Sequestration Program/Carbon Farming	N/A (qualitative analysis)
Construction and Landscape Equipment Emissions Reduction	N/A (qualitative analysis)
Reduce Water Utility Emissions	N/A (qualitative analysis)
Transportation Demand Management Program	Traffic Proximity and Volume (EJScreen)
Reduce Wastewater Emissions	Wastewater discharge (EJScreen)
GHG Local Offset Program	N/A (qualitative analysis)
Biomass Energy	N/A (qualitative analysis)
Wildfire Resilience and Management	N/A (qualitative analysis)
Install Cool Pavements	N/A (qualitative analysis)
Natural and Working Lands Equipment Emissions Reduction	N/A (qualitative analysis)
Electric Bikeshare	N/A (qualitative analysis)
Active Modes of Transportation for Youth	N/A (qualitative analysis)
Establish a School Bus Program	N/A (qualitative analysis)
Require Edible Food Recovery	Solid Waste (CalEnviroScreen)

Other Quantifiable Co-Benefits

Quantifiable co-benefits were evaluated using the CAPCOA Handbook methodology. The economic benefits were estimated using the same assumptions and inputs as the GHG and co-pollutant emission reduction estimates. Benefits such as reduction in VMT, reductions in fuel use, water savings, and energy savings were taken directly from inputs used in the GHG and co-pollutant emission reduction calculations. Benefits from expanding the tree canopy used GHG, and co-pollutant calculation assumptions based on the canopy area of each tree and the number of trees in the Sacramento-Roseville CSA. Estimates of number of jobs created were calculated by scaling the number of existing jobs by the percent increase in parameters affected by each measure, such as number of transit service hours for public transit improvement measures. Additional economic co-benefits including, but not limited to, energy savings and estimated number of jobs created in LIDACs were quantified and spatially allocated where spatial surrogates were available.

Qualitative Assessment

Qualitative benefits for each measure were discussed in the Plan, consistent with those listed for each measure in the CAPCOA Handbook.

REFRENCES

[1] *https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool*

Appendix I. Human Health Impacts Using CARB's Incidence-Per-Ton Approach

To quantify the health benefits associated with this Plan's emission reductions, the planning team estimated health used CARB's incidence-per-ton (IPT) methodology. This peer-reviewed methodology is based upon the mathematical relationship between the changes in emissions and health outcomes for DPM and ammonium nitrate particulate formed from NO_x. Underlying assumptions for this analysis were summarized by CARB[1] as:

1. Changes in health outcomes proportional to changes in PM concentrations;
2. Changes in primary pollutant concentrations proportional to changes in emissions; and
3. Changes in secondary pollutant concentrations approximately proportional to changes in emissions. It should be noted that there may be cases where the relationship between the emission of oxides of nitrogen (NO_x) and ammonium nitrate aerosol are not linear.

CARB's IPT method is a simplified procedure that uses pre-calculated results, obtained by running the health model on a baseline scenario, to estimate the number of cases of adverse health outcomes. Health incidents associated with emission reductions are estimated by multiplying the emission reductions by the applicable IPT scaling factor. IPT scaling factors are typically air basin specific.

The IPT scaling factor approach has been used by CARB in several rulemakings (e.g., 2010 Amendments to the Truck and Bus Rulemaking,[2] 2022 Amendments to the In-Use Off-Road Diesel-Fueled Fleets Regulation,[3] and 2022 Amendments to the Advanced Clean Cars II Regulations).[4]

Application and Results

Readily available applicable IPT factors for the Sacramento Valley Air Basin (Table 1), adjusted from 2007 to 2030 based on an assumed population growth of 39% per the CARB 2010 CARB Truck and Bus Rulemaking[2] were applied.

Table 1. Sacramento Valley Air Basin Incidence-Per-Ton Factors (Source: 2010 Amendments to the Truck and Bus Rulemaking)[2]

Metric	Incidence per Tons per Year		
	Lower	Estimate	Upper
Cardiopulmonary deaths avoided due to diesel PM reductions	0.043980	0.057742	0.072272
Cardiopulmonary deaths avoided due to NO_x reductions	0.002209	0.002827	0.003458

Table 2 shows the estimated annual avoided cardiopulmonary deaths for measures for which co-pollutant emissions reductions were developed. Table 1A and Table 2A show emission reductions and avoided deaths by Plan measure and sub-measure, respectively.

Table 2. Estimates of Annual 2030 Avoided Cardiopulmonary Deaths for Select Sacramento-Roseville CSA Plan Measures

Plan Measure	Annual 2030 Estimate of Cardiopulmonary Deaths Avoided due to Diesel PM Emission Reductions	Annual 2030 Estimate of Cardiopulmonary Deaths Avoided due to NO_x Emission Reductions
ZEV Adoption and Charging Infrastructure	0.0172	0.9710
Land Use Improvements	0.0009	0.0490
Public Transit Improvements	-0.0227	-0.0021 - 0.0017
Roadway Improvements for Multi-Modal Use and Access	0.0008	0.0469
VMT Reductions	-0.0121	-0.0273
Construction Equipment Emissions Reduction	0.5580 - 1.0231	0.7346 - 1.2977
Transportation Demand Management Program	0.0015 - 0.0100	0.0868 - 0.5639
Install Cool Pavement	–	0.0002
Active Modes of Transportation for Youth	0.0007	0.0409
Establish a School Bus Program	0.0002	0.0127
Natural and Working Lands Equipment Emissions Reduction	0.0642	0.0457

Negative values represent decreases in avoided deaths due to increases in emissions.

Emissions and health incident results from recent CARB regulations were reviewed and it was determined that the scale of the avoided health incidents is reasonable given the scale of reduced emissions.

These estimates of reduced health incidents are conservatively low because they account only for potential reductions in mortality from cardiopulmonary deaths. In a recent bulletin[5], CARB noted that "a wealth of evidence demonstrates that air pollution can cause a wide range of health effects."

NO_x and DPM Emission Reductions by Measure

Table 1A. NO_x and DPM Emission Reductions by Measure

Plan Measure	CAPCOA Measure	CAPCOA Measure Name	Annual DPM Emissions Reductions (short tons/year)[1]	Annual NO_x Emissions Reductions (short tons/year)[1]
BE-1: Land Use Improvements	T-55	Infill Development	0.01	12.39
BE-5: Construction and Landscape Equipment Emissions Reduction	C-1-A	Use Electric or Hybrid Powered Equipment	12.66	313.09
	C-1-B	Use of Cleaner-Fuel Equipment	6.90	170.78
	LL-1	Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment	0.00	14.89
BE-6: Install Cool Pavement	E-21	Install Cool Pavement	0.00	0.05
TR-1: ZEV Adoption and Charging Infrastructure	T-14	Provide Electric Vehicle Charging Infrastructure	0.01	6.14
	T-30 BEVs	Use of Cleaner-Fuel Vehicles (BEVs)	0.19	220.15
	T-30 PHEVs	Use of Cleaner-Fuel Vehicles (PHEVs)	0.02	19.13
TR-2: Public Transit Improvements	T-25	Extend Transit Network Coverage or Hours	0.01	6.66
	T-26	Increase Transit Service Frequency	-0.29	-7.31
	TR-5	Provide Transit Shelters (bus shelters only)	0.00	0.11
	TR-5	Provide Transit Shelters (bus shelters and real-time arrival information)	0.00	0.22
TR-3: Provide Bus Rapid Transit	T-28	Provide Bus Rapid Transit	-0.15	-6.90
TR-4: Roadway Improvements for Multi-Modal Use and Access	T-18	Provide Pedestrian Network Improvement	0.01	11.33
	T-19B	Construct or Improve Bike Boulevard	0.00	0.27
	T-20	Expand Bikeway Network	0.00	0.26

Plan Measure	CAPCOA Measure	CAPCOA Measure Name	Annual DPM Emissions Reductions (short tons/ year)[1]	Annual NO_x Emissions Reductions (short tons/ year)[1]
TR-5: Transportation Demand Management Program	T-5	Implement Commute Trip Reduction Program (Voluntary)	0.02	21.93
	T-6	Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)	0.12	142.52
	T-8	Provide Ridesharing Program	0.01	7.93
	T-9	Implement Subsidized or Discounted Transit Program	0.00	0.46
TR-6 - Active Modes of Transportation for Youth	T-56	Active Modes of Transportation for Youth	0.01	10.34
TR-7: Establish a School Bus Program	T-40	Establish a School Bus Program	0.00	3.20
NW-6: Natural and Working Lands Equipment Emissions Reduction	M-6	Natural and Working Lands Equipment Emissions Reduction	0.79	11.56

Estimates of Avoided Deaths by Measure

Table 2A. Estimates of Avoided Deaths for Select Sacramento-Roseville CSA Plan Measures

Measure	Deaths Avoided Due to Diesel PM Reductions			Deaths Avoided Due to NO_x Reductions		
	Lower	Estimate	Upper	Lower	Estimate	Upper
BE-1 – Land Use Improvements						
Infill Development	0.0007	0.0009	0.0011	0.0383	0.0490	0. 0600
BE-5 - Construction Equipment and Landscape Emissions Reduction						
Use Electric or Hybrid Powered Equipment	0.7792	1.0231	1.2805	0.9680	1.2387	1.5152
Use of Cleaner-Fuel Equipment	0.4250	0.5580	0.6985	0.5280	0.6757	0.8265
Replace Gas-Powered Landscape Equipment with Zero-Emission Landscape Equipment	–	–	–	0.0460	0.0589	0.0721
BE-6 – Install Cool Pavement						
Install Cool Pavement	–	–	–	0.0001	0.0002	0.0002
TR-1 – ZEV Adoption and Charging Infrastructure						
Provide Electric Vehicle Charging Infrastructure	0.0003	0.0004	0.0005	0.0190	0.0243	0.0297
Use of Cleaner-Fuel Vehicles (BEVs)	0.0117	0.0154	0.0193	0.6806	0.8710	1.0654
Use of Cleaner-Fuel Vehicles (PHEVs)	0.0010	0.0013	0.0017	0.0591	0.0757	0.0926

Measure	Deaths Avoided Due to Diesel PM Reductions			Deaths Avoided Due to NO_x Reductions		
	Lower	Estimate	Upper	Lower	Estimate	Upper
TR-2 – Public Transit Improvements						
Extend Transit Network Coverage or Hours	0.0004	0.0005	0.0006	0.0206	0.0263	0.0322
Increase Transit Service Frequency	-0.0177	-0.0232	-0.0290	-0.0226	-0.0289	-0.0354
Provide Transit Shelters (bus shelters and real-time arrival information)	0.0000	0.0000	0.0000	0.0007	0.0009	0.0011
Provide Transit Shelters (bus shelters only)	0.0000	0.0000	0.0000	0.0003	0.0004	0.0005
TR-3 – Provide Bus Rapid Transit						
Provide Bus Rapid Transit	-0.0092	-0.0121	-0.0151	-0.0213	-0.0273	-0.0334
TR-4 – Roadway Improvements for Multi-Modal Use and Access						
Provide Pedestrian Network Improvement	0.0006	0.0008	0.0010	0.0350	0.0448	0.0549
Construct or Improve Bike Boulevard	0.0000	0.0000	0.0000	0.0008	0.0011	0.0013
Expand Bikeway Network	0.0000	0.0000	0.0000	0.0008	0.0010	0.0013
TR-5 – Transportation Demand Management Program						
Provide Ridesharing Program	0.0004	0.0006	0.0007	0.0245	0.0314	0.0384
Implement Subsidized or Discounted Transit Program	0.0000	0.0000	0.0000	0.0014	0.0018	0.0022
Implement Commute Trip Reduction Program (Voluntary)	0.0012	0.0015	0.0019	0.0678	0.0868	0.1061
Implement Commute Trip Reduction Program (Mandatory Implementation and Monitoring)	0.0076	0.0100	0.0125	0.4406	0.5639	0.6897
TR-6 – Active Modes of Transportation for Youth						
Active Modes of Transportation for Youth	0.0006	0.0007	0.0009	0.0320	0.0409	0.0500
TR-7 – Establish a School Bus Program						
Establish a School Bus Program	0.0002	0.0002	0.0003	0.0099	0.0127	0.0155
NW-6 – Natural and Working Lands Equipment Emissions Reduction						
Natural and Working Lands Equipment Emissions Reduction	0.0489	0.0642	0.0804	0.0357	0.0457	0.0559

Negative values represent decreases in avoided deaths due to increases in emissions; these will be avoided if zero-emission buses are utilized.

REFERENCES

[1] *https://ww2.arb.ca.gov/sites/default/files/2019-08/Estimating%20the%20Health%20Benefits%20Associated%20with%20Reductions%2in%20PM%20and%20NOX%20Emissions%20-%20Detailed%20Description.pdf*

[2] *https://ww2.arb.ca.gov/our-work/programs/truck-bus-regulation/truck-and-bus-regulation-rulemaking-documents*

[3] *https://ww2.arb.ca.gov/rulemaking/2022/off-roaddiesel*

[4] *https://ww2.arb.ca.gov/rulemaking/2022/advanced-clean-cars-ii*

[5] *CARB. 2022. "California Air Resources Board Updated Health Endpoints Bulletin", https://ww2.arb.ca.gov/sites/default/files/2022-11 California%20Air%20Resources%20Board%20Updated%20Health%20Endpoints%20Bulletin%20-%20Edited%20Nov%202022_0.pdf*