County of San Diego

Electric Vehicle Roadmap

October 2019


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TERMS AND ABBREVIATIONS

AC	Alternating Current
APCD	Air Pollution Control District
Board	County of San Diego Board of Supervisors
CAP	Climate Action Plan
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
County	County of San Diego
CPUC	California Public Utilities Commission
CVRP	Clean Vehicle Rebate Program
DAC	Disadvantaged Community
DCFC	Direct Current Fast Charger
DGS	Department of General Services
EO	Executive Order
EV	Battery Electric Vehicle
EV Roadmap	County of San Diego Electric Vehicle Roadmap
EVCS	Electric Vehicle Charging Station
EVSE	Electric Vehicle Supply Equipment
FAA	Federal Aviation Administration
FCEV	Hydrogen Fuel Cell Electric Vehicle
GFAP	Green Fleet Action Plan
HVIP	Hybrid and Zero-Emission Truck and Bus Voucher Project
kWh	Kilowatt hour
L1	Level I Charger
L2	Level II Charger
MTCO2e	Metric Tons of Carbon Dioxide Equivalent
NREL	National Renewable Energy Laboratory
PDS	Planning and Development Services
PHEV	Plug-in Hybrid Electric Vehicle
PV	Photovoltaic
REVI	Regional Electric Vehicle Infrastructure Working Group
SAE	Society of Automotive Engineers
SANDAG	San Diego Association of Governments
SDG&E	San Diego Gas and Electric
SEP	Strategic Energy Plan
TDM	Transportation Demand Management
VMT	Vehicle Miles Traveled
ZEV	Zero-Emission Vehicle (includes EV, PHEV, FCEV)

EXECUTIVE SUMMARY

Board of Supervisors (Board) Direction

In order to "prepare for the next wave of funding and plot out a map for future investments," the Board directed the Chief Administrative Officer (CAO) on April 10, 2019 to develop an electric vehicle (EV) Roadmap that:

- Builds upon related local studies and progress to date;
- Describes strategies to increase EV ownership and use;
- Increases installation of EV charging infrastructure; and
- Identifies future grant opportunities to support recommendations.

EV Roadmap Policy Framework and Market Conditions

The State of California is a leader in greenhouse gas (GHG) emissions reduction policies and vehicle electrification strategies. However, despite efforts that have led to more efficient vehicles powered by cleaner fuels on California roads, statewide transportation emissions have risen since 2010. To support State GHG reduction targets for the transportation sector, former Governor Brown issued two Executive Orders that set zero emission vehicle (ZEV) and charging infrastructure goals for 2025 and 2030. ZEVs are vehicles that run on fuels other than gasoline and include a variety of low-to-no GHG emission technologies including battery electric EVs, plug-in hybrid EVs, and hydrogen fuel cell vehicles.

The County's General Plan, adopted Climate Action Plan (CAP), Strategic Energy Plan, and Green Fleet Action Plan support state vehicle electrification efforts to achieve GHG emissions reductions from the transportation sector. A majority of the County's GHG emissions (45%) come from on-road transportation sources. Electrifying the transportation sector will reduce GHG emissions because the County has a target of 90% renewable energy by 2030 (CAP Measure E-2.1). Fueling vehicles with renewable electricity will reduce GHG emissions and improve air quality in the region.

The San Diego region is a ZEV market leader because of regional partnerships, policies, and programs that helped to spur EV adoption from the early stages of the transportation electrification movement. However, to meet State ZEV goals there will need to be an increase in EV ownership and significant investment in public and workplace charging infrastructure to meet projected demand. The region currently has approximately 35,000 ZEVs, 1,741 public charging stations including 201 fast chargers, and 3,055 workplace chargers. According to SANDAG research, there will need to be approximately 136,500 ZEVs by 2025 and 449,400 ZEVs by 2030 in the region. To support increased regional charging demand, approximately 6,600 public chargers including 2,500 fast chargers, and 6,700 workplace chargers will need to be installed by 2025; and 19,700 public chargers including 8,300 fast chargers; and 21,300 workplace chargers by 2030.

The unincorporated area has approximately 5,400 ZEVs, 76 public charging stations including 2 fast chargers, and 470 workplace chargers. The unincorporated area's share of projected regional ZEVs and chargers (by population) is approximately 21,000 ZEVs by 2025, and 69,100 ZEVs by 2030. To support charging demand in the unincorporated area, 1,000 public chargers including 400 fast chargers, and 1,000 workplace chargers will need to be installed by 2025; and 3,000 public chargers including 1,300 fast chargers; and 3,300 workplace chargers by 2030.

This EV Roadmap describes strategies to increase ZEV ownership and the installation of charging infrastructure to support the County's CAP GHG emissions reductions efforts and the state's ZEV goals.

COUNTY OF SAN DIEGO EV ROADMAP GOALS AND RECOMMENDATIONS

The EV Roadmap has been prepared by Planning & Development Services (PDS), Department of General Services (DGS), and the San Diego County Air Pollution Control District (APCD) in consultation with the Department of Human Resources (DHR). County staff prepared these recommendations after review of the extensive body of research on applicable federal, state, and local EV legislation; market and technology trends; funding sources; and evaluation of County fleet assets, facilities, and relevant Board policies.

Six goals and 11 recommendations that collectively aim to increase EV ownership and charging infrastructure installation are presented for Board consideration. Through implementation of the recommendations, introduced below, the following targeted outcomes in County operations and in the unincorporated area could be achieved:

County Operations Recommendations

Goal 1: Further Reduce the County's Fleet of Gas-Powered Vehicles.

Targeted Outcome: Increase the number of EVs in the County's fleet to 501 vehicles by 2027.

Recommendations:

- 1-A: Amend three Board policies to assist fleet EV conversion by requiring new light-duty vehicles to be EV.
- 1-B: Convert 250 County fleet gas-powered vehicles to EVs by 2025 and install necessary infrastructure.
- 1-C: Convert an additional 251 County fleet gas-powered vehicles to EVs for a total of 501 by 2027 and install necessary infrastructure.
- 1-D: Keep pace with technological trends, track the costs and benefits of fleet conversion, and update the Green Fleet Action Plan no later than 2025 to set goals for medium- and heavy-duty fleet vehicle conversions.

Goal 2: Accelerate the Installation of EV Charging Stations at Public Locations in County Facilities and in the Unincorporated County.

Targeted Outcome: Contribute to the regional EV charging network by installing 2,040 Level II charging stations at County facilities and throughout the unincorporated area by 2028.

Recommendations:

- 1-A: Amend Board policy G-15, "Design Standards for County Facilities" by 2019 to require charging infrastructure development at new County facilities.
- 1-B: Install an additional 63 publicly accessible EV charging stations for a total of 100 chargers at County facilities by 2021.
- 1-C: Prepare an EV charger site assessment for County facilities and the unincorporated area and install 2,040 Level II chargers.

Goal 3: Promote and Incentivize County Employee EV Ownership.

Targeted Outcome: Increase County employee EV ownership and use to reduce employee commute emissions.

Recommendation:

- Promote and incentivize County employee EV use by developing partnerships with banks, credit unions, and dealerships to extend lending and pricing benefits.

Unincorporated Area Recommendations

Goal 4: Incentivize and/or Require EV Charging Infrastructure in New and Existing Private Multi-Family Residential and/or Non-Residential Development.

Targeted Outcome: Increase charging station installations in new and existing private development.

Recommendation:

- Prepare a cost/benefit analysis of options to incentivize and/or require EV charger installations in private development.

Goal 5: Fund EV Expert/Consumer Advocate as a Regional Resource.

Targeted Outcome: Increase EV ownership and charging station installations through education, outreach, regional collaboration, and incentives.

Recommendation:

- Identify regional partners and cost sharing opportunities to fund a regional EV Expert/consumer advocate on an ongoing basis.

Goal 6: Collaborate with Regional Partners to Support Public and Private Fleet Electrification.

Targeted Outcome: Increase EV use in regional light-, medium-, and heavy-duty fleets.

Recommendation:

- Develop public and private regional partnerships to provide fleet electrification technical support on an ongoing basis.

Implementing actions for some of these goals are already underway as part of the work programs within the County of San Diego Planning & Development Services (PDS), Department of General Services (DGS), and Air Pollution Control District (APCD) while others include new efforts requiring Board direction. A summary of staff recommendations and implementing actions for each goal is provided in Section Three of this report. Detailed descriptions of the recommendations with costs, timelines, and implementing actions are provided in Section Four of this report.

INTRODUCTION

The State of California (State) is a leader in greenhouse gas (GHG) emissions reduction policies and vehicle electrification efforts. Transportation emissions from conventional vehicle tailpipes are a majority (41%) of the state's total GHG emissions due to the amount of vehicle miles traveled (VMT). Several State programs and regulations control vehicle GHG and air pollutant emissions to improve air quality and public health. Despite efforts that have led to more efficient vehicles powered by cleaner fuels on California roads, statewide transportation emissions have risen since 2010.[1] In support of existing State GHG legislation, former Governor Brown issued two Executive Orders B-16-12 (2012), and B-48-18 (2018) to establish zero emissions vehicle (ZEV) and charging infrastructure goals for 2025 and 2030. ZEVs include battery electric vehicles, plug-in hybrid electric, and hydrogen fuel cell vehicle technologies.

Similarly, on-road transportation sources such as passenger vehicles, light- medium- and heavy-duty trucks, buses, and motorcycles account for a majority of GHG emissions (45%) in the unincorporated area (Figure 1).[2] The County's CAP, Green Fleet Action Plan (GFAP), and Strategic Energy Plan (SEP) identify strategies to reduce GHG emissions from the transportation sector and County operations. These efforts aim to increase electric vehicle (EV) ownership in the unincorporated area through investments in charging infrastructure, education and outreach, and regional collaboration efforts.

VEHICLE ELECTRIFICATION AND GREENHOUSE GAS (GHG) EMISSIONS

Vehicle electrification decreases GHG emissions because the energy supplied to vehicles on the grid is from a cleaner fuel mix than gasoline and diesel fuels. In San Diego County, 45% of the electricity on the grid is supplied through emissions-free renewable resources and this proportion is expected to increase in the future. The County's Climate Action Plan (CAP) contains several strategies to electrify the transportation network to reduce GHG emissions and improve air quality in the region.

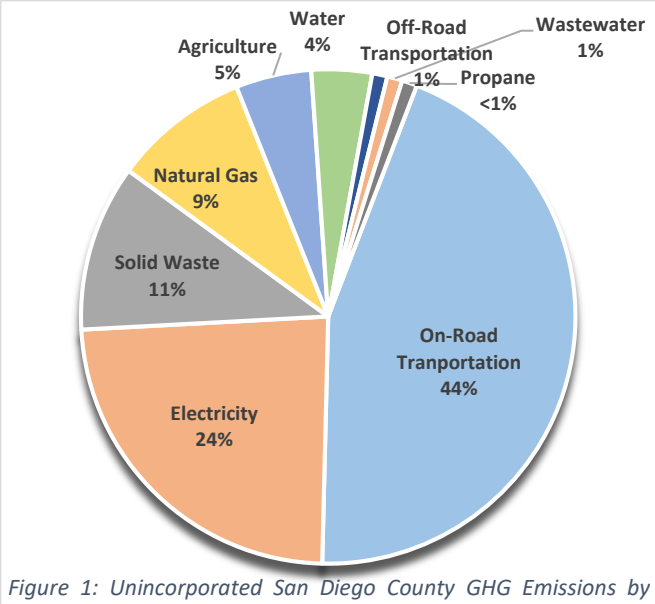


Figure 1: Unincorporated San Diego County GHG Emissions by Sector

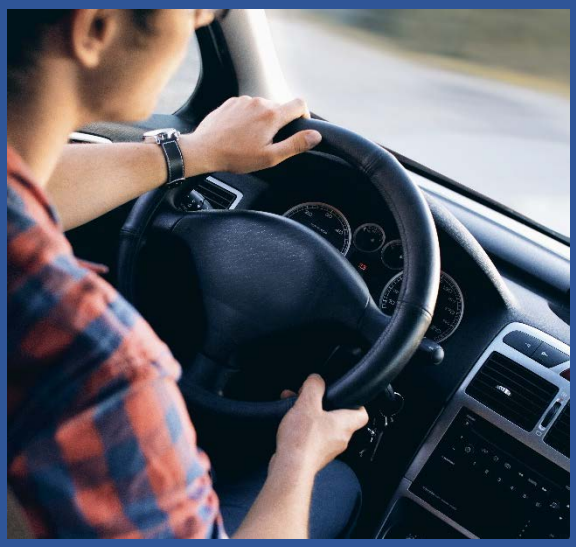
This EV Roadmap includes goals and recommendations to increase and accelerate the County's existing vehicle electrification efforts in order to reduce GHG emissions and improve air quality in the unincorporated area. These recommendations will increase EV ownership and increase the availability of charging infrastructure to support the County's CAP GHG emissions reduction targets and support the State's ZEV goals. The EV Roadmap contains an overview of existing legislation, EV market technology and trends, a summary of barriers to increasing EV ownership, city/county best practices for the Board to consider when providing direction on recommendations, and potential funding sources to support vehicle electrification.

[1] California Air Resources Board *California's Sustainable Communities and Climate Protection Act 2018 Progress Report* (2018), available at: https://ww2.arb.ca.gov/resources/documents/tracking-progress

[2] County of San Diego Climate Action Plan Appendix A (2018), available at: https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/PostBOSDocs/CAP%20Appendix%20A%20%20-%202014%20Inventory%20and%20Projections.pdf

Section 1

EV POLICY FRAMEWORK



Transportation electrification is a key element of State and local efforts to reduce greenhouse gas emissions and improve air quality.

State Legislation

County & Regional Policies

SECTION 1: EV POLICY FRAMEWORK

SUMMARY OF KEY STATE LEGISLATION

The State has adopted legislation that establishes GHG emissions reduction targets for 2020 and 2030 and expands support for EVs and availability of charging infrastructure. Transportation GHG emissions comprise a majority of the state's total emissions and efforts to electrify the transportation network are critical to achieving GHG reductions targets. Below is a summary of key legislation and policies; and a complete legislative review is included in the attached Appendices.

Assembly Bill 32

The Global Warming Solutions Act of 2006 (AB 32) established the State's GHG emissions target to achieve 1990 levels by 2020. The bill required emissions reductions from all sources in the state, including transportation. AB 32 led to the California Air Resources Board (CARB) Scoping Plan, which created the Low Carbon Fuel Standard to reduce the carbon intensity of transportation fuel by 20% by 2030.

Senate Bill 32

SB 32 expanded upon AB 32 and required a 40% reduction in GHG emissions below 1990 levels by 2030.

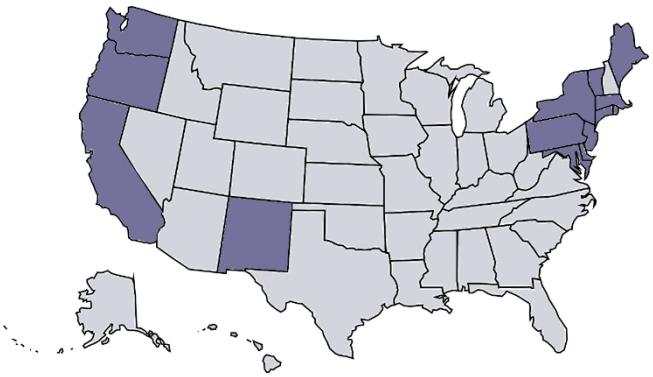


Figure 2: States with Advanced Clean Cars Program Standards

California Advanced Clean Cars Program

The Advanced Clean Cars Program is a collection of regulations to control pollutant and GHG emissions from passenger vehicles. These regulations establish the strictest vehicle emissions regulations in the country and set greater emissions limitations than those required by the federal government. The regulations control passenger vehicle emissions through a coordinated effort to:

1. Reduce smog-forming pollution through emissions standards;
2. Require auto manufacturers to sell prescribed numbers of ZEVs in California; and
3. Reduce GHG emissions.

Thirteen states and the District of Columbia, comprising 55% of the U.S. vehicle market, have adopted these standards to accelerate emissions reductions from the transportation sector. One component of this strategy is the Zero-Emission Vehicle (ZEV) Program that requires auto manufacturers to produce a certain number of ZEVs each year depending on how many cars they sell in the state.

STATE POLICY SUMMARY

- AB 32 and SB 32 established GHG reduction targets for California which drive transportation electrification efforts.
- Advanced Clean Cars is CARB's program that guides State light-duty GHG emissions reductions efforts.
- Executive Orders B-16-12 (2012) and B-48-18 (2018) issued by former Governor Brown established ambitious goals for 2025 and 2030 for statewide ZEV adoption and infrastructure development.

California Clean Truck, Bus, and Off-Road Vehicles and Equipment Technology Program

This program was created with the passage of SB 1204 in 2014 to set up funds for demonstration projects, pilot programs, and spur early commercial deployment of zero-emission heavy-duty technologies with emphasis given to projects in communities with priority populations.[3] This action led to other medium- and heavy-duty electrification efforts such as CARB's Innovative Clean Transit rule that requires 100% ZEV buses by 2024, the Zero-Emissions Airport Shuttle Regulation, and the proposed Advanced Clean Trucks strategy.

Executive Order

In January 2018, Governor Brown issued Executive Order B-48-18 that established goals for 200 hydrogen fueling stations and 250,000 EV charging stations including 10,000 direct current (DC) fast chargers to support 1.5 million ZEVs on California roads by 2025 and 5 million ZEVs on the road by 2030. This order expanded on Governor Brown's 2012 Executive Order (B-16-12) that initially set the goal for 1.5 million ZEVs on the road by 2025.

CALIFORNIA STATE ZEV GOALS

By 2025,

- 1.5 million ZEVs on the road;
- 200 hydrogen fueling stations; and
- 250,000 charging stations.

By 2030,

- 5 million ZEVs on the road.

SUMMARY OF KEY COUNTY POLICIES

Similar to the State, the transportation sector comprises a majority of the County's total GHG emissions. The County has committed to reducing GHG emissions in accordance with State emissions targets through the General Plan and Climate Action Plan (CAP). These policies are consistent with and implemented by the County's Strategic Energy Plan (SEP) and Green Fleet Action Plan (GFAP).

The County's General Plan (2011) implements a compact and sustainable growth model that encourages efficient development and mixed-use communities near infrastructure and services while preserving high quality habitats and environmental resources along with maintaining the unincorporated area's rural and semi-rural character.

The County's CAP established GHG emissions reduction targets that align with State targets and include a reduction of 132,205 metric tons of carbon dioxide equivalent (MTCO2e) by 2020 and 897,145 MTCO2e by 2030. The CAP is comprised of 11 strategies, 26 measures, and supporting efforts that reduce GHG emissions from County government operations and from GHG emitting activities within the unincorporated areas (see Figure 3 for a map of the unincorporated area).

Both the adopted General Plan and CAP contain policies that promote vehicle electrification for the County's fleet and for the unincorporated area. Additional policies are included in the Strategic Energy Plan and Green Fleet Action Plan. A brief description of these policies follows.

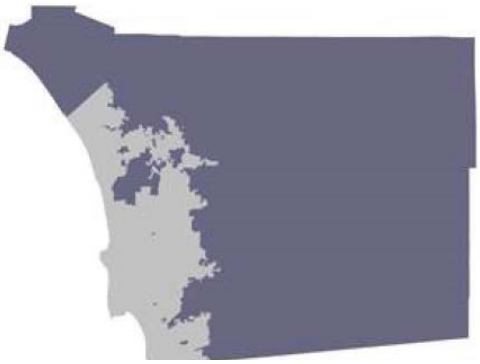


Figure 3: Unincorporated San Diego County Jurisdictional Boundary (Dark Gray)

[3] Priority populations are defined by CARB and include SB 535 Disadvantaged Communities (top 25% most pollution-impacted census tracts) and AB 1550 Low-Income Communities (households that are at or below 80% of the statewide median income).

County of San Diego General Plan

The County's General Plan specifically addresses EV adoption through policies in the Mobility Element and the Conservation and Open Space Element.[4] Specific EV policies include the following:

- Mobility Element Policy M-9.3: Provide incentives for commercial, office, and industrial development to provide preferential parking for EVs, carpools, vanpools, and flex-fuel vehicles.
- Conservation and Open Space Element Policies COS-16.3 and COS-16.4: Incentivize EV and alternative fuel adoption in the unincorporated area.

County of San Diego Climate Action Plan

The County's CAP establishes targets for reducing GHG emissions from County operations and in the unincorporated areas below a 2014 baseline.[5] Two CAP measures, T-3.4 and T-3.5, establish targets for achieving GHG emissions reductions from the electrification of the transportation sector. An additional four CAP measures incentivize EV market growth.

CAP Measure T-3.4 is a County initiative that establishes targets for reducing the County's fleet GHG emissions levels by 10% by 2020 (2,394 MTCO2e emissions reductions) and 20% by 2030 (3,673 MTCO2e emissions reductions). This measure quantifies the GHG emissions reductions achieved by the County's Strategic Energy Plan and Green Fleet Action Plan implementation.

CAP Measure T-3.5 is a County initiative that requires the installation of 100 Level II charging stations by 2025 and an additional 1,940 Level II charging stations by 2030 to achieve 11,987 MTCO2e emissions reductions by 2030. The Level II charging stations are required to be installed at publicly accessible locations within the unincorporated area.

Additional supporting efforts included in the CAP with measures T-2.2, T-2.3, T-2.4, and T-3.3 are:

- Provide education and marketing related to the purchase of EVs, available charging infrastructure, and existing EV resources and programs;
- Develop and implement a local EV Incentive Program;
- Collaborate with regional partners to encourage installation of EV charging stations in new residential and non-residential developments;
- Promote the State's EV Climate Credit;
- Support programs from the local utility to install EV charging stations;
- Encourage increased use of ZEV's in a car sharing and/or shuttle/carpool service;
- Encourage County employees to purchase EVs; and
- Incentivize the use of EVs by updating the Zoning Ordinance to establish minimum requirements for carpool/vanpool, shuttle, and EV-only parking spaces.

County of San Diego Strategic Energy Plan

The SEP guides the energy strategy for County operations and regional programs for 2015-2020.[6] Its key focus areas include energy use,

[4] County of San Diego General Plan (2011), available at: https://www.sandiegocounty.gov/pds/generalplan.html

[5] County of San Diego Climate Action Plan (2018), available at: https://www.sandiegocounty.gov/content/dam/sdc/pds/advance/cap/publicreviewdocuments/PostBOSDocs/San%20Diego%20County%20Final%20CAP.pdf

[6] County of San Diego Strategic Energy Plan (2015), available at:

MEASURING GHG EMISSIONS

GHG emissions are measured in metric tons of carbon dioxide equivalent, abbreviated as MTCO2e.

- A 10% reduction in emissions from County fleet vehicles by 2020 equals 2,394 MTCO2e, equivalent to the emissions created by 287 average sized U.S. homes' energy use for one year.

water use, cost avoidance, transportation, green buildings and infrastructure, and monitoring and communication. SEP transportation electrification actions include the following:

- County Transportation: Reduce GHG emissions of County-owned vehicles by 10% below 2015 levels by 2020. This action explores the feasibility of replacing fleet vehicles with alternative fuel models (including electric) and deploying supportive infrastructure, as implemented by the Green Fleet Action Plan.
- Community Transportation: Reduce demand for fossil fuel consumption and vehicle emissions of unincorporated residents by reducing VMT and using alternative fuels.
- County Green Buildings and Infrastructure: Reduce and recycle resources and use environmentally friendly practices in maintenance and new construction. This action includes exploring the feasibility of installing EV charging stations for public use at County facilities.

County of San Diego Green Fleet Action Plan

The Green Fleet Action Plan (GFAP), published in February 2014, is part of DGS's larger effort to reduce energy use and GHG emissions in County operations outlined in the SEP. In 2016, the GFAP Implementation Strategy was developed to achieve objectives of the GFAP.

The GFAP Implementation Strategy establishes goals to transition County fleet vehicles to EV models to reduce fleet GHG emissions through actions including:

- Installing EV charging stations for fleet use at County facilities;
- Replacing 50 standard fuel light-duty vehicles with PHEV/EV by 2020, and 250 vehicles by 2025;
- Downsizing fleet vehicles and fuel conversions for utility and heavy-duty vehicles; and
- Use of a county-wide motor pool with EV models to reduce the number of underutilized vehicles in the fleet and increase awareness of EV technology.

Through implementation of the County's General Plan, Climate Action Plan, Strategic Energy Plan, and Green Fleet Action Plan, the County has already begun efforts to electrify the transportation sector by installing EV charging infrastructure and transitioning fleet vehicles to electric. Recommendations appearing in Section 3 of the EV Roadmap, would expand efforts to electrify the County's fleet and facilities, and throughout the unincorporated area.

COUNTY POLICY SUMMARY

Multiple County policies include EV-related efforts to reduce GHGs in support of State GHG emissions reduction targets.

- The General Plan reflects the County's commitment to a compact and sustainable growth model.
- The Climate Action Plan includes two primary measures that direct EV purchases and charging infrastructure and four measures direct EV supporting efforts.
- The Strategic Energy Plan and Green Fleet Action Plan establish GHG emissions reduction targets and EV targets for County facilities and operations.

https://www.sandiegocounty.gov/content/dam/sdc/dgs/Doc/Energy_StrategicEnergyPlan.pdf

Section 2

EV TECHNOLOGY & INCENTIVE PROGRAMS

EV technology is rapidly improving and charging infrastructure availability and vehicle cost are key drivers of market growth.

Market & Technology

Funding & Incentives

Comparative Analysis

SECTION 2: EV TECHNOLOGY AND MARKET

SUMMARY OF TECHNOLOGY AND MARKET

Electric vehicle technologies have rapidly improved in the past several years. Passenger vehicle options include all-electric and plug-in hybrid electric technologies with a selection of approximately 70 light-duty available models. Vehicle ranges vary by model, type, and year, but average 114 miles of range on a single charge. In addition, EV models provide 50% fuel and maintenance cost savings when compared to conventional vehicles. EV sales are expected to continue to steadily increase until about 2025 when EVs are expected to cost the same as comparable conventional vehicles without incentives. It is expected that light-duty EV sales will increase rapidly after 2025.

In the longer term, advances in battery technology for medium- and heavy-duty models will continue to improve, which will drive costs down and improve battery range. Mass market adoption of medium- and heavy-duty models is not anticipated until after 2025.

Charging infrastructure availability is a critical component that drives light-, medium-, and heavy-duty EV market growth.

Future market growth projections indicate that by 2040, 57% of global light-duty vehicles sales, over 30% of the passenger vehicle fleet, and 31% of medium-duty commercial fleet will be electric. [7]

Vehicle Technology

While the focus of this Roadmap is on EVs, a brief overview of all ZEV technologies is included below. A summary is included in Table 1.

EV TECHNOLOGY & TRENDS

- Recent technological advancements have increased EV range and decreased overall vehicle purchase costs.
- Industry experts anticipate that light-duty EV models will cost the same as conventional vehicles by 2025 with the medium- and heavy-duty market about five years behind.
- To prepare for the expected increase of EVs on the road, there will need to be significant investment in charging station infrastructure at publicly accessible locations and at workplaces in the region.

Battery Electric

Battery electric vehicles (EVs) are powered by electricity stored in a battery onboard the vehicle. EV battery technology has progressed in recent years, improving the range, charge times, and cost significantly.

Plug-in Hybrid Electric

Plug-in hybrid electric vehicles (PHEV) use two sources of power. An electric battery powers the vehicle until its charge is depleted, at which point a gasoline-powered internal combustion engine provides acceleration in hybrid drive.

Hydrogen Fuel Cell Electric

Hydrogen fuel cell electric vehicles (FCEV) are powered by hydrogen that is extracted from natural gas or water. Operating a FCEV produces water vapor and air as the only emissions. California's FCEV market is supported by the passage of AB 8 (2013) which provides funding for hydrogen fueling stations throughout the state. CARB produces annual reports that evaluate the FCEV market and recommend grant programs to install, upgrade, and operate fueling infrastructure. Although FCEV adoption has

[7] From Bloomberg NEF's *2019 Electric Vehicle Outlook* (2019), available at: https://about.bnef.com/electric-vehicle-outlook/

	Battery Electric Vehicle (EV)	Plug-in Hybrid Electric Vehicle (PHEV)	Fuel Cell Electric Vehicle (FCEV)
Fuel Type	Electricity	Electricity and Gasoline	Hydrogen
Range	60-335 miles per charge	10-40 miles on electric drive, 170-600 on hybrid drive	265-366 miles per tank

Table 1: Light-Duty Zero Emissions Vehicle Technologies[8]

occurred at a slower rate compared to EV and PHEV technologies, CARB has developed the California Hydrogen Infrastructure Tool (CHIT) to prioritize areas for future infrastructure development to spur adoption of this technology.

Light-Duty Model Availability and Cost

Recent year-over-year growth in the light-duty EV market has been propelled by technological advancements that reduce battery cost, increase charging speeds and travel range, and increase consumer awareness. These advancements make EV models cost competitive with conventional gasoline vehicles when considering lifetime cost of ownership. Although purchase costs are currently higher than comparable conventional models, EV operations and maintenance costs are 50% less than those associated with conventional gasoline-powered vehicles.[9 & 10] Based on County Fleet records, EVs require minimal maintenance to their electrical systems, which include the battery and electrical motor. In addition, brake systems typically last longer than conventional vehicles. Since PHEVs have gasoline engines, their maintenance requirements are similar to conventional vehicles. Figure 4 shows the range of vehicle costs for three comparable light-duty vehicles.

CARB estimates there will be approximately 80 light-duty ZEV offerings by Model Year 2021. This number is expected to increase as auto manufacturers develop improved technologies and product offerings.[11]

Medium- and Heavy-Duty Model Availability and Cost

Electric vehicle technology for medium- and heavy-duty vehicle types is emerging. There are approximately 70 medium- and heavy-duty EV/PHEV models available as of August 2019. The main barriers to broad market adoption are limited vehicle range (110-150 maximum range

VEHICLE CLASSIFICATIONS

Vehicles are classified by their weight and engine type.

- Light-Duty: Passenger vehicles including sedans, full-size and mini-vans, sport utility vehicles, pickups, trucks, and motorcycles.
- Medium-Duty: Class 3-6 vehicles including shuttle buses, delivery trucks, medium-duty vans and trucks, off-road vehicles, and groundskeeping equipment.
- Heavy-Duty: Class 7-8 vehicles including street sweeping equipment, transportation buses, fire apparatus, and construction industrial equipment, drayage trucks, long-haul trucks, and freight.

[8] Department of Energy data (2018), available at: https://www.energy.gov/eere/vehicles/articles/fotw-1010-january-1-2018-all-electric-light-vehicle-ranges-can-exceed-those

[9] From ICCT's *Ensuring driving on electricity is cheaper than driving on gasoline* report (2018), available at: https://theicct.org/sites/default/files/publications/Driving-on-electricity-versus-gasoline_ICCT-Briefing_26022018_vF.pdf

[10] From Forbes article (2017), available at: https://cars.usnews.com/cars-trucks/why-people-dont-buy-electric-cars

[11] From CARB *Advanced Clean Cars Appendix C* (2017), available at: https://www.arb.ca.gov/msprog/acc/mtr/appendix_c.pdf?_ga=2.93908253.1229273556.1560290545-404852206.1549497259

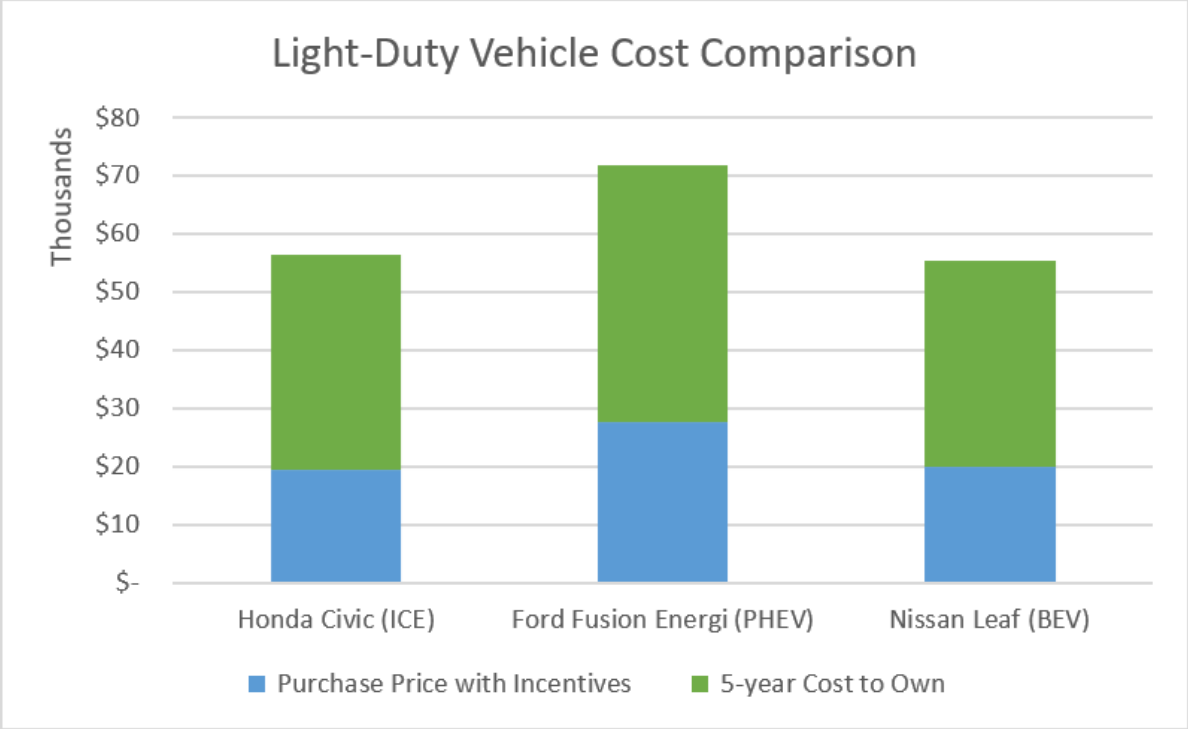


Figure 4: Conventional Vehicle and EV Cost Comparisons[12]

for most vehicle types) and high upfront costs. Commercially available medium- and heavy-duty models are currently best suited for urban/suburban goods movement, shuttle buses, transit bus service, and school bus service due to shorter fleet routes for these types of vehicles. Range presents a paradox for medium- and heavy-duty vehicles because longer ranges require larger batteries, which add extra weight and size that takes away from the vehicle's hauling potential. Battery size also adds to the overall cost of the vehicle. CARB estimated that the upfront cost of a battery-electric bus or truck is twice as much as the cost for a diesel vehicle. Costs in all portions of the medium- and heavy-duty vehicle market are expected to decrease in the mid-term from 2020-2030 as manufacturing scales up, parts become standardized, and batteries become more efficient.

EV Market Trends

Current Vehicle Trends

The EV market, both nationally and abroad, is supported by government policies and programs that seek to reduce GHG emissions and improve energy efficiency. The combined effect of regulations and incentives has resulted in the acceleration of EV technology development, increased consumer demand, widespread deployment of charging infrastructure, and emerging market opportunities. Leaders in this transition include Norway, China, and the United States. In Norway, 39% of vehicle sales included EV models in 2017. China has the greatest EV sales volume, with 579,000 EVs sold in 2017. In the United States, six metropolitan areas are among the top 25 global EV markets: Los Angeles, San Francisco, San Jose, New York, San Diego, and Seattle (in decreasing order).[12]

[12] From ICCT's *Electric Vehicle Capitals: Accelerating the Global Transition to Electric Drive* (2018) report. Available at: https://theicct.org/sites/default/files/publications/EV_Capitals_2018_final_20181029.pdf

California's EV market has grown considerably from 150,000 registered EVs in 2016 to over 613,000 in July 2019. Current market growth shows no sign of slowing with California sales in the first quarter of 2019 increasing 13% from the same period in 2018.[13] State and federal incentives have helped to spur EV market growth by reducing the upfront purchase price of EV models. Proceeds from California's cap-and-trade system have been offered since 2009 to incentivize the purchase of new ZEV models. Federal tax credit incentives from the federal government began in 2010. Collectively, these incentives can result in as much as $14,500 in rebates and tax incentives per vehicle, making the cost of EV models competitive with their conventional vehicle equivalent, and contributing to California's dominant share of the national EV market.

The regional EV market reflects broader state trends in the adoption of ZEV technology and charging infrastructure development with approximately 35,000 ZEVs registered[14] (Table 2) and 1,741 publicly available EV charging stations[15] installed in the region from 2010-2018. This strong local market growth can be attributed to regional partnerships, policies, and programs that helped to spur EV adoption from the early stages of the transportation electrification movement. Examples include state and local policies such as purchase incentives, carpool lane access, availability of EV charging infrastructure, and utility and automaker promotions.

In order for the region to meet the State's Executive Order goals, approximately 136,500 ZEVs will need to be on the road by 2025 and 449,400 by 2030.[16] The unincorporated area's share (by population) is approximately 21,000 ZEVs by 2025 and 69,100 ZEVs by 2030.[17]

Future Vehicle Trends

Future market growth projections indicate that over half of new vehicle sales will be EV by 2040 (Figure 5).[19] This market trend is supported by vehicle battery improvements that have decreased U.S. battery costs by 42% from approximately $400 per kilowatt-hour (kWh) in 2015 to $200/kWh in 2018. As a result of decreasing battery costs and other technological advancements, it is anticipated that light-duty EV industry growth will accelerate once non-incentivized EV's reach price parity with conventional internal-combustion engine vehicles around 2025 in the U.S. market.[20] Medium- and heavy-duty technology is projected to be cost-effective by 2030, trailing the light-duty market by about five years.

San Diego ZEV Registrations[18]	
2010	16
2011	1,185
2012	1,421
2013	3,051
2014	4,382
2015	4,376
2016	5,563
2017	6,914
2018 (Q1-Q3)	7,928
TOTAL	**34,836**

Table 2: Regional EV Registrations, 2010-2018

[13] Veloz Sales Dashboard (2019), available at: https://www.veloz.org/wp-content/uploads/2019/05/4_april_2019_monthly-1.pdf

[14] DMV data from 2010-2018, available at: https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics

[15] Department of Energy July 2019 data, available at: https://afdc.energy.gov/stations/#/find/nearest

[16] From SANDAG research presented at the Regional ZEV Working Group (2019).

[17] Using CA Department of Finance 2019 population data that estimates the unincorporated area as 15.4% of the total county population.

[18] From SANDAG's Board of Directors "Regional EV Charging Program Partnership" presentation on May 24, 2019.

[19] From Bloomberg NEF's *2019 Electric Vehicle Outlook* (2019), available at: https://about.bnef.com/electric-vehicle-outlook/

[20] From Bloomberg NEF's *Electric Cars to Reach Price Parity by 2025* (2017), available at: https://about.bnef.com/blog/electric-cars-reach-price-parity-2025/

EV market growth is also expected to be supported by the increase in shared mobility fleet electrification and use. Shared mobility fleets, including transportation network companies like Lyft and Uber, will contribute to EV market growth because of cost savings on fuel and maintenance. Currently, EVs make up 1.8% of the global shared mobility fleet. Industry experts anticipate that 80% of the shared mobility fleet will be EV by 2040. This market trend will significantly contribute to GHG reductions from the transportation sector as shared mobility annual vehicle miles traveled will increase from 5% of total passenger vehicle miles travelled today to 19% by 2040.[21]

Although past EV market projections considered self-driving or autonomous EVs to contribute significantly to EV market growth as early as 2020, recent trends indicate that this influence is not expected to happen in the near-term future. Technical and safety issues have delayed the launch of the self-driving EV market beyond the "pilot phase" and it is expected that these issues will not be resolved until after 2030.[22]

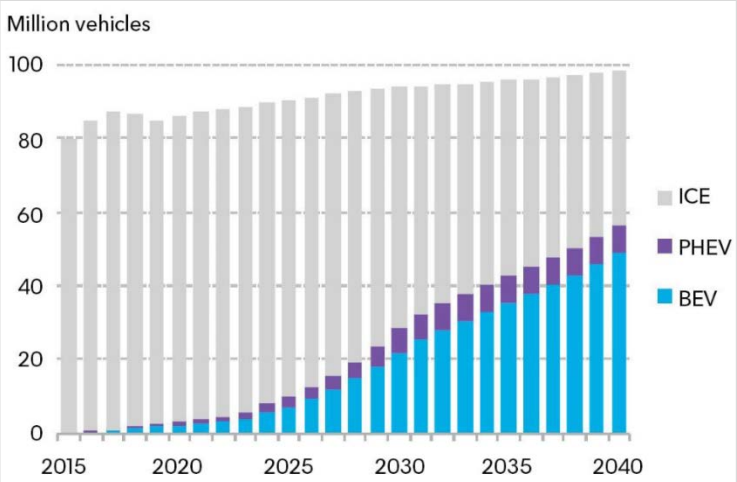


Figure 5: Global Passenger Vehicle Sales by Drivetrain[20]

Charging Technology

Current Charging Technology

An EV charging station delivers AC[23] (Level I and II) or DC[24] (DC fast charger[25]) power to EV batteries at a rate dependent on the vehicle's battery technology and the type of charger. Table 3 provides an overview of charging technology. A portable Level I charger is typically included with a new EV purchase and can be plugged in a standard household outlet. With a charging rate of 4-6 miles/hour, a Level I charger can provide a full charge to a mid-size vehicle in approximately 17-25 hours. Level II chargers have a wide range of charging speeds depending on the rate of electricity delivery. With a charging rate of 8-60 miles/hour, a Level II charger can provide a full charge to a mid-size light-duty vehicle in approximately 3-8 hours. DC fast chargers provide the fastest charging rate, providing an 80% charge in approximately 30 minutes. The first 350-kilowatt DC fast charger in North America was installed in 2018 at a northern California shopping mall. This emerging technology delivers approximately 200 miles of range in about 10 minutes.[26]

Several factors must be considered when selecting the appropriate charging infrastructure for specific locations and use. For example, the proximity of an adequate electricity source, the total cost of infrastructure upgrades needed, charging behaviors of EV drivers, and anticipated

[21] From Bloomberg NEF's *2019 Electric Vehicle Outlook* (2019), available at: https://about.bnef.com/electric-vehicle-outlook/

[22] From The Philadelphia Tribune *Despite high hopes, self-driving cars are 'way in the future'* article (2019), available at: https://www.phillytrib.com/nyt/despite-high-hopes-self-driving-cars-are-way-in-the/article_157e456e-b01b-57c0-8ea9-1230a6bb389c.html

[23] Alternating Current

[24] Direct Current

[25] The U.S. Department of Energy has not defined the parameters for Level III chargers to date.

[26] From CNET's *Electrify America fires up California's first 350-kW EV charger* (2018), available at: https://www.cnet.com/roadshow/news/electrify-america-350-kw-ev-charger-california/

demand factor in to charging technology selection and affect the overall installation cost. Residential and workplace charging takes place over longer periods of time and therefore may be appropriate for Level I or Level II chargers. Alternatively, EV charging stations located at commercial sites and for light-, medium- and heavy-duty vehicles that spend less time parked during their duty cycles can be best served by faster chargers such as high-powered Level II and DC fast chargers.

Installing charging infrastructure in the unincorporated area requires a building permit and is subject to inspection prior to use. Installations must be completed by a certified and licensed electrician. There are specialized training programs to instruct certified electricians on EV charging station installation site assessments and load calculations. The "EV Infrastructure Training Program" provides certification for electrical contractors who complete training on site load calculations, maintenance, repair, and wireless charging applications for light-, medium-, and/or heavy-duty charging equipment. This certification is an optional supplement to the State General Electrician certification. Certain charging station vendors require this optional certification from contractors they partner with.

Future Charging Technology

Recent innovations in power management charging technology allow users to control when and how fast EVs charge. Power management can be used to charge vehicles at times when more renewable energy is available on the grid and to take advantage of lower electricity rates during off-peak hours. Innovations that leverage existing electricity supply to provide EV charging also exist. For example, the City of Los Angeles has been installing Level II charging stations on streetlights since 2012. This program has installed over 130 charging stations on streetlights that have excess electricity capacity after having been converted to energy efficient light-emitting diode (LED) bulbs. This approach is now being used in other highly urbanized locations such as New York and London and is particularly suited to dense residential areas without access to garages.

Bi-directional, or vehicle-to-grid, technology is currently in the pilot phase of development. This technology allows energy to flow from an electricity source to the vehicle battery and/or vice versa. Bi-directional chargers and software allow EVs to connect directly to the grid and buildings to supply power during times when grid disruptions occur or when renewable energy is not available. This charging innovation could contribute to building resilient energy and transportation systems, providing mobile battery storage that functions as a micro-grid system.

Micro-grids are small networks of locally sourced, often renewable, electricity supply that can be connected to the grid but also function independently. Micro-grids often include battery storage to maximize the use of renewable energy produced on-site and for emergency back-up power. As the EV market continues to grow, there are opportunities for re-using EV batteries for energy storage in micro-grid systems. Designing microgrids, especially in disaster-prone areas, to provide indefinite renewables-driven backup power to critical facilities builds resilience into a community. Integrating solar-plus-storage and bi-directional EV charging maximizes the efficiency and environmental benefits of both technologies.

Wireless charging technology, currently under development, is expected to provide the greatest opportunities for commercial fleet

vehicle applications by 2025.[27] In this technology, wireless-charging equipped vehicles are charged through a pad located either in a parking space or along a road in future inductive charging applications. Wireless charging eliminates the need for drivers to remember to plug in their vehicles, saving time in fleet applications, and offering an automated charging solution for autonomous vehicle operations in the future.

Charging Infrastructure and EV Market Growth

Research indicates that EV adoption accelerates as charging infrastructure, incentives, and local government supportive actions increase.[28] In fact, the availability of charging infrastructure was found to be the most significant predictor of EV market growth. Public and workplace charging infrastructure ease range anxiety, extends the functional range of EVs, and can be used as an incentive when free charging is provided. However, despite the correlation between charging infrastructure availability and EV market development, the growth of publicly available charging stations has not kept pace with EV purchases in the state (Figure 6, pg. 20).[29] Increasing the availability of EV charging infrastructure in the unincorporated area is a primary focus of the recommendations contained in this Roadmap.

	Level I (L1)	Level II (L2)	DC Fast Charging (DCFC)
Plug	Standard wall outlet	J1772 connector	SAE Combo (US/Euro models), CHAdeMO (Asian models), Tesla
Compatibility	All EVs	All EVs (Tesla with adaptor)	Varies by car manufacturer
Power Levels	110/120VAC at 15 or 20 Amps	208/240VAC at 30, 40, 50, or 100 Amps	200-500VDC at up to 200 Amps
Charge Rate	4-6 miles/hour	8-60 miles/hour	80% charge in <30 minutes
Best Usage	Single-family, multi-family home; workplace; fleet	Single-family, multi-family home; workplace; fleet	Public in metro areas; gas stations, fleet
Hardware Costs	$0*-$1,500 single port	$400-$6,500 single port	$10,000-$40,000 single port
Installation Cost	$0*-$3,000 per unit	$600-$12,700 per unit ($4,000 San Diego average)	$4,000-$51,000 per unit ($21,000 average)

*Table 3: Overview of EV Charging Port Types.[1] (*Level I chargers are provided with some vehicle purchases)*

[27] From Allied Analytics LLP *Wireless Electric Vehicle Charging Market: Global Opportunity Analysis and Industry Forecast, 2018-2025* report (2019), available at: https://www.researchandmarkets.com/reports/4828958/wireless-electric-vehicle-charging-market-global?utm_source=BW&utm_medium=PressRelase&utm_code=wjtx6r&utm_campaign=1298897+-+Wireless+Electric+Vehicle+Charging+Markets%3a+Global+Outlook+to+2025&utm_exec=joca220prd

[28] From ICCT *The Continued Transition to Electric Vehicles in U.S. Cities* report (2018), available at: https://www.theicct.org/sites/default/files/publications/Transition_EV_US_Cities_20180724.pdf

[29] From Environment California *Plugging In: Speeding the Adoption of Electric Vehicles in California with Smart Local Policies* report (2018), available at: https://environmentcaliforniacenter.org/sites/environment/files/reports/ Plugging%20In%20-%20Environment%20California%20-%20Feb%202018.pdf

Projected Regional Charging Demand

The National Renewable Energy Laboratory (NREL) and California Energy Commission (CEC) have determined that there will need to be one non-residential Level II charger for every 11-14 EVs on the road and one DC fast charger for every 54-56 EVs to meet projected demand from 2020-2030.[30] In 2018, SANDAG published the *Plug-In SD EV Infrastructure Needs Assessment Methodology Report,* which documents the regional approach used to evaluate publicly accessible EV infrastructure needs in the region today and into the future. The report establishes charging demand projections in line with the State's ZEV goals.

There are approximately 1,741 public chargers including 201 DC fast chargers in the region according to the July 2019 Department of Energy data. Of these existing public chargers, 74 Level II and two DC fast chargers are located in the unincorporated area. In addition, there are currently 3,055 workplace chargers in the region. In order to meet projected regional charging demand, there will need to be approximately 6,600 public chargers including 2,500 fast chargers; and 6,700 workplace chargers by 2025. There will need to be approximately 19,700 public chargers including 8,300 fast chargers; and 21,300 workplace chargers by 2030 (see Table 4 below).

The unincorporated area's share of these regional chargers (by population) is approximately 1,000 public chargers including 400 fast chargers; and 1,000 workplace chargers by 2025; and 3,000 public chargers including 1,300 fast chargers; and 3,300 workplace chargers by 2030.

It is expected that after EVs reach price parity with conventional vehicles around 2025, there will be greater demand for EV rather than PHEV models. Because of the longer range of EV models, this market trend will contribute to a greater regional demand for charging infrastructure overall by 2030. Figure 7 shows SANDAG projections for regional EV infrastructure demand through 2030.

	ZEVs	Residential L2	Multifamily L2	Workplace L2	Public L2	Public DC FC
Current Conditions (Unincorporated Area)	34,836[31] (5,356)	N/A	N/A	3,055 EVCS[32] (470)	1,540 EVCS[33] (74)	201 EVCS[33] (2)
2025 Regional Projections (Unincorporated Area)	136,544[35] (20,996)	5,267 EVCS[34] (811)	658 EVCS[34] (101)	6,669 EVCS[35] (1,025)	4,144 EVCS[35] (637)	2,464 EVCS[35] (378)
2030 Projections[35] (Unincorporated Area)	449,430 (69,109)	N/A	N/A	21,299 (3,275)	11,463 (1,762)	8,299 (1,276)

Table 4: Projected Regional and Unincorporated Area EV Ownership and EV Charging Station (EVCS) Demand

[30] From NREL *National Plug-in Electric Vehicle Infrastructure Analysis* (2017), available at: www.nrel.gov/docs/fy17osti/69031.pdf

[31] CVRP data from 2010-2018 (Q1-Q3) scaled to represent 100% of purchases (see footnote #24), available at: https://cleanvehiclerebate.org/eng/rebate-statistics

[32] Data provided by SDGE (2019). Note: number of chargers are for SDGE service territory which extends beyond the county of San Diego boundary.

[33] Department of Energy July 2019 data, available at: https://afdc.energy.gov/stations/#/find/nearest

[34] From SANDAG Plug-in San Diego *Electric Vehicle Infrastructure Needs Assessment Methodology Report* (2018), available at: https://www.sandag.org/uploads/projectid/projectid_511_25370.pdf

[35] From SANDAG research presented at the Regional ZEV Working Group (2019).

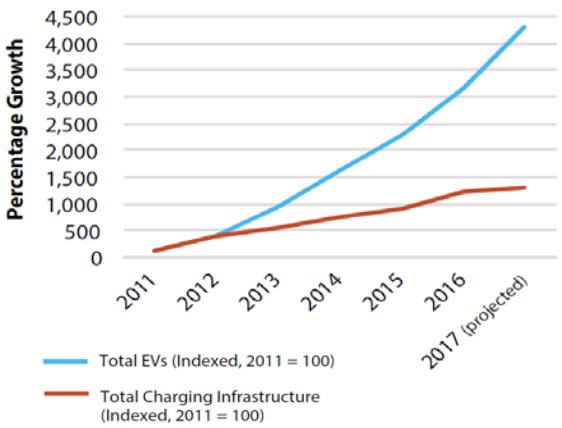


Figure 6: Growth of Electric Vehicles and Growth of Public Charging Stations, 2011-2017[20]

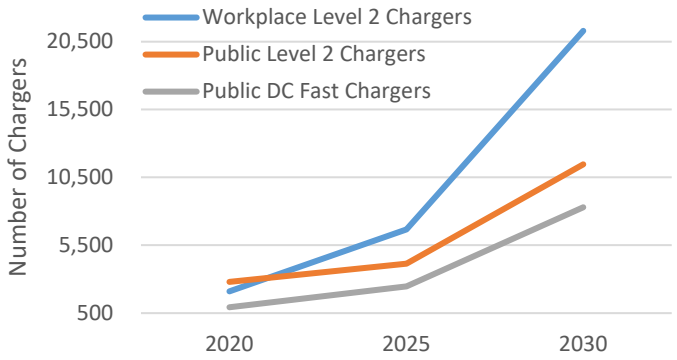


Figure 7: SANDAG EV Charging Station Projections for the Region to Meet EO Goals, 2020-2030

SANDAG's EV Charging Infrastructure Needs Assessment (2018) web-based mapping application identifies areas with high potential EV trip ends for 2025 and 2030 and is a tool for planning future EV charging station infrastructure to meet projected demand.[36] The Assessment shows that projected EV trip ends in the unincorporated area are expected to increase due to the projected increase in EV ownership based on regional historic market growth. In line with NREL (et al.) research cited above, there will need to be a higher number of public EV charging facilities in the rural and semi-rural areas of the unincorporated area to meet public charging demand in the future.

Barriers to Increasing EV Use

Although there has been strong progress towards State ZEV goals in recent years, barriers to increasing EV use persist. Research indicates that barriers to mass-market adoption of EVs include concerns about vehicle range ("range anxiety"), lack of vehicle charging infrastructure, and high upfront costs for EVs.

Although battery technology improvements are rapidly increasing EV range, some potential EV drivers fear that the battery will run out of range before reaching their destination. The median range for a passenger EV is 114-miles, which is significantly lower than the 418-mile median range of a gasoline vehicle. [37] However, range anxiety is more an issue with the public's lack of understanding about charging behavior and charging technology. Except when using a DC fast charger, charging an EV requires longer dwell times when compared to refueling at a gas station. Public outreach and education on EV charging technology can teach consumers about when the best times to charge an EV are, requirements for charging length, and where DC fast chargers are located in case a quick charge is needed. Furthermore, PHEVs offer another solution to range anxiety since they function like a conventional vehicle after the all-electric range is exhausted and have a median range of 450 miles.

Additionally, the lack of charging infrastructure contributes to range anxiety and restricts market growth overall. Increasing public and workplace

[36] SANDAG Plug-in San Diego EV Charging Stations Map (2019), available at: https://evcs.sandag.org/

[37] Department of Energy data (2018), available at: https://www.energy.gov/eere/vehicles/articles/fotw-1010-january-1-2018-all-electric-light-vehicle-ranges-can-exceed-those

charging infrastructure decreases range anxiety and extends the area in which EVs can reliably operate and charge.

And finally, EV models cost 38-50% more than their conventional vehicle equivalent and this cost presents a barrier to widespread EV adoption. Although there are federal and state incentives to reduce this upfront cost, public education and outreach is needed to inform drivers of the lifetime cost savings of EVs over conventional vehicles. Outreach can also increase awareness of incentives that are available to lower upfront purchase cost and fund the installation of charging infrastructure.

Education, Outreach, and Regional Collaboration

Education and Outreach

As described above, public education and outreach increases overall awareness of the economic and environmental benefits of vehicle electrification and addresses barriers to increasing EV use. Education, outreach, and regional collaboration are existing supporting efforts under CAP Measures T-3.3 and T-3.5. Implementation of these Measures will include education and marketing related to the purchase of EVs, available charging infrastructure, and existing EV resources and programs through existing and new CAP media. Regional collaboration will also encourage installation of charging infrastructure through engagement with a broader audience, further reducing barriers to EV adoption and supporting State EV goals.

Education and outreach efforts are integrated into each of the six goals presented in Section Three of this Roadmap.

EV Roadmap Public Engagement

EV Roadmap public engagement efforts included multiple interviews, meetings, and engagement with EV industry experts, local agencies, SDG&E, Caltrans, and the general public. The input that was provided is summarized below. A detailed description of the public workshop held at the County offices and held on July 21, 2019 is included in the attached Appendices.

- Eliminate cumbersome regulations and streamline permit processing.
- Consider electrification from a regional perspective and include all stakeholders equitably.
- Partner with existing community organizations to provide resources and education to communities with priority populations.[38]
- Strategize cross jurisdictionally to get large workforces to electrify.
- Consider ways to pair solar photovoltaic and charging times strategically.
- Consider using electrical contractors that are certified by the Electrical Vehicle Infrastructure Training Program.
- Consider actions to prepare for growth in the medium- and heavy-duty electric vehicle sector.
- Incorporate grid resiliency into electrification planning efforts.
- Consider ways to include charging infrastructure in existing multi-family developments.
- Coordinate with SDG&E on planning of charging infrastructure.

The feedback that was provided throughout the public engagement period of EV Roadmap development was incorporated directly into recommendations in many cases, and in other

[38] Priority populations are defined by CARB and include SB 535 Disadvantaged Communities (top 25% most pollution-impacted census tracts) and AB 1550 Low-Income Communities (households that are at or below 80% of the statewide median income).

cases will be incorporated at the time of implementation.

Regional Collaboration, Partners, and Studies

The San Diego region has a well-established framework for agency collaboration to support regional transportation electrification efforts. The Regional Electric Vehicle Infrastructure (REVI) Working Group was founded in 2012 by the San Diego Association of Governments (SANDAG) with funding from the California Energy Commission (CEC) to support regional EV charging infrastructure planning and development. This working group included members from local agencies, educational institutions, non-profit organizations, and private industry to gain regional perspectives to support EV market growth. In 2014, REVI developed the *San Diego Regional PHEV Readiness Plan* to identify barriers to EV charging infrastructure deployment in the region and present key recommendations for local jurisdictions.[39] This effort led to the development of SANDAG's Plug-in San Diego program which implements the recommendations for EV adoption and infrastructure development identified in REVI's Readiness Plan. This program, launched in 2015, has provided regional EV expert and consumer advocate assistance and resources for consumers, charging infrastructure developers, and local jurisdictions.

In addition to regional EV collaborations, local jurisdictions (e.g., County, City of San Diego, City of Chula Vista, City of La Mesa, City of Carlsbad, City of Encinitas, etc.) throughout the region have included CAP measures to encourage the adoption of EVs. CAP EV measures that support regional EV market growth include incentivizing the purchase of EVs through preferential parking requirements, establishing fleet conversion targets, and expanding the development of EV charging infrastructure requirements. As part of CAP implementation, regional jurisdictions have amended local zoning ordinances and building codes to streamline EV charging station installation permitting practices, waive EV charging station permitting fees, and increase the amount of EVs in municipal fleets. An overview of regional CAP EV measures and ordinances can be found in the Appendices.

Implementation of the County's CAP Measures and Roadmap recommendations will include collaboration with regional partners to streamline development standards and practices across the region, address gaps in charging infrastructure along major transportation corridors, and provide equitable access to EV technology.

Summary of Best Practices in EV Policy

Staff reviewed EV-related policies from over 30 jurisdictions, industry expert research and guidance documents from over 30 government and non-government sources and engaged with numerous industry experts to develop Roadmap recommendations. A detailed analysis of relevant literature and case studies is included in the Appendices.

VEHICLE ELECTRIFICATION BEST PRACTICES

Jurisdictions that most comprehensively address the barriers to EV adoption implement the following strategies:

- Leading by example with County fleet vehicles and charger installation.
- Creating incentives and permit streamlining to encourage charging infrastructure in private development.
- Increasing public awareness of EV benefits, including economic and environmental.
- Adopting goals to support and evaluate emerging technology.

[39] REVI *San Diego Regional PHEV Readiness Plan* (2014), available at: https://www.sandag.org/index.asp?classid=17&subclassid=46&projectid=413&fuseaction=projects.detail

City/County EV Policy Comparative Analysis

A review of jurisdictions in California and elsewhere indicates that progressive EV policies include efforts to:

Facilities and Operations

- Convert light-duty fleet vehicles to EV
- Establish medium- and heavy-duty vehicle goals
- Incentivize employee EV ownership
- Install EV chargers in publicly accessible locations

Jurisdiction-wide

- Streamline and incentivize charger permits
- Incentivize/require EV ready parking spaces and chargers in new and retrofit multi-family and commercial development
- Ensure equitable access to EVs and charging infrastructure
- Enhance education and outreach efforts on EV benefits

The following jurisdictions were identified as leaders in promoting EV ownership and comprehensively addressing barriers to EV adoption described in the previous section.

City and County of San Francisco

The City and County of San Francisco intend to make all transportation modes, including public transportation and private cars and trucks emissions-free by 2040. When combined with the City's goal to achieve 100% renewable energy by 2030, EVs will create virtually zero GHG emissions.

Jurisdiction Strategies		
City and County of San Francisco	**EV Roadmap for San Francisco (2019)[40]**	
	The plan focuses on the following six strategies: • Achieve broad public awareness of the options and benefits of electric mobility. • Provide incentives to create a preference for electric mobility over gasoline and diesel vehicles. • Ensure EV charging infrastructure is available and convenient for all residents, businesses, and visitors. • Integrate EV charging with the electrical grid to support the transition to a renewable energy future. • Lead the way in medium- and heavy-duty electrification. • Encourage emerging mobility options to be emission-free.	
	EV Readiness Ordinance (2017)[41]	
	• The ordinance applies to both new construction and major alterations to existing development. • In new single and two-family dwellings, each parking space must be EV ready. • In new and major alterations to multifamily dwellings (3 or more units) and nonresidential development, 100% of spaces must be EV capable. At least 10% of those must be EV ready and in no case fewer than two. • Installation of one DC fast charger can reduce the number of EV spaces by five at a residential site and by ten at a nonresidential site.	

[40] Mayor's Electric Vehicle Working Group *Proposed Electric Vehicle Roadmap for San Francisco* (2019), available at: https://sfenvironment.org/sites/default/files/fliers/files/sfe_tr_ev-roadmap.pdf

[41] City and County of San Francisco *EV Readiness Ordinance* (2017), available at: https://sfbos.org/sites/default/files/o0092-17.pdf

City of Sacramento

The City of Sacramento is striving to be the ZEV capital of California. The City aims to improve air quality, combat climate change, increase mobility for low-income and disadvantaged communities, and strengthen its position as a hub for transportation technology through vehicle electrification and investment.

Jurisdiction Strategies	
City of Sacramento	**EV Strategy (2017)** [42] The plan focuses on the following eight strategies: • Facilitate installation of community charging and infrastructure. • Advance heavy-duty and new ZEV applications. • Support and maximize benefits from Electrify America's Green City Initiative. • Improve availability and use of City facility charging infrastructure. • Support electrification of public and private fleets. • Support economic development and innovation from the ZEV industry. • ZEV education through programs, partnerships, and engagement. • Ensure equitable ZEV access. **Fleet Sustainability Policy (2017)** [43] • Commitment for 50% of annual light-duty fleet purchases to be ZEV by 2018 and 75% by 2020. • "ZEV First" procurement process to require BEV, FCEV, or other ZEV types for vehicle replacements. • Actively seek grants, rebates and other financial incentives to implement the fleet transition. • Actively participate with transportation electrification organizations to stay up to date with innovative ideas and utilize City vehicles to demonstrate promising technology. **"Sac-to-Zero" - Electrify America "Green City"** [44] In 2017, Sacramento was designated as Electrify America's first "Green City." The Initiative will invest $44 million in the city by 2020 and will include the following programs: • Two electric carshare programs, GIG and Envoy, to provide a combined 400 EVs. • ZEV buses and on-demand ZEV micro shuttle service to UC Davis and the Franklin Blvd. Corridor. • Installation of over 10 DC fast chargers, including new 350 kW ultra-fast DCFC.

[42] City of Sacramento *Electric Vehicle Strategy* (2017), available at: http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVStrategy_171212_FINAL_CityOfSacramento.pdf?la=en

[43] City of Sacramento *Fleet Sustainability Policy* (2017), available at: https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Fleet/Fleet-Sustainability-Policy-121217/Fleet-Sustainability-Policy-121217.pdf?la=en

[44] City of Sacramento *Sac-to-Zero Factsheet*, available at: https://www.cityofsacramento.org/-/media/Corporate/Files/Green-City/Sac-to-Zero-Fact-Sheet.pdf?la=en

City of Los Angeles

The City of Los Angeles aims to be carbon neutral by 2050 and achieve a zero-carbon grid, zero-carbon transportation, zero-carbon buildings, zero waste, and waste zero water. The City is also working with regional partners to reduce GHGs and pollution ahead of the 2028 Olympic and Paralympic Games.

Jurisdiction Strategies	

City of Los Angeles	**LA's Green New Deal – Sustainability pLAn 2019** [45]
	Transportation electrification targets and initiatives can be found in two of the 13 chapters of the plan:
	• Zero-Emission Vehicles: Increase the percentage of ZEV in the city to 25% by 2025; 80% by 2035; and 100% by 2050.
	  o Distribute rebates for used EVs, Level II chargers, and DCFC.
	  o Develop a zero-emission roadmap for LAX.
	  o Develop and implement a roadmap for a fossil-fuel-free zone.
	  o Install publicly available chargers.
	  o Electrify the taxi fleet, school buses, and urban delivery vehicles.
	• Zero-Emission Vehicles: Electrify 100% of transit buses by 2030.
	  o Introduce new electric buses and deploy charging infrastructure.
	  o Electrify paratransit shuttle buses.
	• Zero-Emission Vehicles: Reduce port-related GHG emissions by 80% by 2050.
	  o Deploy zero-emission cargo handling equipment and on-road drayage trucks.
	• Lead by Example: Convert all City fleet vehicles to zero-emission where technically feasible by 2028.
	  o Deploy charging stations at City buildings, parks, libraries, and streetlights.
	  o Lead locally through the Transportation Electrification Partnership and nationally through the Climate Mayors EV Purchasing Collaborative.
	  o "Zero-emission first" vehicle procurement policy for new light-duty purchases and new Meals on Wheels vehicles.
	  o Electrify medium-duty trash and recycling trucks.
	Zero Emissions 2028 Roadmap (2018) [46]
	The plan focuses on the following three strategies:
	• Reduce emissions from people movement, including light-duty vehicles, commuter rail, and local transit.
	• Reduce emissions from goods movement, including medium- and heavy-duty trucks, marine shipping, and aerial transit.
	• Strengthen the energy-transportation nexus as the grid becomes more dependent on renewable energy through smart grid technologies, increases in grid capacity, and digital innovation.

[45] City of Los Angeles *LA's Green New Deal- Sustainable City pLAn 2019* (2019), available at http://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf

[46] Transportation Electrification Partnership *Zero Emissions 2028 Roadmap* (2018), available at: https://roadmap.laci.org/

Funding and Incentives for Electric Vehicle Market Development

Program	Source	Incentive Amount	Applicability
Light-Duty Vehicles			
Qualified Plug-in Electric Drive Motor Vehicle Credit	IRS	$7,500 max. tax credit	Public and private
Clean Vehicle Rebate Project (CVRP)	CARB	$7,000 max. rebate	Public and private
State of California Green Fleet Employee Pricing Program	CA DGS	$100-500 rebate	State and local government employees
Champions for Clean Air	SDG&E	$1,000 rebate	Teachers and first responders
EV Time of Use Pricing Plans	SDG&E	Pricing varies by plan	Public and private
Medium- and Heavy-Duty Vehicles			
Carl Moyer On-Road Voucher Incentive Program	APCD	$510,000 total funding	Private
Hybrid and Zero-Emission Truck and Bus Voucher Project (HVIP)	CARB	Up to half the incremental cost between conventional truck or bus and their hybrid or zero-emission equivalent	Public and private
Clean Off-Road Equipment Voucher Incentive Program (CORE)	CARB	$40 M total funding	Public and private
Volkswagen Mitigation Trust (Heavy-Duty)	CARB	$290 M total funding	Public and private
School Bus Replacement Program	CEC	$94 M total funding	Public
Clean Air for All	APCD	$28.5 M total funding	Public and private

Table 5: EV Incentives Programs Overview

Public funding from federal, state, and regional agencies has resulted in a variety of EV and EV charging station incentive programs. An overview of funding and incentive programs can be found in Tables 5 above and 6 below, and more detailed descriptions can be found in the attached Appendices.

Vehicle Incentives

Vehicle incentives at the federal and state level, with additional regional offerings, support the purchase of EVs and are a necessary driver for EV market growth until EV models are at price parity with their conventional internal combustion engine equivalent.

County's Use of Vehicle Incentives

Future vehicle purchases by the County may be subsidized through incentive programs as they are awarded. These programs are competitive and offered on a rolling basis, and are restricted based upon income, tax status, and types of vehicles purchased. Through 2017, the County Department of General Services (DGS) has participated in the Clean Vehicle Rebate Project (CVRP) to purchase vehicles. To date, more than 30 applications have received CVRP rebates for a total of $65,000 amounting to an average of $2,033 per vehicle (14 Chevrolet Bolts, 4 Chrysler Pacificas, 5 Ford C-MAX Energis, and 7 Ford Fusion Energis). DGS will continue to seek rebates through this program at the maximum allowable levels for light-duty fleet vehicles. The County does not qualify for the federal tax credit

as this incentive is not claimable by a government directly. The federal tax credit is only available to taxpayers and businesses that can submit annual or quarterly returns.

The County may be eligible to compete for grants in other programs on a rolling basis for future medium- and heavy- duty vehicle conversions. Those programs include the Hybrid and Zero-Emissions Truck and Bus Voucher Project (HVIP), the Clean-Off-Road Equipment Voucher Incentive Program (CORE), Climate Air Protection Program (CAPP), and the Volkswagen Mitigation Trust Heavy-Duty Replacement program. DGS is monitoring these programs for applicability as fleet vehicles become eligible for replacement.

DGS will also continue to monitor Carl Moyer programs for funding opportunities. These programs include incentives for the replacement of on- and off-road heavy-duty vehicles. Previous applications for on-road heavy-duty vehicle incentives have not resulted in funding because County equipment is typically used fewer hours/miles than privately held equipment and therefore has a harder time qualifying in a competitive funding process. Off-Road Equipment incentives are limited for fleets greater than 10 vehicles and to projects that are above and beyond the States Off-Road Diesel Regulation final 2023 fleet requirements or are zero-emission. Feasibility of replacing existing operational equipment with zero-emission (i.e. battery powered) is limited since this equipment operates primarily in rural areas and does not have charging infrastructure capable of supporting such equipment use.

Roadmap and CAP implementation education and outreach efforts in the unincorporated area will include strategies to increase general public and private fleet operator awareness of available vehicle incentives to increase EV ownership and use. These efforts will include collaboration with community-based organizations to reach target audiences, with particular interest to increase awareness of vehicle incentives in communities with priority populations.

Infrastructure Incentives

Charging infrastructure incentives are generally offered at the state and regional level with upcoming opportunities expected to increase EV charging station installations for public use in the near-term from 2020-2023. EV charging infrastructure incentives are currently available for airports, multi-family housing, private, and public property.

From a regional perspective, there has been a considerable effort to increase funding opportunities for EV charging infrastructure locally. SANDAG's *EVCS Funding Opportunities Report* has identified gaps in regional EV charging infrastructure funding for single-family, workplace, and public applications to meet projected demand in 2025.[47] Currently, SANDAG and San Diego County APCD are collaborating with the CEC CALeVIP program to launch a Regional EV Charger Incentive Program. This program will contribute to the development of public Level II and DC Fast chargers in the near term, and the program is anticipated to begin in mid-2020. In addition, two approved SDG&E pilot programs, which focus on medium- and heavy-duty EV charging infrastructure, are expected to begin in 2020.

[47] From SANDAG Plug-in San Diego *Electric Vehicle Infrastructure Needs Assessment Methodology Report* (2018), available at: https://www.sandag.org/uploads/projectid/projectid_511_25370.pdf

Program	Source	Funding/Incentive Amount	Applicability
Airport ZEV and Infrastructure Pilot Program	FAA	50% of project cost	Airport administrators
CA Capital Access Program EVCS Financing Program	CEC	$500,000 max. loan	Small businesses and multi-unit dwelling owners
Property Assessed Clean Energy (PACE) Loss Reserve Program	CEC	$500,000 max. loan	Private property owners
California EV Infrastructure Project (CALeVIP)	CEC	$7,500 max. rebate	Private and public property owners
Volkswagen Mitigation Trust (Light-Duty)	CARB	$5 M total funding	Private and public property owners
Electrify America	Electrify America	Private Investment	Encourages private investments in public EV charging infrastructure
Clean Mobility for Disadvantaged Communities	CARB	$17 M total funding	Communities with priority populations
Tesla Workplace Charging Program	Tesla	Cost of charging equipment	Workplace property owners
CALeVIP- Regional EV Charging Incentive Program (in development)	SANDAG, APCD, CEC	To be determined	Private and public property owners
Medium and Heavy-Duty EV Charging Infrastructure Program	SDG&E	$107.4 M total funding	Private and public property owners
Parks Pilot (under CPUC review)	SDG&E	$9.8 M total funding	State parks and beaches, city and county parks
Schools Pilot (under review)	SDG&E	$9.9 M total funding	Educational facilities

Table 6: Charging Infrastructure Incentives Programs Overview

County's Use of Infrastructure Incentives

The County has received funding for both public and fleet charging infrastructure in the past. A 2015 grant from the CEC for $500,000 was used to develop the public charging station infrastructure at County facilities. In addition, the County partnered with the San Diego Gas and Electric (SDG&E) on the Power Your Drive initiative to install Level II chargers at County facilities.

Upcoming incentive programs such as the CALeVIP, Volkswagen Mitigation Trust, and SDG&E's proposed Parks Pilot program could be utilized to install charging infrastructure for public use at County facilities, including parks and County staff are monitoring opportunities to apply. Charging infrastructure for the County fleet could also be funded through the upcoming SDG&E Medium and Heavy-Duty EV Charging Infrastructure Program. This program is currently under development, but it is expected that the County could recommend sites for charging infrastructure development to support future medium- and heavy-duty fleet vehicle conversions.

County staff are also coordinating with Electrify America's rural program that is scheduled to install $2 million worth of Level II chargers in rural areas for their Cycle 2 investment. While this program is private and not available for

application, County staff are exploring opportunities to partner with Electrify America to site new charging infrastructure within the unincorporated area. Currently, this program is slated to install infrastructure in areas outside the region.

Roadmap and CAP implementation education and outreach efforts in the unincorporated area will include strategies to increase private development and general public awareness of available charging infrastructure incentives to increase charging station installations. These efforts will include collaboration with community-based organizations to reach target audiences, with particular interest to increase the accessibility of charging infrastructure to priority populations in communities of concern.


LOCATION
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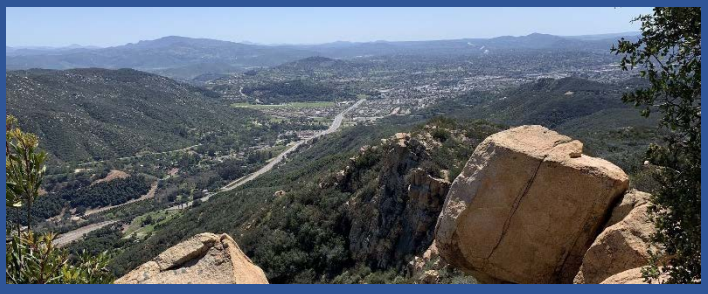
Section 3

EV ROADMAP RECOMMENDATIONS

The EV Roadmap goals and recommendations leverage the County's land use authority, permitting processes, and outreach platforms.



County Operations

Unincorporated Areas

SECTION 3: EV ROADMAP RECOMMENDATIONS

This section outlines recommendations for Board consideration that leverage the County's land use authority, permitting processes, and outreach platforms in order to increase EV ownership and charging installations to support State ZEV goals and County GHG reduction efforts. Staff identified policy updates, fleet management strategies, local incentives, public outreach and engagement, and external engagement strategies that are best suited for the needs and conditions of the unincorporated area. These recommendations are described in detail below.

Summary of Electric Vehicle Roadmap Goals and Recommendations

Six goals and 11 recommendations that collectively aim to increase EV ownership and charging infrastructure installation are presented for Board consideration. Through implementation of these recommendations, the following key objectives in County operations and in the unincorporated area will be achieved:

County Operations Recommendations

County operations Roadmap recommendations increase County fleet and employee EV use and charging station installations at County facilities. These goals demonstrate leadership in transportation electrification efforts and contribute to GHG emissions reductions from County operations:

Goal 1: Further Reduce the County's Fleet of Gas-Powered Vehicles.

- Targeted Outcome: Increase the number of EVs in the County's fleet to 501 vehicles by 2027.

Goal 2: Accelerate the Installation of EV Charging Stations at Public Locations in County Facilities and in the Unincorporated County.

- Targeted Outcome: Contribute to the regional EV charging network by installing 2,040 Level II charging stations at County facilities and throughout the unincorporated area by 2028.

Goal 3: Promote and Incentivize County Employee EV Ownership.

- Targeted Outcome: Increase County employee EV ownership and use to reduce employee commute emissions.

The following tables outline three goals and eight recommendations for County operations:

	County Operations – Goal 1: Further Reduce the County's Fleet of Gas-Powered Vehicles.
1-A	**Recommendation:** Amend Board policies F-22, "Lease of Real Property for County Use", H-1, "Fleet Management and Internal Service Fund", and H-2, "Fleet Vehicle and Mobile Equipment Acquisition Policy", in the October 2019 sunset review. Policy amendments would assist EV conversion by requiring new vehicles to be EV when feasible. **Costs:** There is no additional funding requested to amend the policies. However, the implementation of the amended policies could have associated costs that would impact the availability of General Fund resources, including General Purpose Revenue and/or available General Fund fund balance, which would be included in future Operational Plans. **Timeframe:** Short-Term (1 Year)

	County Operations – Goal 1: Further Reduce the County's Fleet of Gas-Powered Vehicles.
1-B	**Recommendation:** Convert 250 County fleet gas-powered vehicles to EVs by 2025 and install necessary EV charging infrastructure. This recommendation will mandate the implementation of Green Fleet Action Plan (GFAP) goals for EV purchases. EV purchase premiums of approximately $9,500-$14,800 per vehicle will be paid for by each department. Cost estimates include the additional upfront EV purchase and charging infrastructure installation costs associated with Recommendation A. **Costs:** Phased approach with one-time funding requests to be included in future Operational Plans (FY 2020-21: $1.85M, FY 2021-22: $4.05M, FY 2022-23: $2.05M) and an ongoing cost of $0.148M to fund 1.0 additional FTE beginning in FY 2020-21. **Timeframe**: Mid-Term (2-4 Years)
1-C	**Recommendation:** Convert an additional 251 County fleet gas-powered vehicles to EVs for a total of 501 by 2027 and install necessary EV charging infrastructure at 16 County sites. This recommendation will exceed the GFAP goal for EV purchases through a phased approach through FY 2026-27 EV purchase premiums of approximately $9,500-$14,800 per vehicle will be paid for by each department. Cost estimates include the additional upfront EV purchase and charging infrastructure installation costs associated with Recommendation A. This recommendation would result in GHG emissions reductions and demonstrate leadership in fleet electrification efforts. **Costs:** Phased approach with one-time funding requests to be included in future Operational Plans (FY 2023-24: $4.39M, FY 2024-25: $3.53M, FY 2025-26: $3.52M, FY 2026-27: $1.70M). **Timeframe:** Long-Term (>5 Years)
1-D	**Recommendation:** Keep pace with technological trends, track the costs and benefits of fleet conversion, and update the Green Fleet Action Plan no later than 2025 to set goals for medium- and heavy-duty fleet vehicle conversions. Consider additional categories of light-duty vehicles for conversion, and purchase EVs as feasible. Consider additional categories of light-duty vehicles for conversion, and purchase EVs as feasible. This recommendation would result in GHG emissions reductions and demonstrate leadership in fleet electrification efforts. **Costs:** $50,000 in one-time costs for fleet vehicle telematics and technology tracking in FY 2020-21. **Timeframe:** Long-Term (>5 Years)

Implementing Actions:

Continue to:

- Identify and pursue incentives and grant funding to bridge the gap between the cost of gas-powered light-duty vehicles and that of EV light-duty vehicles.
- Identify and pursue incentives and grant funding to install EV charging infrastructure.
- Promote use of an EV motor pool for employees to use for County operations.

2021-2025:

- Identify and pursue incentives and grant funding opportunities to bridge the gap between the cost of gas-powered medium- and heavy-duty vehicles and that of EV medium- and heavy-duty vehicles when the technology is commercially available.
- Identify funding availability and investigate cost effectiveness of transitioning to DC fast charging, solar powered EV charging systems, and other available technology to supplement fleet and public charging at County facilities.

2026-2030:

- Take advantage of the opportunities that EV batteries have for resiliency such as storage, vehicle-to-grid charging, other emerging cutting-edge charging infrastructure technology.
- Apply fleet wireless charging technology when it becomes commercially available, efficient, and cost-effective.
- Evaluate autonomous and other emerging EV shuttles technology and cost effectiveness of providing shuttle services between County facilities for employee use.

County Operations – Goal 2: Accelerate Installation of EV Charging Stations at Public Locations in County Facilities and in the Unincorporated County.	
2-A	**Recommendation:** Amend Board Policy G-15, "Design Standards for County Facilities" in the October 2019 sunset review to require all new County facilities to include charging infrastructure for public and employee use. The policy amendment will increase the availability of public charging infrastructure at County facilities. **Costs:** There is no additional requested funding to amend the policy. However, the implementation of the amended policy could have associated costs that would impact the availability of General Fund resources, including General Purpose Revenue and/or available General Fund fund balance, which would be included in future Operational Plans. **Timeframe:** Short-Term (1 Year)
2-B	**Recommendation:** Fund the installation of 63 publicly accessible Level II chargers at seven County facilities for public and employee use. This recommendation would increase the number of public charging infrastructure at County facilities to 100 chargers by 2021 and contribute to meeting CAP Measure T-3.5 targets. **Costs:** $760,000 in one-time costs in FY 2020-21. **Timeframe:** Short-Term (1 Year)
2-C	**Recommendation:** Complete an EV charger site assessment study and develop the EV Charger Installation Program by FY 2022-23. Return to the Board for funding and install 2,040 Level II chargers by FY 2027-28. This recommendation would accelerate the installation of publicly accessible charging infrastructure at priority locations in the unincorporated area to meet the anticipated demand timeframe. Implementing actions include coordinating with regional partners to identify funding and infrastructure gaps to support vehicle electrification efforts and equitably distribute charging infrastructure across the region and developing an outreach plan to site charging infrastructure at multi-family residential and workplaces in the unincorporated area. **Costs:** There is no additional funding requested specifically to complete an EV charger site assessment study. However, the installation of the chargers will have associated costs that would impact the availability of General Fund resources, including General Purpose Revenue and/or available General Fund fund balance, which would be included in future Operational Plans. **Timeframe:** Long-Term (>5 Years)

Implementing Actions:

Continue to:

- Coordinate with regional partners such as SANDAG, SDG&E, CalTrans, and other local jurisdictions to evaluate regional EV charging infrastructure gaps and opportunities for funding in the region.
- Participate in the CALeVIP and similar infrastructure grant programs and coordinate with Electrify America to identify locations for possible charger installations in the unincorporated area as part of their Cycle 2 rural investment.
- Educate the community on the economic and environmental benefits of EVs and promote available funding from infrastructure grant programs and EV incentives.

2021-2025:

- Lead an initiative with local agencies to streamline local EV Charger permitting process to provide certainty for infrastructure developers and reduce project timelines and costs.
- By 2022, prepare an EV charger site assessment for County facilities and the unincorporated area and return to the Board of Supervisors with implementation options. The site assessment shall be prepared using consultant resources and shall consider the following:
  - Highly travelled corridors, including east-west corridors and others lacking charging infrastructure;
  - Priority areas and communities of concern with lower income and higher exposure to air pollutants;
  - Popular commercial and public destinations;
  - Public right-of-way options; and
  - Workforce centers.

2026-2030:

- Keep pace with emerging technology and investigate cost effectiveness of transitioning program implementation to include:
  - Remote charging and battery storage (including the re-use of EV batteries) infrastructure to increase grid resiliency in disaster prone areas;
  - DC fast charger installations at County facilities for public use and to benefit priority populations; and
  - Public right-of-way installation applications, including charging stations on streetlights, with partner agencies.

County Operations – Goal 3: Promote and Incentivize County Employee EV Ownership.
Recommendation: Promote and incentivize County employee EV use by developing partnerships with banks, credit unions, dealerships to extend lending and pricing benefits. This recommendation would include employee outreach, and test drive events to promote and incentivize County employee EV use. **Costs:** There is no additional funding requested specifically to expand the scope of the measure. However, the implementation of these options could have associated costs that would impact the availability of General Fund resources, including General Purpose Revenue and/or available General Fund fund balance, which would be included in future Operational Plans. **Timeframe:** Mid-Term (2-4 Years)
Implementing Actions: Continue to: • Prepare outreach materials to advertise the benefits of driving an EV for personal and fleet use. • Host workplace charging challenges and collaborate with regional partners to hold EV "ride and drive" events at County facilities. • Coordinate with and leverage existing County partnerships to extend lending and pricing benefits. 2021-2025: • Establish employee ownership incentive programs including lending and pricing benefits, parking. incentives, EV car share, and other similar strategies. • Track and report on employee participation to determine GHG reductions.

Unincorporated Area Recommendations

Unincorporated area Roadmap recommendations leverage the County's land use authority, permitting processes, and outreach platforms in order to increase EV ownership and charging installations in the unincorporated area. These goals support State EV goals and encourage regional collaboration to decrease GHG emissions from the transportation sector:

Goal 4: Incentivize and/or Require EV Charging Infrastructure in New and Existing Private Multi-Family Residential and/or Non-Residential Development.

- Targeted Outcome: Increase charging station installations in new and existing private development.

Goal 5: Fund EV Expert/Consumer Advocate as a Regional Resource.

- Targeted Outcome: Increase EV ownership and charging station installations through education, outreach, regional collaboration, and incentives.

Goal 6: Collaborate with Regional Partners to Support Public and Private Fleet Electrification.

- Targeted Outcome: Increase EV use in regional light-, medium-, and heavy-duty fleets.

The following tables outline three goals and three recommendations for the unincorporated area:

Unincorporated Area – Goal 4 Incentivize and/or Require EV Charging Infrastructure in New and Existing Private Multi-Family Residential and/or Non-Residential Development.
Recommendation: Prepare a cost/benefit analysis of options to incentivize and/or require EV charger installations in new and/or retrofits of multi-family and non-residential development in the unincorporated area. Incentives could include amending the County's Green Building Incentive Program to include EV charging stations as a qualifier for expedited plan check and reduced building permit fees, a permit fee waiver, and reduced parking space requirements for projects that include EV charging station installations. Requirements to be considered could include adopting building code requirements that exceed the State's existing EV charging parking space requirements. This recommendation would increase the availability of chargers in private development throughout the unincorporated area. **Costs:** There is no additional funding requested specifically to prepare a cost/benefit analysis. However, the implementation of these options could have associated costs depending on the types of incentives and/or requirements, which may result in the request for a waiver of the full cost recovery directive of Board Policy B-29, *Fees, Grants, Revenue Contracts – Department Responsibility for Cost Recovery* and would impact the availability of General Fund resources, including General Purpose Revenue and/or available General Fund fund balance. These costs and a request for funding would be brought to the Board for further consideration. **Timeframe:** Mid-Term (2-4 Years)
Implementing Actions: Beginning in 2019: • Evaluate parking and related EV charging stations requirements to implement shared parking facilities. • Promote streamlined County EV charging station permit process to encourage development of charging infrastructure in the unincorporated area. 2021-2025: • Evaluate options for Building Code amendments for multi-family and non-residential new development and major retrofits to: o Increase requirements for "EV capable" parking spaces (conduit and electrical panel capacity); o Require "EV ready" parking spaces (conduit, wiring, and electrical panel capacity); or o Require installation of EV charging stations. • Develop options to incentivize multi-family and non-residential new development and major retrofits to install EV charging stations through: o Green Building Incentive Program; o Permit fee waiver; or o EV parking space incentives. 2026-2030: • Keep pace with emerging technology and investigate the costs/benefits of incentivizing and/or requiring: o Alternate ZEV fueling station, such as hydrogen fueling; o Wireless charging applications; and o Vehicle-to-grid compatible systems.

Unincorporated Area – Goal 5

Fund EV Expert/Consumer Advocate as a Regional Resource.

Recommendation: Identify regional partners and cost sharing opportunities to fund a regional "EV Expert/Consumer Advocate" that would provide no-cost consultations for residents, agencies, and businesses to learn more about available incentives, technologies, and charger installation procedures on an ongoing basis. This service would provide education and outreach of EV technology and increases awareness of the environmental and economic benefits of transportation electrification. A similar service was previously administered by SANDAG and is no longer being funded. This recommendation would extend this previously operated service through a regional cost-share program contracted through SANDAG with local and regional agencies.

Costs: Not-to-exceed $25,000 in ongoing costs beginning in FY 2020-21.

Timeframe: Ongoing

Implementing Actions:

Beginning in 2019:

- Convene local agency partners to determine cost-share agreement between agencies to cover the approximate $75,000 annual program administration cost.
- Procure a third-party entity to administer EV Expert/consumer advocate service to provide general and technical support to residents, agencies, and businesses on EV-related topics including incentive availability, technology, and charger installation procedures.

2021-2025:

- Evaluate EV Expert/Consumer Advocate effectiveness and identify opportunities to expand/modify the service to satisfy regional demand.

2026-2030:

- Expand EV expert advice capabilities to cover emerging ZEV technologies including such as hydrogen fuel cell technology.

Unincorporated Area – Goal 6

Collaborate with Regional Partners to Support Public and Private Fleet Electrification.

Recommendation: Develop public and private regional partnerships to provide fleet electrification technical support to convert large regional fleets such as delivery services, rideshare, school districts, and transportation network companies to EV on an ongoing basis. This recommendation would reduce GHG emissions from regional transportation sources throughout the region. Examples of efforts include coordination around state funding, regional support for large fleet electrification, identification of regional charging infrastructure needs, and education and outreach to the regional business community.

Costs: There is no additional funding requested specifically to explore participation in regional partnerships. However, the participation could have associated costs that would impact the availability of General Fund resources, including General Purpose Revenue and/or available General Fund fund balance, which would be included in future Operational Plans.

Timeframe: Ongoing

Implementing Actions:

Continue to:

- Coordinate with regional partners such as SANDAG, SDG&E, and other local jurisdictions to:
  - Monitor existing pilot programs and identify future programs to electrify regional fleets including delivery service, school district, transportation network companies, and others to electric in the unincorporated area;
  - Evaluate fleet opportunities within the unincorporated county and conduct targeted outreach in collaboration with regional partners;
  - Evaluate charging infrastructure placement to ensure grid stability and resiliency; and
  - Identify gaps in EV adoption and consider ride share EV fleets to make this technology more accessible, especially to priority populations in the region.
  - Promote clean transportation innovations to demonstrate leadership and attract investment in future charging and vehicle technologies.


addict
electric
drive

Section 4

EV ROADMAP RECOMENDATIONS ANALYSIS

The EV Roadmap contains eleven recommended actions for Board consideration for County operations and unincorporated areas.

County Actions

Community Actions

SECTION 4: EV ROADMAP RECOMMENDATIONS ANALYSIS

GOAL 1: FURTHER REDUCE THE COUNTY'S FLEET OF GAS-POWERED VEHICLES

Background

The County of San Diego Department of General Services (DGS) plans for fleet efficiency through the CAP and SEP, which establishes targets and actions to reduce the County's fleet emissions from approximately 4,500 heavy- and light-duty vehicles (see Figure 8 for the light-duty fleet fuel mix in 2018). CAP Measure T-3.4 establishes a target of reducing County fleet emissions by 10% below 2014 levels by 2020 and 20% below by 2030. The SEP and GFAP will be updated in 2020 to reflect CAP 2030 GHG emissions reductions targets and Board direction.

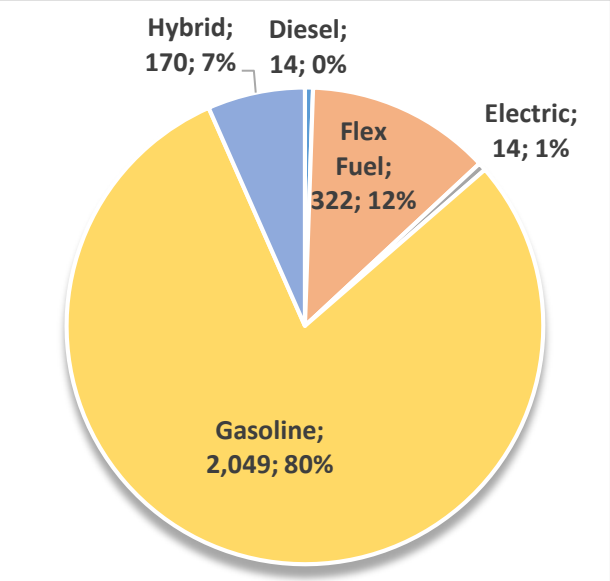


Figure 8: County of San Diego 2,569 Vehicle Light-Duty Fleet Fuel Mix, 2018

In 2018, the County's fleet GHG emissions were 11% below 2014 levels, achieving the 2020 CAP target one year ahead of schedule. These emissions reductions were achieved by transitioning to cleaner fuels, including electricity and renewable diesel. The County's fleet converted to 100% renewable diesel (R99) as an alternative fuel in 2017. Renewable diesel provides more power, lower maintenance costs, superior cold-weather performance, and causes no deterioration in engine quality.

To achieve CAP and SEP emissions reductions targets through vehicle electrification, the GFAP sets goals to transition 50 light-duty vehicles to EV/PHEV models by 2020; and 250 vehicles by 2025. Currently, there are 40 EV/PHEVs in the light-duty fleet with an additional 10 PHEVs on order for Fiscal Year (FY) 2019-20. The County has charging infrastructure installed to support an additional 38 vehicles and a recommendation to purchase 38 EVs in FY 2020-21 is included as part of this goal.

In addition to transitioning the County fleet to EV/PHEV models, the County has installed EV charging stations for fleet use within County facilities since 2016. Currently, there are 84 Level II EV chargers available for fleet use at eight County facilities. Of these, 70 were installed as part of SDG&E's "Power Your Drive" program. Two portable solar photovoltaic chargers are currently located at the County Operations Center in Kearny Mesa. These chargers

produced a total of 888 kWh of electricity from July to December 2018 and provide an example of how to use a renewable energy source to power the fleet's transition to EVs.

DGS implements three EV-related Board policies. Board Policy H-2, "Fleet Vehicle and Mobile Equipment Acquisition Policy," establishes County vehicle purchase procedures. Board Policy H-1, "Fleet Management Internal Service Fund," defines minimum utilization rates for County fleet vehicles as 10,000 miles per year or more than one trip per day average use. Working with departments to reduce their underutilized vehicles is a critical step in reducing County fleet GHG emissions and will also help to fund EV transitions. The recent transition of DGS internal combustion vehicles into an EV motor pool reduced 23 vehicles to nine and increased utilization from 13% to 61%. Increased pooling of vehicles within departments and where there are concentrations of vehicles will be a key to increased utilization rates across the County fleet. Board Policy F-22 "Lease of Real Property for County Use," establishes standards for the lease of property.

Agency	Fleet Size	Number of EV in Fleet	Percentage of Fleet
County of San Diego	4,530	40*	0.8%
UCSD	1050	63	6%
Encinitas	89	5	5.6%
Chula Vista	600	15*	2.5%
City of San Diego	4,400	6*	0.1%
City of Oceanside	550	2	0.3%
Los Angeles County	5,000	599	12%
City and County of San Francisco	5,267	60	1.1%
Alameda County	1,200	84	7%
City of Portland	3,197	196	6.1%
City of Seattle	3,480	296	8.5%
* Additional EVs on-order but not in service at time of report writing			

Table 7: Fleet Electrification Results

Analysis and Recommendations

As part of this Goal, Recommendation A identifies policy changes to H-1, H-2 and F-22, that would provide greater purchasing power to aid in the conversion of fleet vehicles in accordance with vehicle replacement schedules, and allow for negotiations with lessors to consider installing charging infrastructure in non-County owned facilities. DGS prepared a comprehensive analysis of the County fleet and facilities that supports Recommendation B to achieve the GFAP EV goal of 250 EVs by 2025. This is achieved by purchasing 38 EVs in FY 2020-21 (charging infrastructure is already installed and available) and purchasing an additional 162 EVs and installing charging infrastructure through FY 2023-24. With the existing 50 EVs in the County fleet, this recommendation would result in meeting the 250 EV vehicle goal by FY 2023-24. County-owned sites with three or more assigned vehicles were considered for fleet EV charging infrastructure development. Fleet vehicles eligible for transition included light-duty sedans, mid-size mini-vans, SUVs and trucks, with the exception of patrol and home-assigned vehicles. This recommendation also includes an increase of 1.0 staff year in FY 2020-21 to manage the fleet conversion to electric vehicles; identify and pursue incentives and grant funding opportunities; conduct outreach; keep pace with technological trends; track the costs and benefits of fleet conversion; and update the Green Fleet Action Plan.

DGS also identified additional feasible locations that would allow for the Board to consider in Recommendation C, to increase the total EVs in fleet by 251 by purchasing EVs through FY 2026-27. If the Board approves this option, the County fleet would include a total of 501 EVs, which exceeds the existing goal. This recommendation would contribute to implementing CAP Measure T-3.4 and required 10% GHG emissions reductions by 2030. Exceeding the existing EV goal would also demonstrate leadership and commitment to achieve State ZEV goals and GHG reduction targets. As demonstrated in Table 7 above, achieving a total of 501 EVs would place the County in the most electrified fleets in the state.

Detailed descriptions of each phase and incremental vehicle and charging infrastructure costs are provided in Table 8 below.

Phase	Number of Vehicles Converted to EV	Requested Funding for EV Charging Infrastructure Cost	Requested Funding for Vehicle Premium
Existing/On Order FY19/20	50	N/A	N/A
FY19/20	38	N/A	N/A
SUBTOTAL	**88**	**N/A**	**N/A**
FY20/21	35	$0.93 M	$0.92 M
FY21/22	84	$1.84 M	$2.21 M
FY22/23	43	$0.91 M	$1.14 M
SUBTOTAL	**162**	**$3.68** M	**$4.27** M
FY23/24	95	$1.88 M	$2.51 M
FY24/25	72	$1.93 M	$1.60 M
FY25/26	53	$2.35 M	$1.17 M
FY26/27	31	$1.20 M	$0.50 M
SUBTOTAL	**251**	**$7.36** M	**$5.78** M
TOTAL	**501**	**$11.04** M	**$10.05** M

Table 8: County Fleet Electrification Strategy, FY19/20-FY27/28

Lastly, Recommendation D would result in DGS establishing new goals for the conversion of medium- and heavy-duty fleet vehicles and purchasing the technology as feasible. DGS will monitor the availability of potential grants and funding opportunities to facilitate the conversion of this segment of the fleet. Additionally, DGS will purchase fleet EV telematics and technology tracking equipment in FY 2020-21 to inform the department about vehicle usage, to aid in purchasing decisions. As part of this effort, DGS will monitor advancements in EV technology and monitor the cost effectiveness of DC fast charging options for fleet and public use, battery storage options to charge EV batteries with onsite renewable energy, vehicle-to-grid solutions, remote solar charging options, and wireless charging applications.

If the Board directs action on these recommendations, the following implementing actions will occur:

Continue to:

- Identify and pursue incentives and grant funding to bridge the gap between the cost of gas-powered light-duty vehicles and that of EV light-duty vehicles.
- Identify and pursue incentives and grant funding to install EV charging infrastructure.
- Promote use of an EV motor pool for employees to use for County operations.

2021-2025:

- Identify and pursue incentives and grant funding opportunities to bridge the gap between the cost of gas-powered medium- and heavy-duty vehicles and that of EV medium- and heavy-duty vehicles when the technology is commercially available.
- Identify funding availability and investigate cost effectiveness of transitioning to DC fast charging, solar powered EV charging systems, and other available technology to supplement fleet and public charging at County facilities.

2026-2030:

- Take advantage of the opportunities that EV batteries have for resiliency such as storage, vehicle-to-grid charging, other emerging cutting-edge charging infrastructure technology.
- Apply fleet wireless charging technology when it becomes commercially available, efficient, and cost-effective.
- Evaluate autonomous and other emerging EV shuttles technology and cost effectiveness of providing shuttle services between County facilities for employee use.

To Move Forward with the Recommendations

The Board may provide direction on one or a combination of the following:

1. Recommendation A: Amend Board policies F-22, "Lease of Real Property for County Use", H-1, "Fleet Management and Internal Service Fund", and H-2, "Fleet Vehicle and Mobile Equipment Acquisition Policy", in the October 2019 sunset review. Policy amendments would assist EV conversion by requiring new vehicles to be EV when feasible.
2. Recommendation B: Convert 250 County fleet gas-powered vehicles to EVs by 2025 and install necessary EV charging infrastructure. This recommendation will mandate the implementation of Green Fleet Action Plan (GFAP) goals for EV purchases. EV purchase premiums of approximately $9,500-$14,800 per vehicle will be paid for by each department. Cost estimates include the additional upfront EV purchase and charging infrastructure installation costs associated with Recommendation A.
3. Recommendation C: Convert an additional 251 County fleet gas-powered vehicles to EVs for a total of 501 by 2027 and install necessary EV charging infrastructure at 16 County sites. This recommendation will exceed the GFAP goal for EV purchases through a phased approach through FY 2026-27 EV purchase premiums of approximately $9,500-$14,800 per vehicle will be paid for by each department. Cost estimates include the additional upfront EV purchase and charging infrastructure installation costs associated with Recommendation A. This recommendation would result in GHG emissions reductions and demonstrate leadership in fleet electrification efforts.
4. Recommendation D: Keep pace with technological trends, track the costs and benefits of fleet conversion, and update the Green Fleet Action Plan no later than 2025 to set goals for medium- and heavy-duty fleet vehicle conversions. Consider additional categories of light-duty vehicles for conversion, and purchase EVs as feasible. Consider additional categories of light-duty vehicles for conversion, and purchase EVs as feasible. This recommendation would result in GHG emissions reductions and demonstrate leadership in fleet electrification efforts.

GOAL 2: ACCELERATE INSTALLATION OF EV CHARGING STATIONS AT PUBLIC LOCATIONS IN COUNTY FACILITIES AND IN THE UNINCORPORATED COUNTY

Background

In addition to EV chargers available for County fleet use, 37 EV charging stations have been installed for public and County employee use at ten sites since 2016. Across the public network, there was a 66% utilization rate as of June 2019. The County's Level II EV charging stations are operated and maintained by ChargePoint, with rates of 20 cents/kWh plus 55 cents/hour for parking. When the vehicle is fully charged, the parking portion of the charge remains per hour to encourage users to move their vehicles and allow others to charge. During FY 2016-17, the average utilization was 544 charging sessions per month with usage increasing 20% in FY 2017-18.

Analysis and Recommendations

The lack of convenient EV charging station access causes some drivers to have "range anxiety," which has been demonstrated in literature reviews as one of the primary barriers to widespread adoption of EV technology. Currently, there are approximately 1,741 public charging stations available throughout the region. Of these, 76 are located in the unincorporated area. For the unincorporated area to meet projected demand and to meet State goals, there will need to be approximately 1,000 public chargers including 400 fast chargers; and 1,000 workplace chargers by 2025; and 3,000 public chargers including 1,300 fast chargers; and 3,300 workplace chargers by 2030.

This goal would facilitate an increase in EV ownership in the unincorporated area by increasing the availability of charging infrastructure. CAP Measure T-3.5 requires that 2,040 Level II chargers are installed in public areas throughout the unincorporated area by 2030. However, research and market analysis indicate that greater demand for charging infrastructure will occur more quickly than the existing timeframe will allow.

Recommendation A identifies a policy amendment to Board Policy G-15, "Design Standards for County Facilities," that would require charging infrastructure for employee and public use in all new County facilities. The amendment will be presented as part of the Board's consideration of policy sunset reviews for DGS in October 2019. This amendment would ensure that all County facilities include charging infrastructure as feasible in all new construction.

Recommendation B identifies seven County facilities that can support 63 Level II chargers for employee and public use within FY 2020-21 which would provide immediate charging infrastructure support to various locations around the region. DGS recommends proceeding with Level II charging installations, as they are more cost effective, attract more usage, and currently offer greater access by EV drivers. DGS considered the potential for placing DC fast chargers at county-owned property where fleet and public charging infrastructure is needed or feasible. Such installations at existing sites are currently constrained by cost (more electrical equipment is required) and capacity (more electrical power is required). Staff would continue to work across departments to determine additional locations that can support charging infrastructure and funding options as part of the completion of the site assessment study referenced below.

Next, Recommendation C would accelerate implementation of CAP Measure T-3.5 which would result in the preparation of a site assessment study and development of an EV Charger Installation Program by FY 2022-23 to determine priority locations for placement of charging infrastructure. Installation of all 2,040 chargers would be completed by FY 2027-28.

Preparing an EV charging site assessment as part of program development will identify areas of greatest projected charging demand and could help prioritize upcoming funding opportunities to encourage EV ownership and use in the unincorporated area. Areas of particular interest will include County-owned public sites (e.g. parks, airports, libraries, community centers), priority areas and communities of concern with lower income and higher exposure to air pollutants, popular commercial and public destinations, public right-of-way options, highly traveled corridors (east-west corridors and others lacking adequate charging infrastructure), multi-family homes, and workforce centers. Staff will also look for opportunities to build grid stability and resiliency in remote areas.

Public outreach and community engagement will continue to be an important component, as directed by CAP Measures T-3.3 and T-3.5, of program development. Staff will engage the community to educate and promote the economic and environments benefits of EVs through existing EV resources and programs, and CAP media outlets, and host and promote regional ride and drive events, and coordinate with communities on desirable and highly beneficial locations for charging infrastructure. Regional collaboration with agencies, industry, business, and environmental stakeholders will also encourage installation of charging infrastructure through engagement with a broader audience. Stakeholders that may qualify for grants will be identified and targeted outreach will occur to notify them of opportunities to apply for funding.

Staff will identify and monitor funding opportunities during this time and return to the Board as needed for funding required to complete the installation of all 2,040 chargers. Staff will monitor and evaluate the impact of California Energy Commission CALeVIP funding that will be brought to the region in mid-2020. This program is expected to fund 34-40 DC fast chargers and 150 Level II chargers. SANDAG and APCD are expected to collaborate in this effort and make annual contributions of $1M and $0.5M from 2020-2030, respectively, to fund Level II chargers. Staff will continue to coordinate across departments to position the County to receive grants from this rebate program. This rebate program will support the development of publicly available charging infrastructure to meet projected demand and those chargers installed in the unincorporated area will contribute to CAP Measure T-3.5 implementation.

If the Board directs action on these recommendations, the following implementing actions will occur:

Continue to:

- Coordinate with regional partners such as SANDAG, SDG&E, CalTrans, and other local jurisdictions to evaluate regional EV charging infrastructure gaps and opportunities for funding in the region.
- Participate in the CALeVIP and similar infrastructure grant programs and coordinate with Electrify America to identify locations for possible charger installations in the unincorporated area as part of their Cycle 2 rural investment.
- Educate the community on the economic and environmental benefits of EVs and promote available funding from infrastructure grant programs and EV incentives.

2021-2025:

- Lead an initiative with local agencies to streamline local EV Charger permitting process to provide certainty for infrastructure developers and reduce project timelines and costs.

- By 2022, prepare an EV charger site assessment for County facilities and the unincorporated area and return to the Board of Supervisors with implementation options. The site assessment shall be prepared using consultant resources and shall consider the following:
    - Highly travelled corridors, including east-west corridors and others lacking charging infrastructure;
    - Priority areas and communities of concern with lower income and higher exposure to air pollutants;
    - Popular commercial and public destinations;
    - Public right-of-way options; and
    - Workforce centers.

2026-2030:

- Keep pace with emerging technology and investigate cost effectiveness of transitioning program implementation to include:
    - Remote charging and battery storage (including the re-use of EV batteries) infrastructure to increase grid resiliency in disaster prone areas;
    - DC fast charger installations at County facilities for public use and to benefit priority populations; and
    - Public right-of-way installation applications, including charging stations on streetlights, with partner agencies.

To Move Forward with the Recommendations

The Board may provide direction on one or a combination of the following:

1. Recommendation A: Amend Board Policy G-15, "Design Standards for County Facilities" in the October 2019 sunset review to require all new County facilities to include charging infrastructure for public and employee use. The policy amendment will increase the availability of public charging infrastructure at County facilities.
2. Recommendation B: Fund the installation of 63 publicly accessible Level II chargers at seven County facilities for public and employee use. This recommendation would increase the number of public charging infrastructure at County facilities to 100 chargers by 2021 and contribute to meeting CAP Measure T-3.5 targets.
3. Recommendation C: Complete an EV charger site assessment study and develop the EV Charger Installation Program by FY 2022-23. Return to the Board for funding and install 2,040 Level II chargers by FY 2027-28. This recommendation would accelerate the installation of publicly accessible charging infrastructure at priority locations in the unincorporated area to meet the anticipated demand timeframe. Implementing actions include coordinating with regional partners to identify funding and infrastructure gaps to support vehicle electrification efforts and equitably distribute charging infrastructure across the region and developing an outreach plan to site charging infrastructure at multi-family residential and workplaces in the unincorporated area.

GOAL 3: PROMOTE AND INCENTIVIZE COUNTY EMPLOYEE EV OWNERSHIP

Background

Reducing the amount of vehicle miles traveled (VMT) by employees reduces GHG emissions associated with employee commute. CAP Measure T-2.3 requires a 20% reduction in County employee VMT by 2030, resulting in an estimated GHG emission reduction of 7,473 MTCO2e. The measure identifies potential implementation strategies including teleworking, encouraging carpool/vanpool, and using public transit. Increasing employee EV adoption through incentives will also contribute to those GHG emissions reductions.

Analysis and Recommendation

The County is the third largest employer in the San Diego region (after UCSD and Sharp Healthcare). Average County employee daily commute is 36 miles, amounting to 2.6 MTCO2e/employee/year. With over 17,500 employees in FY 2019-20, increased adoption of EVs will help the County reduce emissions and reach the CAP target.

This goal will expand the scope of CAP Measure T-2.3 to include promotional efforts, outreach and education to encourage EV ownership for County employees. The Recommendation associated with this goal will include exploring partnerships with banks and/or credit unions to offer special EV financing options and partnering with local dealerships to offer point of sale purchase rebates. The County currently offers the San Diego County Auto Buying Program on the employee discount program, called PerkSpot. Employees have access to deals on new and used vehicles, including EVs, from many major manufacturers. Average savings for new cars using employee pricing is $3,383 off the manufacturer's suggested retail price. Development of parking incentives, and hosting/promotion of work-place charging challenges and ride-and-drive events will also increase employee awareness and familiarity of EV technologies.

If the Board directs action on these recommendations, the following implementing actions will occur:

Continue to:

- Prepare outreach materials to advertise the benefits of driving an EV for personal and fleet use.
- Host workplace charging challenges and collaborate with regional partners to hold EV "ride and drive" events at County facilities.
- Coordinate with and leverage existing County partnerships to extend lending and pricing benefits.

2021-2025:

- Establish employee ownership incentive programs including lending and pricing benefits, parking. incentives, EV car share, and other similar strategies.
- Track and report on employee participation to determine GHG reductions.

To Move Forward with the Recommendation

This goal has one recommendation for Board consideration and further direction:

1. Promote and incentivize County employee EV use by developing partnerships with banks, credit unions, dealerships to extend lending and pricing benefits. This recommendation would include employee outreach, and test drive events to promote and incentivize County employee EV use.

GOAL 4: INCENTIVIZE AND/OR REQUIRE EV CHARGING INFRASTRUCTURE IN NEW AND EXISTING PRIVATE MULTI-FAMILY RESIDENTIAL AND/OR NON-RESIDENTIAL DEVELOPMENT

Background

Research indicates that most EV drivers charge vehicles at locations with longer dwell times, such as at home and at work. However, regional research demonstrates a charging infrastructure shortage in both multi-family and non-residential properties. This goal considers the economic benefits associated with including charging infrastructure at the time of construction versus retrofitting projects in order to increase charging station installations in the unincorporated area.

Projects are currently required to meet the existing CALGreen standard which requires the inclusion of "EV capable" parking spaces which results in conduit installation and does not include wiring or charging equipment at the time of development. This is currently a requirement of multi-family and non-residential properties in the state.

The code currently requires 3% of parking spaces in new, large multi-family (17 or more units) and 6% of parking spaces in all non-residential development be EV capable.[48] The County's code will be updated to reflect 2019 CALGreen to increase new multi-family requirements to 10% of parking spaces in all multi-family properties (three or more units) in 2020. In addition, the County's "Solar and EV Ready Ordinance" (effective 2015) requires newly constructed single-family dwelling units to have EV capable infrastructure for future charger installations.[49] CARB and City of Sacramento estimates that it costs $800-$900 to make parking spaces EV capable and an additional $300-$700 for EV ready. CARB research indicates that there is an approximate 30% conversion of EV capable parking space to charger installations in the State.

Factors that deter charging station installation include parking space limitations, difficulties in meeting minimum parking requirements when accessible charging infrastructure is installed, and the cost of charging equipment, which averages $7,500 for Level II chargers.

Analysis and Recommendation

This goal considers several options to encourage and/or require the installation of charging infrastructure in multi-family and commercial properties.

The Recommendation identifies opportunities to incentivize the installation of charging infrastructure through the following: parking space incentives that would count charging station parking as 2 or 3 spaces towards parking minimum requirements in feasible locations, inclusion of charging stations as a qualifier for the Green Building Incentive Program, and waiving charging station permitting fees. These options would be evaluated as part of a cost/benefit analysis which would include the consideration of impacts such as increased development costs, a loss of revenue to the County, and the potential to result in parking shortages.

[48] "EV Capable" refers to the installation of raceway and adequate electrical panel capacity to accommodate future installation of a dedicated branch circuit and charging station. Alternatively, "EV Ready" refers to installation of dedicated branch circuits, circuit breakers, and other electrical components, also referred to "make-ready" spaces.
[49] Although the Ordinance is described as "EV Ready," the requirements align with the definition of "EV Capable".

The consideration of parking space incentives for charging infrastructure development could be included within the existing work program required of CAP Measure T-2.4 which requires an update to the County's Zoning Ordinance by 2020 to require shared and reduced parking for all new non-residential development by 10% by 2030. This effort could include a parking incentive program evaluation as part of the parking study required by ordinance update. This recommendation would result in additional charging stations within new development and in major retrofits by incentivizing applicants to include charging stations where parking space is not constrained.

PDS has existing policies that encourage or require sustainable design in new development. The Green Building Incentive Program provides reduced plan check turnaround times and a 7.5% reduction in plan check and building permit fees for projects that incorporate natural resource, water, and/or energy conservation features. Including charging station installations as a qualifier for the benefits of the Green Building Incentive Program would incentivize charging station installation in new construction and retrofits to existing buildings. In addition, permit fee waivers can be implemented through the Homeowner and/or Businessowner Relief Acts to reduce project costs and encourage charger installations.

The Recommendation also considers the potential to require additional EV capable and/or EV ready spaces by adopting CALGreen voluntary measures to enforce additional requirements in new development. The County could also consider adopting a reach code that would require multi-family and/or non-residential to install charging infrastructure at the time of construction or major retrofits.

Increasing County Building Code requirements to include voluntary CALGreen requirements would result in additional conduit but would not result in additional charging infrastructure. A reach code would be warranted if the Board desires to see additional charging infrastructure included in new and major retrofits of multi-family and non-residential projects. Any reach code that goes beyond CALGreen standards (requiring higher amounts of EV capable spaces, EV charger installation requirements, and/or including major retrofits) would require a cost-effectiveness study and approval by the CEC.

To implement this recommendation, a cost/benefit analysis will be completed by FY 23/24 to determine the fiscal impact of offering charging station permitting and installation incentives and/or requirements. This analysis will determine a minimum threshold for the number of charging station installations for multi-family residential and non-residential development to qualify for Green Building Incentive Program benefits and also consider including solar PV to EV and/or battery storage qualifiers. In addition, the analysis will determine whether the potential fee waiver would be a permanent waiver as part of the Homeowner Relief Act and Business Relief Act (Administrative Code Section 362.1) or as a limited-time trial through an amendment to Administrative Code Section 362.1d. Finally, the analysis will determine how increased EV capable, EV ready, and or infrastructure installation requirements would affect the development process and impacts to overall project cost. The analysis would be brought to the Board for consideration and further direction.

If the Board directs action on these recommendations, the following implementing actions will occur:

Beginning in 2019:

- Evaluate parking and related EV charging stations requirements to implement shared parking facilities.
- Promote streamlined County EV charging station permit process to encourage development of charging infrastructure in the unincorporated area.

2021-2025:

- Evaluate options for Building Code amendments for multi-family and non-residential new development and major retrofits to:
    - Increase requirements for "EV capable" parking spaces (conduit and electrical panel capacity);
    - Require "EV ready" parking spaces (conduit, wiring, and electrical panel capacity); or
    - Require installation of EV charging stations.
- Develop options to incentivize multi-family and non-residential new development and major retrofits to install EV charging stations through:
    - Green Building Incentive Program;
    - Permit fee waiver; or
    - EV parking space incentives.

2026-2030:

- Keep pace with emerging technology and investigate the costs/benefits of incentivizing and/or requiring:
    - Alternate ZEV fueling station, such as hydrogen fueling;
    - Wireless charging applications; and
    - Vehicle-to-grid compatible systems.

To Move Forward with the Recommendation

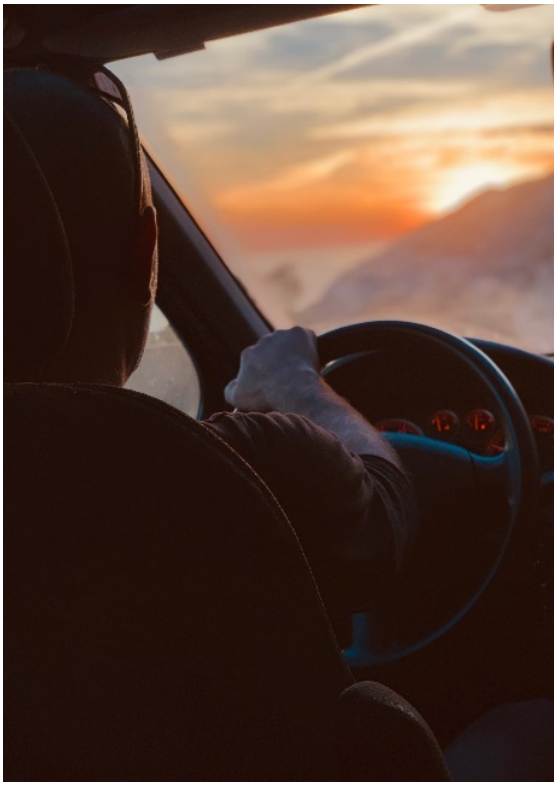
This goal has one recommendation for Board consideration and further direction:

1. Prepare a cost/benefit analysis of options to incentivize and/or require EV charger installations in new and/or retrofits of multi-family and non-residential development in the unincorporated area. Incentives could include amending the County's Green Building Incentive Program to include EV charging stations as a qualifier for expedited plan check and reduced building permit fees, a permit fee waiver, and reduced parking space requirements for projects that include EV charging station installations. Requirements to be considered could include adopting building code requirements that exceed the State's existing EV charging parking space requirements. This recommendation would increase the availability of chargers in private development throughout the unincorporated area.

GOAL 5: FUND EV EXPERT/CONSUMER ADVOCATE AS A REGIONAL RESOURCE

Background

Increasing awareness of the economic and environmental benefits of driving an EV and the process for installing charging infrastructure would increase EV ownership and charging station installations in the unincorporated area. Collaborating with regional partners in these efforts will contribute to vehicle electrification efforts throughout the region.



The County has existing supporting efforts through CAP Measure T-3.5 to:

- Provide education and marketing related to the purchase of EVs, available charging infrastructure, and existing EV resources and programs; and
- Collaborate with regional partners to encourage the installation of EV charging stations in new residential and non-residential development.

This recommendation would refine these supporting efforts to include regional collaboration to fund an "EV Expert" consumer advocate service to provide technical support, education, and outreach to increase EV use and charging station installations throughout the region.

Analysis and Recommendation

SANDAG has historically led regional efforts to increase awareness of EVs and charging infrastructure. Their Plug-in San Diego program included an "EV Expert" consumer advocate service which ran from 2016-2019. This no-cost service, administered by the Center for Sustainable Energy, provided general and technical support to residents, agencies, and businesses on EV-related topics including incentive availability, technology, and charger installation procedures. Providing a consolidated source of vehicle electrification information to the public will help to dispel misconceptions about EV performance, cost, and processes for installing EV charging infrastructure. Extending this service will help residents and businesses take advantage of existing incentives and the upcoming CALeVIP funding opportunity and will contribute to increasing EV ownership and use throughout the region.

If the Board directs action on these recommendations, the following implementing actions will occur:

Beginning in 2019:

- Convene local agency partners to determine cost-share agreement between agencies to cover the approximate $75,000 annual program administration cost.
- Procure a third-party entity to administer EV Expert/consumer advocate service to provide general and technical support to residents, agencies, and businesses on EV-related topics including incentive availability, technology, and charger installation procedures.

2021-2025:

- Evaluate EV Expert/Consumer Advocate effectiveness and identify opportunities to expand/modify the service to satisfy regional demand.

2026-2030:

- Expand EV expert advice capabilities to cover emerging ZEV technologies including such as hydrogen fuel cell technology.

To Move Forward with the Recommendation

This goal has one recommendation for Board consideration and further direction:

1. Identify regional partners and cost sharing opportunities to fund a regional "EV Expert/Consumer Advocate" that would provide no-cost consultations for residents, agencies, and businesses to learn more about available incentives, technologies, and charger installation procedures on an ongoing basis. This service would provide education and outreach of EV technology and increases awareness of the environmental and economic benefits of transportation electrification. A similar service was previously administered by SANDAG and is no longer being funded. This recommendation would extend this previously operated service through a regional cost-share program contracted through SANDAG with local and regional agencies.

GOAL 6: COLLABORATE WITH REGIONAL PARTNERS TO SUPPORT PUBLIC AND PRIVATE FLEET ELECTRIFICATION

Background

Electrification of large fleets, including light-, medium-, and heavy-duty vehicles provides an opportunity to significantly reduce business operation costs by reducing fuel and maintenance expenses as well as resulting in GHG reductions. Medium- and heavy-duty electrification offers significant GHG reduction potential (>80% reduction on a grid supplied by renewable energy) because most conventional models are currently fueled by diesel engines. It is expected that electric heavy-duty vehicle technologies could offer cost-effective opportunities for deep emissions reductions by 2030. In addition, battery improvements will continue to extend the range of medium- and heavy-duty fleet vehicles to expand the applicability of this technology beyond limited-range applications.

This goal would result in the County collaborating with State and local agencies, private businesses, and other regional partners to advocate for the electrification of large fleets within the region. The County could also opt to support grant applications to facilitate pilot projects to increase EV use in the region.

Analysis and Recommendation

SB 1403 (2018) requires CARB to create a three-year investment strategy for ZEV fleet vehicles and equipment. This legislation has spurred programs and regulations that establish bus, airport shuttle, and heavy-duty truck ZEV transition requirements for 2030 and beyond. These efforts are supported by state and regional actions that develop pilot programs for EV school and transit bus replacements, and fleet charging station development. Private fleets are also contributing to state and regional electrification efforts. Several delivery companies are piloting EV delivery vans and trucks. Transportation network companies are also committing to increasing the use of light-duty EVs in their fleets to reduce GHG emissions associated with ridesharing services.

This recommendation considers increasing regional collaboration to support fleet vehicle transition to EV to reduce GHG emissions from goods and people movement throughout the region. The Recommendation directs staff to coordinate with other agencies, stakeholders, and fleet operators to identify opportunities to electrify regional fleets. This will result in a decrease in regional GHG emissions related to the regional transportation network. Staff would look for opportunities to identify and support grant funding, identify sites to co-locate high power DC Fast charging equipment, identify opportunities to support the electrification of shared vehicle fleets which can be especially beneficial to communities of concern, and coordinate efforts to support state legislation and funding priorities related to electrification.

If the Board directs action on these recommendations, the following implementing actions will occur:

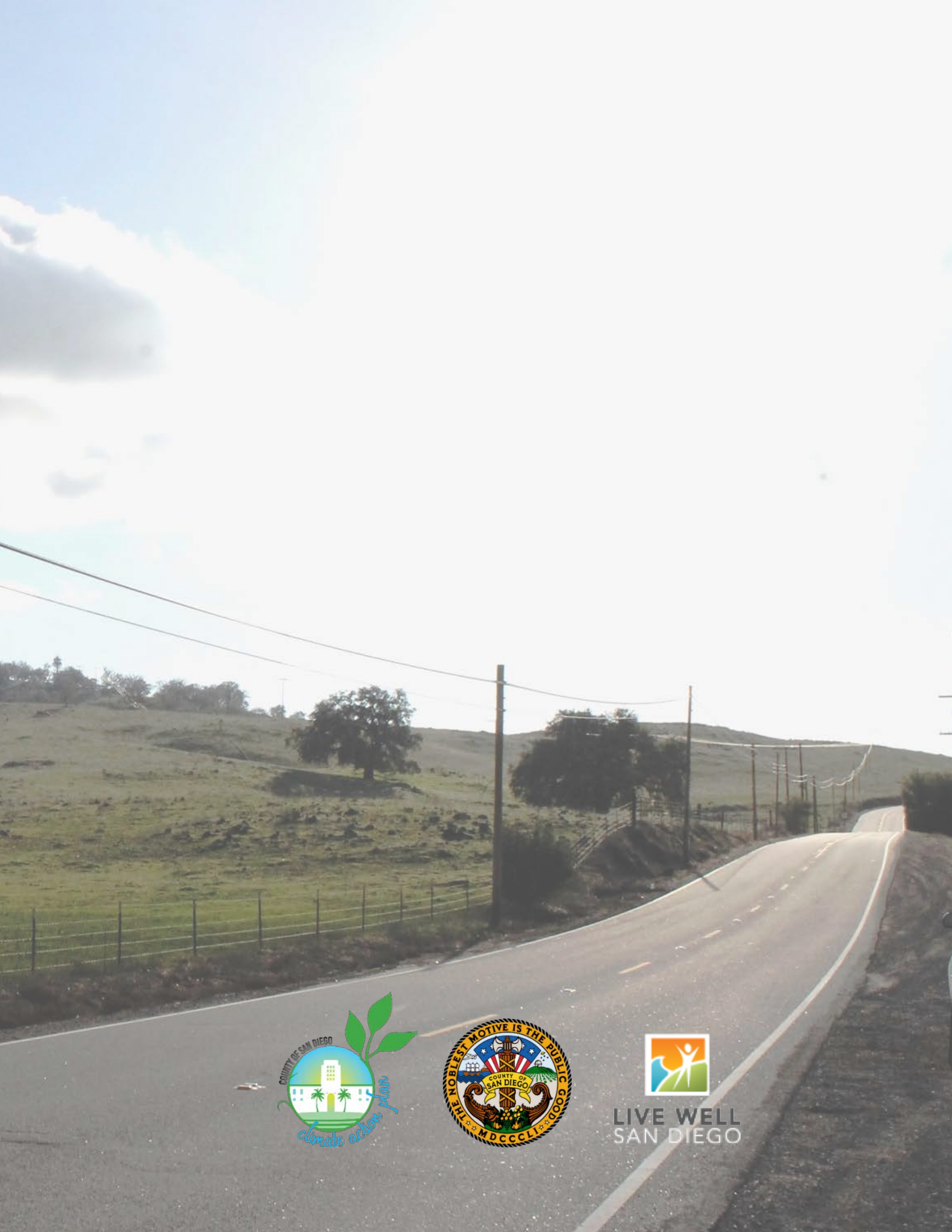
Continue to:

- Coordinate with regional partners such as SANDAG, SDG&E, and other local jurisdictions to:
    - Monitor existing pilot programs and identify future programs to electrify regional fleets including delivery service, school district, transportation network companies, and others to electric in the unincorporated area;
    - Evaluate fleet opportunities within the unincorporated county and conduct targeted outreach in collaboration with regional partners;
    - Evaluate charging infrastructure placement to ensure grid stability and resiliency; and
    - Identify gaps in EV adoption and consider ride share EV fleets to make this technology more accessible, especially to priority populations in the region.
    - Promote clean transportation innovations to demonstrate leadership and attract investment in future charging and vehicle technologies.

To Move Forward with the Recommendation

This goal has one recommendation for Board consideration and further direction:

1. Develop public and private regional partnerships to provide fleet electrification technical support to convert large regional fleets such as delivery services, rideshare, school districts, and transportation network companies to EV on an ongoing basis. This recommendation would reduce GHG emissions from regional transportation sources throughout the region. Examples of efforts include coordination around state funding, regional support for large fleet electrification, identification of regional charging infrastructure needs, and education and outreach to the regional business community.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EV ROADMAP APPENDICES

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APPENDICES

APPENDIX A: INCENTIVE PROGRAMS OVERVIEW

The following table describes existing and upcoming vehicle and charging infrastructure incentive programs that are available to public and private entities. Implementation of Roadmap goals will consider each of these to reduce project costs when feasible. Public outreach and education of available incentives will include reference to these programs when applicable.

Program	Administrator	Timeframe	Contribution	Description	Link
Vehicle Incentives					
Qualified Plug-in Electric Drive Motor Vehicle Credit	IRS	Based on vehicle sales (established in 2010)	Maximum credit of $7,500 per vehicle, phased out after meeting threshold	Pursuant to the Internal Revenue Code Section 30D, qualified hybrid and electric passenger vehicles and light trucks acquired after 12/31/2009 can receive a tax credit up to $7,500. Full credit applies to the first 200,000 qualifying vehicles sold by a manufacturer, then phases out in two steps during the calendar year.	https://www.irs.gov/forms-pubs/about-form-8936
Clean Vehicle Rebate Project (CVRP)	CSE (for CARB)	Ongoing (established in 2009)	Varies by vehicle model. Maximum rebate possible is $7,000.	Standard rebate rates are $5,000 for hydrogen fuel cell vehicles, $2,500 for battery electric vehicles, $1,500 for plug-in hybrids, and $900 for zero emission motorcycles. Low-income households with incomes less than 30% the federal poverty level are eligible to receive an additional $2,000; for instance, a low-income household can receive a rebate up to $7,000 for the purchase or lease of a new hydrogen fuel cell vehicle and $4,500 for an EV. CVRP also provides rebates up to $5,000 for public agencies to purchase or lease eligible EVs, BEVs, fuel cell vehicles, PHEVs, and zero emission motorcycles for their fleets. Jurisdictions in disadvantaged communities may receive an additional $2,000. Agencies are eligible for up to 30 rebates annually, subject to demand.	https://cleanvehiclerebate.org/eng
State of California Green Fleet Employee Pricing Program	CA Department of General Services	Ongoing	Discounts vary ($100-500) by vehicle and dealership	State and local government employees can receive cash discounts or rebates for select vehicles at participating dealerships throughout the state. Vehicles are for personal use. (Note: the closest participating dealerships to San Diego are in Covina).	https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/State-of-California-Green-Fleet-Employee-Pricing-Program

Program	Administrator	Timeframe	Contribution	Description	Link
Champions for Clean Air	SDG&E	Ongoing	$1,000	Offers point-of-sale rebate for teachers and first responders to purchase or lease a new electric or plug-in hybrid vehicle.	https://www.sdge.com/residential/electric-vehicles/champions-clean-air-ev-rebate
EV Time of Use Pricing Plans	SDG&E	Ongoing	Pricing varies by plan	Customers who own EVs or PHEVs can choose from three different pricing plans that allow them to pay reduced rates per kWh by charging during off-peak hours.	https://www.sdge.com/residential/pricing-plans/about-our-pricing-plans/electric-vehicle-plans
Hybrid and Zero-Emission Truck and Bus Voucher Project (HVIP)	CALSTART (for CARB)	Ongoing (established in 2009)	Varies by vehicle; vouchers for new hybrid vehicles limited to half the incremental cost	Funded by California Climate Investments (Cap-and-Trade), this program offers point-of-sale incentives to purchase clean trucks and buses through approved vendors. Vouchers typically cover about half of the difference in cost between a conventional truck or bus and their hybrid or zero emission equivalent. Hydrogen fuel cell trucks and buses can receive a $300,000 voucher. As of June 2019, large voucher requests (100+ vouchers for the same fleet in a one-year period) are subject to CARB review and approval.	https://www.californiahvip.org/
Clean Off-Road Equipment (CORE) Voucher Incentive Project	CALSTART (for CARB)	Ongoing (established 2019)	Varies by vehicle	Program is analogous to HVIP but applies to equipment including on- and off-road terminal tractors, forklifts, airport cargo loaders, railcar movers, etc.	https://ww2.arb.ca.gov/our-work/programs/clean-off-road-equipment-voucher-incentive-project
School Bus Replacement Program	CEC	Ongoing (established 2018)	Varies by project	Funding split into $18.75 million to four regions in the state with focus on disadvantaged/low-income communities. South included Orange, Riverside, San Diego, and Imperial Counties. Program includes school bus replacement (diesel to battery electric or CNG) for public school districts and county offices of education. Also includes fueling infrastructure to support the buses (up to $60,000 per electric bus), and workforce training to support EV bus maintenance. Three San Diego school districts received funding in 2019: La Mesa-Spring Valley ($3.54M), Escondido Union High School District ($794,940), and Cajon Valley ($390,109).	https://www.energy.ca.gov/programs-and-topics/programs/school-bus-replacement-program
Clean Air for All	SDAPCD (for CARB)	Ongoing	Varies by project	Grant program has a total of $28.5 million for Carl Moyer, FARMER, and AB 617 programs. Provides funding for vehicle replacement, repower, and conversion of school buses, heavy duty diesel trucks/buses, transit vehicles, drayage trucks, solid waste collection vehicles, public agency utility vehicles, and emergency	https://www.sandiegocounty.gov/content/sdc/apcd/en/grants-and-incentives/carl-moyer-program.html

Program	Administrator	Timeframe	Contribution	Description	Link
				vehicles. Not specifically designed to replace with electric but they do qualify for funds.	
Carl Moyer On-Road Voucher Incentive Program	SDAPCD (for CARB)	Ongoing	Varies by project. Maximum incentive is $60,000	Funding for fleet owners with 10 or fewer vehicles to replace their older heavy-duty diesel or alternative fuel vehicles with new or used vehicles MY 2013 or newer. Not specifically to replace with electric but they do qualify for funds.	https://ww3.arb.ca.gov/msprog/moyer/voucher/voucher.htm?bay
Volkswagen Mitigation Trust (Heavy-Duty)	CARB	Varies by funding category	$130 million for ZE transit, school, and shuttle buses; $90 million for ZE Class 8 freight and port drayage trucks; $70 million for ZE freight and marine projects.	A total of $422.6 million dollars will be allocated to projects that promote ZEV technology in the state. There are three heavy-duty funding categories: zero-emission transit, school, and shuttle buses; zero-emission Class 8 freight and port drayage trucks; and zero-emission freight and marine projects. All categories are open to private and public entities. Funding can cover 100% of the costs for government-owned vehicles and 75% for non-government owned vehicles.	https://www.vwenvironmentalmitigationtrust.com/
Charging Station Infrastructure Incentives					
Airport ZEV and Infrastructure Pilot Program	FAA	Ongoing (established in 2012)	50% of project cost	The pilot program provides grant funding to airports to acquire ZEVs for airport fleets and install supportive infrastructure.	https://www.faa.gov/airports/environmental/zero_emissions_vehicles/
Low Carbon Fuel Standard	CARB	Ongoing (established in 2009)	N/A; credits are used to offer rebates and other benefits.	LCFS credit given to eligible hydrogen fueling station or DCFC station developers.	https://ww3.arb.ca.gov/fuels/lcfs/lcfs.htm\
Alternative and Renewable Fuel and Vehicle Technology Program	CEC	1/1/2008 – 1/1/2024	Up to $100,000 per year	Established by AB 118, ARFVT investments promote advanced transportation and fuel technologies through projects that expand fuel infrastructure, develop or produce alternative fuels in California, and establish educational programs. At least $20 million per year shall be allocated to hydrogen refueling infrastructure until the state goal of 100 stations is met.	https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program
California Capital Access Program (CalCAP) EVCS Financing Program	CPCFA (for CEC)	Ongoing (established in 2017)	Loans up to $500,000	Provides rebates to small businesses with less than 1,000 employees and owners of multi-unit dwellings to install EVCS. The program provides loans up to $500,000 for the installation of Level II and DCFC stations.	https://www.treasurer.ca.gov/cpcfa/calcap/evcs/index.asp

Program	Administrator	Timeframe	Contribution	Description	Link
Property Assessed Clean Energy (PACE) Loss Reserve Program	CPCFA (for CEC)	Ongoing (established in 2017)	Loans up to $500,000	The PACE Loss Reserve Program administered by the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) works with partners and lenders to support PACE financing for energy or water efficiency and clean energy home improvements. Property owners in a PACE-designated area can use PACE financing to retrofit their homes without putting any money down and repay via property tax bills.	https://www.treasurer.ca.gov/caeatfa/pace/index.asp
California EV Infrastructure Project (CALeVIP)	CSE (for CEC)	New project area selected every year (established in 2017)	Project funding varies	CALeVIP was established in 2017 to design and implement EVCS incentive and installation projects in regions prioritized based on the gaps in a region's charging needs. Projects install Level II and DCFC. CEC provides expert program implementation and administration at a reduced cost. Project funding varies by project; the first project was in Fresno County in 2017 and was funded for $4 million, while Sacramento County received $14 million in 2019.	https://calevip.org/
Volkswagen Mitigation Trust (Light-Duty)	San Joaquin Valley, South Coast, and Bay Area Air Quality Management Districts (for CARB)	Varies by funding category. ZEV infrastructure funding will be distributed through one solicitation period starting in CY 2019 Q3/Q4	$5 million for EV infrastructure; $5 million for hydrogen fuel cell infrastructure	A total of $422.6 million will be allocated to projects that promote ZEV technology in the state. In the light-duty ZEV infrastructure category, $10 million is to be split between hydrogen fueling stations and EVCS. For EVCS, funding can be applied for up to 100% of the cost of public stations on public property, up to 80% for public stations on private property, and up to 60% for non-public stations at workplaces and multi-unit dwellings.	https://www.vwenvironmentalmitigationtrust.com/
Electrify America	Electrify America (for CARB)	Cycle 2: July 2019 – December 2021	Private Investment, $153 million – Not available for public use	Electrify America is a for-profit entity conducting private investments. Volkswagen Group of America will invest a total of $800 million from 2017-27 in California for ZEV infrastructure, access, and education. This funding cycle commits a majority of funds ($95-115 million) towards DCFC in metro areas (including San Diego). it is estimated that 7-10 DCFC EVCS will be installed in the San Diego region, however this amount could be less if SDG&E does not create new rates for EVCS. Approximately $2 million will go towards Level II chargers in rural areas.	https://www.electrifyamerica.com/
Clean Mobility for Disadvantaged Communities	CALSTART, Shared-Use Mobility Center, GRID Alternatives, Local	2-year pilot project initiated in April 2019	$17 million for pilot	This pilot program will create new opportunities for zero-emission car-sharing and ridesharing, bike-sharing, and innovative public transit services like demand-responsive transit and mobility service partnerships in disadvantaged communities statewide. The program aims to help communities start their own smaller scale	https://calstart.org/carb-mobility-release-announcement-english/

Program	Administrator	Timeframe	Contribution	Description	Link
	Government Commission (for CARB)			clean mobility programs by providing financial support and helping to coordinate partnerships and additional outside investment. The program will focus on "first and last-mile connector trips" and will set up a voucher program for buying or leasing clean vehicles, electric bicycles, scooters and other equipment, and by funding the infrastructure — charging stations, bike and scooter racks, for example — needed for these projects. As part of its outreach efforts to communities, CALSTART will hold workshops throughout the state, helping communities that have faced barriers to funding.	
Medium and Heavy-Duty EV Charging Infrastructure Program	SDG&E	Approved August 2019. Pilot will last for 5 years	$107.4 million	The pilot program aims to facilitate transportation electrification of the medium and heavy-duty (MD/HD). The MD/HD program will install, maintain and own charging infrastructure to support approximately 3,100 Class 2-8 vehicles used by businesses, freight movement, and similar operations.	https://www.sdge.com/electrification-projects
Parks Pilot (proposal in review, subject to CPUC approval)	SDG&E	CPUC decision expected CY 2019 Q2. If approved, pilot last for two years	$9.88 million	Pursuant to AB 1083, utilities can file applications for pilot programs to install EVCS at state parks and beaches, with priority given to those located in DACs. SDG&E's proposal requests $9.88 million to install 74 EVCS at 12 state parks and beaches and 66 EVCS at 10 city and county parks. SDG&E acknowledges that its proposal goes outside the bounds of what is authorized by AB 1083.	https://www.sdge.com/electrification-projects
Regional EV Charging Incentive Program (in development)	SANDAG, SD APCD, CSE (for CEC)	Expected start date July 2020	To be determined	To carry out measures in the 2015 RTP and the County of San Diego CAP, SANDAG and APCD are collaborating with CALeVIP (CEC and CSE) to create a joint incentive program for EV charging for San Diego. The program aims to leverage $10-23 million in CALeVIP funds in addition to SANDAG ($30 million) and APCD ($5 million) contributions. The program is in its initial stages of development but SANDAG intends to launch in mid-2020.	TBD
Schools Pilot (proposal in review, subject to CPUC approval)	SDG&E	CPUC decision expected CY 2019 Q2. If approved, pilot last for two years	$9.9 million	Pursuant to AB 1082, utilities can file applications for pilot programs to install EVCS at schools and educational facilities. SDG&E proposes to install 196 EVCS – 184 L2 and 12 DCFC – at 30 sites. Chargers can be for students, staff, and/or the general public. 25% will be located in DACs.	https://www.sdge.com/electrification-projects
Tesla Workplace Charging Program	Tesla	Ongoing (established in 2018)	Varies; covers cost of charging equipment	Tesla will install Level II Tesla Wall Connectors at workplaces free of cost for qualifying businesses with an online application. Chargers are for employee use only. The company does not pay for associated permitting, construction, labor, or energy costs.	https://www.tesla.com/charging-partners#apply

Program	Administrator	Timeframe	Contribution	Description	Link
Vehicle-to-Grid Electric School Bus Pilot	SDG&E	Approved August 2019. Pilot will last for one year	$2.1 million	The V2G pilot will use 10 EV school buses at one location as a distributed energy resource for grid services to combat the "duck curve" of electricity demand. SDG&E will give preference to locating the pilot within a DAC and will contribute $450,000 to the school district to fund the purchase of the school buses. It will also provide up to $100,000 to pay for electricity used during the one-year pilot.	https://www.sdge.com/electrification-projects
Expired Programs					
CPUC/NRG Energy Settlement	EVgo (for NRG)	Agreement obligations for EV upgrades, and DCFC plazas have been met as of CY 2019 Q1	$102.5 million	A 2012 settlement related to the California energy crisis required project funding for public DCFC, electrical "make-ready" upgrades and public charging plazas ("Freedom Stations"), research and development, and programs to increase EV access for under-served communities. Of the 200 Freedom Stations required, 20 were required in San Diego County (construction of all but one project was complete as of March 2019).	https://www.cpuc.ca.gov/General.aspx?id=5936
Dealership Incentives Pilot	SDG&E	September 2018 -September 2019	$250 for dealership and $250 for salesperson who sells or completes a lease of an EV	In the program approved by CPUC January 2018, SDG&E trains car dealerships and provides incentives to them if customers purchase an EV and sign up for SDG&E EV programs. Training covers benefits of driving EV, how to promote EVs during the sales process, and how to sign up drivers for SDG&E time-of-use rate programs.	https://www.sdge.com/ev-incentives
EV Climate Credit	SDG&E	2019 is the final year	Varies; $850 in 2019	Offers annual credits to drivers of EVs or PHEVs as part of the Low Carbon Fuel Standard regulations. In 2019 a $850 credit was given to over 21,000 SDG&E customers.	https://webarchive.sdge.com/clean-energy/electric-vehicles/electric-vehicle-climate-credit
Power Your Drive	SDG&E	Program is fully subscribed	$235/charger at multifamily residential; $630/charger at businesses	The pilot program installs, operates, and maintains EVCS for private use at multifamily and work sites. Project participants only pay a one-time payment of $235/EVCS for MUDs and $630/EVCS for businesses, plus the costs of electricity. For projects in low-income communities, there is no cost for the installation, equipment, or ongoing maintenance and operations. This program is fully subscribed and is installation of 3,500 EVCS is currently underway.	https://webarchive.sdge.com/clean-energy/electric-vehicles/poweryourdrive

APPENDIX B: SUMMARY OF CALIFORNIA EV RELATED LEGISLATION

This table lists relevant State of California greenhouse gas emissions reduction and vehicle electrification legislation.

Bill	Year	Description
AB 32	2006	Established the state's GHG emissions target to 1990 levels by 2020. One requirement was the CARB Scoping Plan, which includes reduction measures in all sectors including cars, trucks, and fuels.
AB 118	2007	Established the Air Quality Improvement Program, which encompasses a variety of programs that support alternative fuel technology and vehicles.
AB 8	2013	Made changes to the ARFVT Program to include funding for the development of hydrogen refueling infrastructure (HRI) to support the fuel cell market.
SB 454	2013	Created the Electric Vehicle Charging Stations Open Access Act, which ensures that all drivers can access public charging stations regardless of membership status.
SB 350	2015	Established the state's GHG emissions target of 40% below 1990 levels by 2030. As part of the requirements to increase renewable electricity procurement goals, large publicly owned utilities are required to develop Integrated Resource Plans (IRPs) that must include transportation electrification activities. Required that CARB study barriers to EV adoption experienced by low-income and disadvantaged communities and to present solutions to those barriers.
AB 2565	2014	Property owners cannot unreasonably deny a lessee or resident's written request to install an EV charging station at their allotted parking space for any lease executed, renewed, or extended on or after July 1, 2015. Properties with fewer than 5 parking spaces and those subject to rent control are exempt from the requirements. Regulations were modified by AB 1796, which removed the exemption for a dwelling subject to residential rent control.
AB 1236	2015	Requires a city, county, or city and county with a population greater than 200,000 residents to adopt a local ordinance for streamlined electric vehicle charging station permitting by September 30, 2016. Every city, county, or city and county with fewer than 200,000 residents must do so by September 30, 2017. The bill also states that ordinances could refer to a specified guidebook.
SB 32	2016	Expands upon CA Global Warming Solutions Act of 2006 to require a 40% reduction in GHG emissions below 1990 levels by 2030.
AB 109 & AB 134	2017	The two budget bills allocated $1.5 billion in cap-and-trade funds for the advancement of ZEV technology.
SB 110	2017	Appropriated $75 million for CEC to distribute to school districts, county offices of education, and transportation JPAs to replace old diesel school buses with battery electric ones. Priority is given to disadvantaged and low-income communities.
AB 1082	2017	Allows an electrical corporation to file with CPUC for a pilot program for the installation of EVCS at schools and educational institutions. Institutions in disadvantaged communities (DACs) shall be prioritized.

Bill	Year	Description
AB 1083	2017	Allows an electrical corporation to file with CPUC a pilot program for the installation of EVCS at state parks and beaches within its service territory. Beaches and parks in DACs shall be prioritized.
AB 1452	2017	Authorizes local authorities to designate stalls or spaces on a public street for exclusive use of charging and parking an EV connected to charging equipment. It also authorizes local authorities to designate EV charging/parking spaces in an off-street parking facility that it owns and operates. Vehicles can be towed from these spaces if they have completed charging or are not EVs.
AB 193	2018	Requires that CARB provide rebates for the replacement of batteries, fuel cells, or other components for eligible used ZEVs until July 31, 2025
SB 957	2018	Authorizes the DMV to issue HOV identifiers for vehicles whose identifiers expired on January 1, 2019. Identifier can be issued to qualifying low- and zero-emission vehicles to extend their validity until January 1, 2024.
SB 1000	2018	Prohibits cities and counties from restricting types of EVs that can access EVCS that are publicly accessible and were funded by public money. Also requires CPUC to consider facilitating policies that promote grid integration.
SB 1014	2018	Requires CARB and CPUC to set emissions standards and reduction goals for transportation network companies such as Uber and Lyft.
SB 1403	2018	Requires CARB to make a three-year investment strategy for zero- and near-zero emission heavy duty vehicles and equipment.
AB 2885	2018	Requires that the CEC prepare a statewide assessment of EV charging infrastructure to be updated biennially.

APPENDIX C: LITERATURE REVIEW

The table below lists literature that demonstrates vehicle electrification strategies, best practices, and research. Although this list is not comprehensive of all literature reviewed during Roadmap development, these sources cite recent and relevant examples of vehicle electrification strategies that are applicable to the County's operations and jurisdiction in the unincorporated area.

#	Title	Date	Type	Author	Source	Summary	Link
Municipal EV Roadmap/Plans & Ordinance Development							
1	City of Carlsbad Electric Vehicle Ordinance Cost Analysis	2018	Report	Center for Sustainable Energy; TRC Solutions	City of Carlsbad	This reach code cost effectiveness report found that the proposed EV parking reach code ordinances will reduce costs for EV upgrades associated with major alterations in comparison to no EV ordinance (following CALGreen), assuming that EV retrofits would need to take place eventually in order to meet California's greenhouse gas emissions goals. Avoided retrofit costs ranged from 8-46% of total installation cost, depending on the building type and defined EV parking scenarios.	http://www.carlsbadca.gov/civicax/filebank/blobdload.aspx?BlobID=37502
2	LACI Zero Emissions Roadmap	2018	Report	Los Angeles Clean Tech Incubator	City of Los Angeles	Report outlines a strategy for achieving accelerated GHG emissions reductions through transportation electrification strategies by the 2028 Olympic and Paralympic Games. These strategies are to be achieved through the Transportation Electrification Partnership that includes state, municipal, utility, and private industry partners that will identify pilot projects to begin implementation and establish key milestones for Roadmap 2.0 to be published in September 2019.	https://roadmap.laci.org/wp-content/uploads/2019/02/LACI-ROADMAP-V7-FINAL-HI-FI-1-020819.T6J-2.pdf
3	A Roadmap for Vehicle Electrification in New Jersey: Market Development Strategy and High Impact Initiatives	2017	Report	Charge EVC	State of New Jersey	Report outlines several policy actions that increase the use of EVs in the State of New Jersey including: setting goals for EVs and charging infrastructure, eliminating range anxiety, addressing affordability gaps, ensuring widespread "right to charge" for routine charging, equitable access to vehicle electrification, long term funding opportunities for the Transportation Trust fund, building consumer awareness, and implementing supportive market development efforts.	http://www.chargevc.org/wp-content/uploads/2017/09/ChargEVC_Roadmap.pdf
4	Plug-In Electric Vehicle Infrastructure Cost-Effectiveness Report for San Francisco	2016	Report	Energy Solutions: Kamei, Evan Pike, Ed Steuben, Jeffrey	PG&E	Report finds that installing PEV charging infrastructure for multi-family and non-residential buildings during initial construction is more cost effective than retrofitting existing buildings. Based on modeling of two scenarios, it would cost about $860-920 per space to install electric circuits during initial construction, while it would cost $2,370-$3,710 per space to retrofit. All costs are higher during retrofit, with a majority going towards balance of circuit and building	http://evchargingpros.com/wp-content/uploads/2017/04/City-of-SF-PEV-Infrastructure-Cost-Effectiveness-Report-2016.pdf

#	Title	Date	Type	Author	Source	Summary	Link
						the conduit/raceway (permitting and construction management costs are also higher). Report argues that changing building codes to require EV infrastructure with new construction or major alteration (reach code) will benefit landlords and tenants, as installation would be much cheaper and easier than the previous San Francisco rule that tenants can install their own EV charging equipment at their own expense.	
5	2017 City of Portland Electric Vehicle Strategy	2016	Plan	City of Portland	City of Portland	Portland's CAP required an update to the existing EV strategy. 2020 goals include replacing at least 10,000 fossil fuel vehicles with EVs in Multnomah County, adding 60 EVs to the City fleet, and doubling the number of publicly accessible Level II and DC fast chargers. The strategy includes nearly 50 actions to achieve 2020 goals in the categories of charging infrastructure; fleets; personal vehicles and shared mobility; innovation and information; and economic development.	https://www.portlandoregon.gov/bps/article/619275
Regional Planning							
6	Draft Summary Report on Existing EV Charger Incentive Programs in the United States	2018	Report	ICF International	SANDAG	The report summarizes government-funded incentive programs and select California utility programs that are available for the installation of EVCS. It summarizes the type of incentive, program administration, eligible charging technologies, participation requirements, allocation of funds, performance metrics, stakeholder outreach, and state/federal involvement. Examples of California programs analyzed include Los Angeles Department of Water and Power Rebates, CEC CALeVIP for Southern California Rebate, and SDG&E's Power Your Drive Program. It also reviews other state programs including Colorado's grant program, Washington DC's tax credit, and New Jersey's grant program.	https://www.sandag.org/uploads/projectid/projectid_560_24783.pdf
7	Summary Review of Policies to Guide Program Development	2018	Report	ICF International	SANDAG	This report summarizes federal, state, regional, and local policies that guide the development of SANDAG's Regional EV Charging Infrastructure Program. The only significant federal policies are the federal tax credit and fuel economy/tailpipe emission standards; it concludes that the tax credit will likely remain as federal policy, but Trump and the EPA Administration under him have indicated their intent to revoke California's ability to implement its own GHG emission reduction standards. The report also summarizes California policies such as the ZEV program and local policies (mostly Climate Action Plan measures). Based on the review of policies, considerations for SANDAG's program development include:	https://www.sandag.org/uploads/projectid/projectid_560_25091.pdf

#	Title	Date	Type	Author	Source	Summary	Link
						Recognize EV charging infrastructure as a critical asset; Incorporate equity into program design; Maintain a neutral approach to EV technology; Coordinate with other policies; and Maximize revenue from the Low Carbon Fuel Standard Program.	
8	Incentives Analysis Report and EVCS Funding Opportunities	2018	Report	Center for Sustainable Energy	SANDAG	These appendices to the "Plug-in San Diego Electric Vehicle Infrastructure Needs Assessment Methodology Report" include regional EVCS installation and permitting costs, a review of incentive programs, EV charging market sectors, estimated charging demand for 2025 in San Diego county by sector, current funding opportunities, and funding gaps with future funding opportunities.	https://www.sandag.org/uploads/projectid/projectid_511_25370.pdf
9	Electric Vehicle Charging Station Permitting and Inspection Best Practices	2016	Report	Center for Sustainable Energy	Plug-in SD/SANDAG	This report offers recommendations to streamline the permit review, issuance and inspection process so that local jurisdictions can reduce the time it takes to determine proper permit requirements, obtain an EVCS permit and complete the inspections. Key best practices include: Clear website information; Provision of an EVCS application guide; Fillable EVCS applications that can be submitted online or in person; Permit fee incentives; Pre-made plan and inspection correction lists; and Online permitting and inspections.	https://energycenter.org/sites/default/files/docs/nav/transportation/plug-in_sd/Plug-in%20SD%20Permitting%20and%20Inspection%20Report.pdf
10	San Diego Regional Alternative Fuel Readiness Plan	2016	Plan	Center for Sustainable Energy; SANDAG	SANDAG	Some barriers identified include but are not limited to lack of training for municipal staff; high demand charges; procuring and financing AFVs; and lack of consumer familiarity with AFV technology. Recommendations: 1. Continue to emphasize alternative fuels as a key strategy in the region's GHG reduction efforts. 2. Continue to align alt. fuel policies across all local agencies. 3. Seek new funding sources for alt. fuel and infrastructure deployment. 4. Enhance education and outreach efforts. 5. Accelerate market growth through workforce development, training, and local entrepreneurship.	https://www.sandag.org/uploads/projectid/projectid_487_20274.pdf

#	Title	Date	Type	Author	Source	Summary	Link
11	Refuel Report: Alternative Fuels for Public Agencies	2016	Toolkit	SANDAG	SANDAG	Toolkit provides guidance, case studies, and fact sheets that public agencies can use for training and assistance in the transition into AFVs. Includes information about biodiesel, E85 (flex-fuel), natural gas, and propane autogas. EVs: considerations for assessing location of EVCS (availability of power, constructability, environmental protection, accessibility, dwell time, demand); costs of installation; permitting best practices; codes and standards (CALGreen, ordinances); policies and laws. Hydrogen fuel cells: installation of fuel stations; costs; permitting process; construction and setbacks; codes and standards.	https://www.sandag.org/uploads/projectid/projectid_487_19926.pdf
12	Regional Energy Strategy for the San Diego Region	2014	Report	SANDAG	SANDAG	This version of the Regional Energy Strategy (RES) is a technical update to the RES adopted in 2009. It summarizes progress made towards each goal since 2009, relevant data and monitoring methods, and recommendations for continued progress. The RES goal topic areas are: Energy Efficiency and Conservation; Renewable Energy; Distributed Generation; Energy and Water; Peak Demand; Smart Energy; Natural Gas Power Plants; Transportation Fuels; Land Use and Transportation Planning; Border Energy; and Clean Energy Economy.	https://www.sandag.org/uploads/projectid/projectid_374_18168.pdf
13	San Diego Regional Plug-in Electric Vehicle (PEV) Readiness Plan	2014	Plan	Center for Sustainable Energy	SANDAG	The Plan provides background and analysis of the San Diego plug-in electric vehicle (PEV) market and assesses areas where local governments, workplaces and residents can adopt and prepare for PEVs and charging infrastructure in the region. Key recommendations to address regional barriers to EV supply equipment (EVSE) are regional planning for public EVSE, addressing permitting issues, and utility solutions. The Plan concludes that publicly available Level II chargers and a network of 290 strategically located DC fast chargers would enable 98% of drivers to adopt battery electric vehicles (BEV).	https://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-diego/San_Diego_PEV_Readiness_Planning_Guide-2013_low-resolution.pdf
State Guidance Documents							
14	Electric Vehicle Charging Station Permitting Guidebook	2019	Report	Governor's Office of Business and Economic Development (GO-Biz)	Governor's Office of Business and Economic Development (GO-Biz)	Provides guidance on how local planning efforts can incorporate EV charging in binding and non-binding ways through planning tools such as general plans, improvement plans, climate action plans, design guidelines, and zoning codes. ZEV readiness plans can be prepared to encompass all actions/strategies to achieve state and local ZEV goals and involve stakeholders. The guide provides context, requirements, and recommendations and best practices for local governments in planning, permitting, accessibility, and grid connection.	http://businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf

#	Title	Date	Type	Author	Source	Summary	Link
15	Demonstrating Plug-in Electric Vehicles Smart Charging and Storage Supporting the Grid	2018	Report	UCLA Smart Grid Energy Research Center	California Energy Commission	Report outlines emerging vehicle-to-grid and vehicle-to-building technology that help utilities resolve issues of reliability and stability and is the final report for the Demonstration of PEV Smart Charging and Storage Supporting Grid Objectives project that developed and deployed smart charging, vehicle-to-grid, vehicle-to-building, demand response, and power quality hardware and software to demonstrate bi-directional EV infrastructure, air quality enhancement, and financial benefits from these systems.	https://www.energy.ca.gov/2018publications/CEC-500-2018-020/CEC-500-2018-020.pdf
16	California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025	2018	Report	California Energy Commission	California Energy Commission	The report presents a solution to the infrastructure needs in the scenario that the state's 2025 ZEV goals are met. Based on analysis at a county level, the results show a need for 99,000-133,000 chargers at workplaces and public locations and 9,000-25,000 fast chargers. The state will need a total of 229,000-279,000 EV chargers to support 1.3 million PEVs. It also shows that more charging stations are needed in multifamily dwellings, which are expected to host about 121,000 PEVs by 2025 (chargers in single-family homes were not accounted for in the study).	https://www.nrel.gov/docs/fy18osti/70893.pdf
17	2018 ZEV Action Plan Priorities Update	2018	Plan	Governor's Interagency Working Group on Zero-Emission Vehicles	Office of Governor Edmund G. Brown	The 2018 ZEV Priorities Update serves as an addendum to the 2016 Plan in response to Governor Brown's Executive Order B-48-18. B-48-18 set targets for 200 hydrogen fuel stations and 250,000 EVCS to support 1.5 million ZEVs by 2025 and 5 million by 2030. This Priorities Update focuses on 39 actions serving three overall purposes: Provide direction to state agencies on the most important actions to be executed in 2018; Give stakeholders transparency; and Creating a platform for stakeholder engagement.	http://business.ca.gov/Portals/0/ZEV/2018-ZEV-Action-Plan-Priorities-Update.pdf

#	Title	Date	Type	Author	Source	Summary	Link
18	Beneficiary Mitigation Plan for the Volkswagen Environmental Mitigation Trust	2018	Plan	California Air Resources Board	California Air Resources Board	The Beneficiary Mitigation Plan (Plan) contains eligible mitigation actions that CARB will fund from California's $423 million portion of the Volkswagen (VW) Environmental Mitigation Trust. CARB implements incentives in two ways: 1) makes investment decisions consistent with direction from the Legislature (e.g. Low Carbon Transportation Program, VW Mitigation Trust); 2) CARB establishes guidelines but investments are made by local APCDs or AQMDs (e.g. Carl Moyer, AB 617). Funding categories and allocations are as follows: ZE Transit, school, and shuttle buses ($130M); ZE Class 8 Freight and Port Drayage Trucks ($90M); ZE Freight and Marine ($70M); Combustion Freight and Marine ($60M); Light duty ZEV infrastructure ($10M); $63M for administrative costs and reserve. the $10M for infrastructure will be split evenly between EV and hydrogen fueling stations. Funding for infrastructure will go through the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP).	https://ww2.arb.ca.gov/sites/default/files/2018-07/bmp_june2018.pdf
19	Electric Vehicle (EV) Charging Infrastructure: Multifamily Building Standards	2018	Tech/ Cost Analy-sis	California Air Resources Board	California Air Resources Board	CARB analyses and makes recommendations for the 2019 CALGreen update for EV parking standards in multifamily. CARB recommends that a 10% requirement of EV capable spaces in all multifamily (not 17+) is needed beginning in 2020 to meet the demand for L2 EVCS between 2025. It also analyzes the Tier 1 (15%) and 2 (20%) reach codes, saying that adopting them would help more than triple EV adoption between 2025-2030. CARB also suggests that Tier 2 should require at least one EVCS be installed, since it would visually normalize the existence of EVCS and would still be cost effective. However, EV capability is still the best form of infrastructure development in new building because it allows for flexibility.	https://ww3.arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf

#	Title	Date	Type	Author	Source	Summary	Link
20	2016 ZEV Action Plan	2016	Plan	Governor's Interagency Working Group on Zero-Emission Vehicles	Office of Governor Edmund G. Brown	The 2016 ZEV Action Plan is an update on the progress meeting Governor Brown's Executive Order B-16-12 that called for 1.5 million ZEVs in California by 2025. The Plan introduces over 200 actions to build California's zero emission vehicle (ZEV) market and meet the following priorities: Raise consumer awareness and education about ZEVs; Ensure ZEVs are accessible to a broad range of Californians; Making ZEV technologies commercially viable for the medium, -duty, heavy-duty, and freight sectors; and Aiding ZEV market growth beyond California.	https://www.gov.ca.gov/wp-content/uploads/2017/09/2016_ZEV_Action_Plan.pdf
News and NGO Reports							
21	How States can Overcome the Looming Electric Vehicle Infrastructure GAP	2019	News Article	Meyers, Amanda	Forbes	This article addresses how states can address the fact that 88 of the top 100 US metropolitan areas do not have enough EV charging infrastructure to support the anticipated 3 million EVs on the road by 2025. Closing this gap would require increasing workplace and public Level II chargers by 7x and 3x respectively, and DC fast chargers by 3x. California serves as an example with its pilot programs for Southern California Edison, San Diego Gas & Electric, and Pacific Gas & Electric. The state has targeted underserved markets and encourages market development.	https://www.forbes.com/sites/energyinnovation/2019/04/03/how-states-can-overcome-the-looming-electric-vehicle-charging-infrastructure-gap/#1f6080ef4ded
22	Not as Easy as it Looks: Report Highlights Obstacles for Charging Electric Vehicles	2019	News Article	Nikolewski, Rob	San Diego Union Tribune	Article highlights the challenges EV users face when trying to find a place to charge. Dan Jacobson, the executive director of Environment California, rented and EV in San Diego and found various roadblocks. First, a garage in downtown had 16 Tesla Superchargers that he could not connect to the BMW i3. Second, at the Waterfront Park CAC garage the EV spaces could only be accessed after business hours and the charger could not be disconnected from the car without full charge. He had success at a strip mall in Kearny Mesa, where spaces were served by EVgo charging stations.	https://www.sandiegouniontribune.com/business/energy-green/story/2019-04-04/not-as-easy-as-it-looks-report-highlights-obstacles-for-charging-electric-vehicles

#	Title	Date	Type	Author	Source	Summary	Link
23	Ready to Charge: Five Ways California can Improve Charging to Unleash the Power of Electric Cars	2019	Report	Jacobson, Dan Miller, Alana Rusch, Emily	Environment California Research & Policy Center	Report finds that the day-to-day experience of EV drivers seeking to charge their vehicles, especially in public, is much more difficult and inconvenient than refueling a gasoline-powered car. Main challenges are that there are too few chargers, they are not always publicly available, incompatibility between types of cars, too many proprietary networks and apps, and opaque pricing. Five strategies to address issues are: Support installation of public stations; Ensure interoperability between EVCS; Require open data from companies to disclose station availability and pricing; Enforce EV charging in spaces; and Promote other electric transit options.	https://uspirg.org/sites/pirg/files/reports/Ready%20to%20Charge%20-%20Environment%20California%20-%20Spring%202019.pdf
24	Estimating electric vehicle charging infrastructure costs across major US metropolitan areas	2019	Work-ing Paper	Nicholas, Michael	ICCT	Analysis indicates that the US will need to increase investments in workplace, Level II, and DCFC to $270 million in 2025 and invest $1.3 billion in Level II home charging. Costs for public charging infrastructure will decrease on a per-vehicle basis, from $480/vehicle in 2019 to $300/vehicle in 2025. This can be attributed to lower costs of infrastructure installation with chargers per site, stronger utilization of public chargers, and general market growth.	https://theicct.org/publications/charging-cost-US
25	When does electrifying shared mobility make economic sense?	2019	Work-ing Paper	Pavlenko, Nikita Slowik, Peter Lutsey, Nic	ICCT	Paper analyzes how the use of shared and electric vehicles can accelerate the benefits of each technology by assessing the total cost of operation of EVs for private owners, ride-hailing drivers, carsharing, and taxi services.	https://theicct.org/publications/shared-mobility-economic-sense
26	Electric vehicle capitals: Accelerating the global transition to electric drive	2018	Report	ICCT	ICCT	Report identifies the top EV markets in the world based on EV sales and charging infrastructure. Chinese cities including Shenzhen, Shanghai, and Beijing have the highest number of EV sales, while European cities such as Oslo and Bergen, Norway, have the largest share of EVs (40 and 50 percent, respectively). The report also analyzes key EV-supportive policies in EV capitals, such as their overall charging infrastructure strategies, bus electrification, parking benefits, zero-emissions zones and bans.	https://theicct.org/publications/ev-capitals-of-the-world-2018

#	Title	Date	Type	Author	Source	Summary	Link
27	PEV Policy Evaluation Rubric	2018	Report	National Association of State Energy Officials, Cadmus	NASEO	The report analyzes six policy categories and 14 policy subcategories to determine the most effective policies for increasing PEV sales on a scale of 1-100. Vehicle purchase incentives scored the highest, followed by PEV deployment targets and policies that incentivize EV charging infrastructure and reduce charging infrastructure operating costs. Rubric was prepared to guide Electrify America Cycle 2 investments.	https://www.naseo.org/data/sites/1/documents/publications/PEVPolicyRubricMethodology_NASEO.PDF
28	Plugging In: Speeding the Adoption of Electric Vehicles in California with Smart Local Policies	2018	Report	Kinman, Michelle Miller, Alana Morris, Teague	Environment California Research & Policy Center	With the explosive growth in the number of EVs in California, this report focuses on how cities can provide charging opportunities for residents, especially those without off-street parking. It identifies placing EVCS on residential streets (freestanding or plugs at streetlights/utility poles) and off-street EVCS (in garages or through off-hour partnerships) as potential solutions to barriers facing EV users who are not capable of charging at home. Reducing parking demand and reducing vehicle ownership through shared mobility also can help create space for off-street EVCS.	https://environmentcalifornia.org/sites/environment/files/reports/Plugging%20In%20-%20Environment%20California%20-%20Feb%202018.pdf
29	Medium- and Heavy-Duty Electrification in California	2018	Lit. Review	ICF International	CA Electric Transportation Coalition	Main findings from the prevailing literature is that medium- and heavy-duty electric vehicles are quickly evolving but are only in the early stages of commercialization. Like with light-duty vehicles, the overall cost of the medium- and heavy-duty vehicles is decreasing as battery costs lower; but electrical rate structures will greatly impact fuel costs. Overall, electric medium- and heavy-duty vehicles provide more GHG emissions reductions per vehicle than conventional vehicles.	http://www.caletc.com/wp-content/uploads/2019/01/Literature-Review_Final_December_2018.pdf
30	Transitioning to Zero-Emission Heavy-Duty Freight Vehicles	2017	White Paper	Moultak, Marissa Lutsey, Nic Hall, Dale	ICCT	Report assesses prospects of widespread commercialization of electric medium- and heavy-duty vehicles in the years 2025 and beyond. The main conclusions are that using electric heavy-duty vehicles could achieve an over 80% reduction in emissions, that electric heavy-duty technology could be cost effective by 2030 (due to battery efficiency and dropping low-carbon fuel costs), and that massive amounts of infrastructure investments are needed to enable longer-distance transport.	https://theicct.org/sites/default/files/publications/Zero-emission-freight-trucks_ICCT-white-paper_26092017_vF.pdf

#	Title	Date	Type	Author	Source	Summary	Link
31	Pulling Back the Veil on EV Charging Station Costs	2014	Blog Post	Agenbroad, Josh	Rocky Mountain Institute	The author interviewed over a dozen companies to explore the costs of charging station infrastructure. At-home Level II chargers can cost a little over $1,000 including the charge station itself, installation, and potentially a new breaker panel in older homes. Public AC single-port station hardware can be $2,300-$6,000, with installation accounting for 60-80% of the cost (highly dependent on distance to the breaker box). Parking garage installations are the easiest and most economical, while curbside and surface-lot stations are much more expensive due to trenching required. DC fast chargers can cost $50,000-$100,000 per station and can be much more costly to permit.	https://rmi.org/pulling-back-veil-ev-charging-station-costs/

APPENDIX D: ROADMAP CASE STUDY ANALYSIS

This table highlights best practice case studies for successful vehicle electrification efforts in California, the U.S., and internationally.

Strategy	Date	Source	Agency	Description	Outcome	Opportunity	Link
Curbside EVCS	2019	Pilot Project	City of Sacramento, CA	Curbside EV Charging Pilot Project with EVgo to install, operate, and maintain up to 6 DCFC and 10 designated EV parking spaces in the public right-of-way at no cost to the city. The charging plazas are located near a public park and multi-family residences. Chargers are subject to all commercial plan checks, encroachment permits, electrical permits, and inspections.	Pilot project will run for one year starting in May 2019. When the City has results from the program, it will analyze any issues and prepare a curbside charging guidance document.	Public right-of-way EVCS installations for public use.	http://www.cityofsacramento.org/Public-Works/Electric-Vehicle-Initiatives/Curbside-Charging
EVCS in Municipal Lots and Garages	2019	Press Release	City and County of San Francisco, CA	City is inviting EVCS providers to submit proposals to install EVCS in municipal parking facilities accessible to the public.	Would apply to 38 city-owned parking facilities, resulting in 340 new EVCS in city-owned lots. City currently has 200 EVCS at municipal parking facilities and SFO.	Public/private partnership solicitation to install EVCS at public parking facilities.	https://sfmayor.org/article/mayor-london-breed-and-supervisor-aaron-peskin-initiate-plan-fully-electrify-ground
EVCS in Commercial Lots and Garages	2019	Press Release	City and County of San Francisco, CA	City is planning to propose legislation that would require commercial parking lots and garages with more than 100 parking spaces to install EVCS in at least 10% of spaces.	Would apply to approximately 300 commercial parking facilities throughout the city. EVCS would be installed by 1/1/2023.	Local EV parking reach code development for commercial parking facilities.	https://sfmayor.org/article/mayor-london-breed-and-supervisor-aaron-peskin-initiate-plan-fully-electrify-ground
Employee EV Outreach	2019	Webinar	Alameda County, CA	County conducts internal "Ride and Drive" events for employees to provide information and hands-on experience with driving an EV. Fleet EVs also include informational stickers to help employees understand more	86% of Ride and Drive attendees have driven an EV versus 63% of non-attendees (departments often make the trainings mandatory for employees to ensure they get exposure to	Increase employee awareness of fleet EV use and benefits.	https://zoom.us/recording/play/VIYtITviHomPxi2fMonLoKe7R8bffVFj4Q0bjDpbrdzKCltGOxw

Strategy	Date	Source	Agency	Description	Outcome	Opportunity	Link
				about EV benefits and range while driving them. Other outreach efforts included contests/raffles, where employees get a raffle ticket for test driving an EV, and employee newsletters.	EV technology, so it was not only attended by people who were already interested). Fleet saw a 50% decrease in times when employees forgot to plug in the EV when they returned to the garage. Contests led to a 5% increase in employees who have driven an EV at least once.		KEmLnYjTqHJIr?continueMode=true
EV Ordinance – EV Ready Infrastructure	2019	Ordinance	City of Seattle, WA	The EV Readiness Ordinance (adopted Spring 2019) requires parking spaces to include EV-ready wiring and electrical outlets. Each private parking garage or parking area for an individual residence must include an EV-ready space; 20% of parking spaces in shared parking areas for multifamily development must be EV-ready (with higher requirements for smaller parking facilities); 10% of parking spaces for non-residential uses must be EV-ready.	Ordinance has only been in effect since May 2019 so effects on EV charger installation and EV adoption is not yet known. Per the staff report, the regulations will increase EVs driven in Seattle and reduce emissions because the city's electrical power is 100% carbon neutral. Costs will be limited by allowing applicants to request flexibility from EV requirements to avoid providing transformer upgrades. Any reduction in the amount of parking provided in the city is expected to be minimal.	Local EV parking reach code development.	http://seattle.legistar.com /View.ashx?M=F&ID=7226916&GUID=734F02DC -0CF2-419F-8378-02F124F52644
Private Sector EV Outreach	2019	Article	City of Columbus, OH	Acceleration Partner Program is used to organize private sector engagement around EV adoption. Outreach includes EV test drives through the Smart Columbus Ride and Drive Roadshow.	More than 60 companies have pledged to help employees and residents drive EVs and drive less. Close to 8,000 EV test drives have been held, leading to 13% of participants choosing to be contacted by a dealer	Public/private partnership solicitation to install EVCS at public parking facilities.	https://www.americancityandcounty.com/2019/07/08/driving-change/

Strategy	Date	Source	Agency	Description	Outcome	Opportunity	Link
					to get more information about EVs.		
Outreach to Low-income Communities through Partnerships with Established Community Organizations	2019	Program	Peninsula Clean Energy - San Mateo County, CA	The CCE is offering a $4,000 incentive through its DriveForward Electric Program in partnership with Peninsula Family Service, an existing program that helps residents afford vehicles. Incentives are for both PHEVs and EVs, but it is promoting the PHEV more because their recipients typically only have one vehicle. Recipients must be at or below 400% of the 2019 Federal Poverty level.	PCE's program began in Spring 2019. Program will run on a first-come-first serve basis until 100 vehicles are sold. However, their partner Peninsula Family Service has a proven record of effectiveness; in 2018, the organization gave nearly $500,000 in loans to 50 individuals and families through their DriveForward vehicle loan program. 78% of DriveForward participants reduced their need for government assistance.	Agency collaboration with an established community service provider to provide outreach and incentives to low-income residents.	https://www.peninsulacleanenergy.com/driveforwardelectric/
Transit Bus Electrification	2018	Article	City of Shenzhen, China	City transitioned its entire bus fleet to electric largely due to central and local government subsidies. At purchase, over half the cost of the bus is subsidized by the government, and the operator receives another subsidy for running the buses for a certain threshold of kilometers.	100% of 16,000 transit bus fleet transitioned to electric in 2017.	Transit bus electrification.	https://www.theguardian.com/cities/2018/dec/12/silence-shenzhen-world-first-electric-bus-fleet
EV Ordinance – Major Alterations to Existing Development	2017	Ordinance	City and County of San Francisco, CA	EV Ready Ordinance applies to new development and major alterations (i.e. significant EPM upgrades or over 25,000 sf of construction to an existing building). 100% of parking spaces must be EV capable; at least 10% of those must have full EV Ready wiring and there must be electrical infrastructure to carry	San Francisco was an established leader in EV uptake and infrastructure even before the ordinance came into effect since 2017, so it is difficult to distinguish its specific effects. However, the EV Ready Ordinance saves developers and property owners money	Local EV parking reach code development for existing development.	https://sfbos.org/sites/default/files/o0092-17.pdf

Strategy	Date	Source	Agency	Description	Outcome	Opportunity	Link
				out charging in at least 20% of spaces.	through avoided retrofit costs when installing EVCS in the future. Based on modeling of two scenarios, it would cost about $860-920 per space to install electric circuits during initial construction, while it would cost $2,370-$3,710 per space to retrofit.[50]		
Streetlight EVCS	2017	Infrastructure Plan	City of Los Angeles, CA	Streetlight EVCS program run by the Bureau of Street Lighting has installed city owned EVCS financed through various grants on streetlights since 2012.	From 2012-2018, 132 EVCS were installed and an additional 150 EVCS are planned for installation in 2019.	Public right-of-way EVCS installations for public use.	http://clkrep.lacity.org/onlinedocs/2014/14-0079-s2_rpt_GSD_03-10-2017.pdf
Local EV Incentive	2016	Program	Ventura County APCD, CA	The VCAPCD EV Rebate Program began in 2016 when the APCD entered into an agreement with 10 local dealerships in the area to offer $1,100 or $2,200 vouchers towards the purchase of EVs. The Clean Air Fund matched funding from the dealerships totaling $274,821.	The match funding from Clean Air Fund monies and dealerships doubled the incentive for customers. VCAPCD staff indicated that it was important to focus on providing rebates for lower cost EVs. The Program is no longer in effect as funds have been exhausted.	Local EV incentive program to fund vehicle purchases, close the gap between federal/state EV incentives and conventional vehicle MSRP.	Program no longer available.
Employee EV Dealership Incentives	Est. 2016	Website, Personal Correspondence	UC San Diego – San Diego, CA	UC San Diego arranges discounted pricing with local dealerships for UC San Diego students, faculty, staff, and retirees. Incentives are determined by the vehicle manufacturer based on inventory, though local dealerships may add additional incentives on top of that. Examples of current available dealers include $3,500	Local car dealerships have become top sellers in the country corresponding with the start of the UCSD EV incentives. UCSD campus has also seen an 8% growth per month of EV charging on campus since then.	Reduce employee commute GHG emissions through partnership with local dealership.	http://rmp.ucsd.edu/strategic-energy/ev/offers.html

[50] See Appendix C: Literature Review for more detail.

Strategy	Date	Source	Agency	Description	Outcome	Opportunity	Link
				off the 2019 Nissan Leaf and $500 off Honda PHEV and hybrids.			
Joint Agency Procurement for Fleet Electrification	2015	Report	City of Stockholm, Sweden	Years before the Climate Mayors EV Collaborative, Stockholm and 296 other municipalities joined to purchase EVs from six automakers. Since the EV Strategy was made in 2011, the city purchased approximately 20 EVs per year for the fleet.	City transitioned 99% of the 800- vehicle municipal fleet to electric by 2015.	Joint procurement for fleet EV.	https://www.forbes.com/sites/justingerdes/2012/05/11/the-global-electric-vehicle-movement-best-practices-from-16-cities/#1a44f34f4cde
Vehicle Retirement with EV Incentive	Est. 2015	Program	South Coast AQMD, CA	Replace Your Ride Program to replace gasoline vehicles MY 2010 or older with a gas vehicle 2012 or newer ($3,000-4,500, to moderate or low-income applicants only); a hybrid, PHEV, or BEV ($2,500-$4,500 open to all incomes, but incentive varies); or a transit pass.	4,600 vouchers for vehicle replacements were issued since 2015. Per a study published in Energy Policy, since the implementation of the program in 2015, at least 49% of BEVs, 39% of PHEVs, and 70% of hybrid vehicles (HEVs) purchased by the eligible population after the policy's implementation were attributable to the policy. [51]	Local EV incentive program to fund vehicle purchases, close the gap between federal/state EV incentives and conventional vehicle MSRP.	https://xappprod.aqmd.gov/RYR/
EV Parking Ratio	2015	Municipal Code	Sacramento County, CA	Development standards count EV charging spaces as up to two parking spaces. EV charging is also an allowed accessory use in every zone designation.	Regulations facilitate installation of EV charging infrastructure in all types of development.	Local EV parking regulation incentives to increase EVCS installations.	http://www.per.saccounty.net/LandUseRegulationDocuments/Documents/Zoning%20Code%20Final%20Adopted%20July%2022%202015/Updates%20to%202015%20Zoning%20Code/Effective%20January

[51] From Energy Policy Vol. 132 *Assessing the effectiveness of California's "Replace Your Ride"* (2019)

Strategy	Date	Source	Agency	Description	Outcome	Opportunity	Link
							%2012,%202019/Chapter%205_Effective%20September%2025,%202015%20[01-12-2019].pdf
Demand-based Allocation of Curbside EVCS	2011	Program	City of Amsterdam, Denmark	Demand-driven approach allows citizens to make requests online for the city's contractor to build an EVCS near their home in any location that is publicly accessible.	As of 2018 there were 2,600 charging points in the city.	Public right-of-way EVCS installations for EV owners who do not have dedicated parking spaces.	https://issuu.com/gemeenteamsterdam/docs/plan_amsterdam_4-2018_the_electric_
EV Density Bonus	2011	Municipal Code	City of San Carlos, CA	San Carlos Municipal Code indicates that the provision of carshare or electric car facilities can qualify Mixed-Use Buildings in Mixed-Use Districts for an increase in floor-area ration (FAR) up to 10% (subject to conditional use permit).	Strategy is part of 2009 CAP measure to encourage developers to dedicate parking to EVCS. The CAP assumed that 25 EVCS would be installed before 2020, leading to a reduction of 30 MTCO2e per year.	Policy to encourage development of both housing and EV infrastructure.	https://www.codepublishing.com/CA/SanCarlos/#!/SanCarlos18/SanCarlos1805.html#18.05
Green Fleet Policy	2010	Policy	City of Minneapolis, MN	Minneapolis' Green Fleet Policy states that alternative fuel vehicles shall be considered for procurement when appropriate to the application and when the technology economically feasible. It requires that light-duty vehicles be at least EPA Smartway certified and medium- and heavy-duty vehicles be EPA low-emission certified. Policy does not specifically require EVs.	The municipal fleet contains only five EVs (two PHEVs and three BEVs). It also has 71 hybrid vehicles, 404 flex-fuel vehicles, and 290 biodiesel vehicles.	Vehicle replacement policy that considers factors such as vehicle cost, alternative fuel vehicle availability or preference, and suitability for intended job.	http://www.minneapolismn.gov/publicworks/green/public-works_pw_green_fleets

APPENDIX E: SURVEY OF CLIMATE ACTION PLAN MEASURES AND ELECTRIC VEHICLE ORDINANCES

Climate Action Plan Measures

This table provides an overview of regional vehicle electrification Climate Action Plan efforts and a summary of relevant examples from other jurisdictions outside of the San Diego region.

Title	Date	Measure Name	Measure Description	Supporting Actions	Assumptions & Methodology	Reductions ($MTCO_2e$)	Link
City of Encinitas Climate Action Plan	2018	MCET-1: Transition to ZEV Municipal Fleet	Develop a municipal fleet replacement plan to 1) convert gasoline-fueled cars and light-duty trucks to Zero Emission Vehicles, including all-electric vehicles or other ZEV technology by 2030. 2) convert to renewable diesel for all diesel-fueled heavy-duty trucks by 2020.	• Install EV charging stations at municipal facilities. • Develop a City vehicle fleet conversion plan and identify funding to support conversion of fleet vehicles.	Performance metric: Reduce City fleet fossil fuel use (gasoline and diesel) by 10% by 2020; Reduce City fleet fossil fuel use (diesel) by 30% and convert gasoline-fueled cars and light duty trucks to ZEV by 2030. Total fleet size of 89 vehicles.	2030: 370 $MTCO_2e$	https://www.encinitasenvironment.org
		CET-4: Require Residential EVCS	Starting in 2018, require new residential units to install EVCS equipment. For 1) Single-family: Install complete 40-Amp electrical circuit (EV Ready) 2) Multi-Family: Install EVCS equipment at 5% of the total number of parking spaces.	• Expand and implement a Green Building Incentive Program to increase electric vehicle charging at home and businesses. • Complete and implement an EVCS Master Plan to increase the use of ZEV by the community. • Work with SDG&E to explore projects through their Power Your Drive Program. • Develop and implement EV charging plan for municipal facilities. • Pursue partnerships with school districts and NCTD to explore the use of electric	Assumption: 3,251 EVs on the road by 2030. Projected impact of CET-4: 374 ZEV by 2030. Performance metric: Install 370 EVCS by 2030.	2030: 1,357 $MTCO_2e$	

				busing or public transit busing for schools.			
		CET-5: Require Commercial EVCS	Starting in 2018, require installation of EVCS at 8% of the total number of parking spaces. For 1) all new commercial buildings, including the commercial portion of mixed-use projects, 2) commercial building modifications, alterations, and additions that require building permits with square footage larger than 10,000 sq. ft.	• Same as above.	Assumption: 3,251 EVs on the road by 2030. Projected impact of CET-5: 492 ZEV by 2030. Performance metric: Install 490 EVCS by 2030.	2030: 1,789 $MTCO_2e$	
City of La Mesa Climate Action Plan	2018	T-5: Alternative Refueling Infrastructure Development	Support community-wide use of alternative fuel vehicles through expansion of alternative vehicle refueling infrastructure.	• Continue to implement requirements CALGreen, including pre-wiring requirements for EVCS. • Adopt a streamlined permitting process for EVCS, per requirements of AB 1236. • Expand EVCS to new commercial construction to increase the presence of EV charging units available in the workplace, and for public use in retail and office parking lots. • Collaborate with other local governments to develop a strategy for increasing installation of EVCS in existing multi-family rental properties.	Assumption: Reduction in emissions achieved through reduced travel demand and less GHG-emitting fuel sources. Performance metric: Reduce VMT per capita by 6% compared to 2010 by 2035.	2035: 550 $MTCO_2e$	https://www.cityoflamesa.us/1488/Climate-Action

		T-6: Municipal Fleet Transition	Continue to transition the municipal vehicle fleet from gasoline- and diesel-powered vehicles to alternative-fuel or other low-emissions vehicles.	• City will develop fleet-related targets for emissions, fuel consumption, or specific vehicle type. • Install refueling and recharging infrastructure. • Track fleet inventory.	Performance Metric: 220 gal of gasoline/yr saved from passenger vehicle replacement; 340 gal of gasoline/yr saved from light-duty truck replacement.	2035: 10 $MTCO_2e$	
City of Chula Vista Climate Action Plan	2017	100% Clean Vehicle Replacement Policy for City Fleet (2008 Climate Mitigation Plans)	Replace retired vehicles through the purchase or lease of alternative fuel and hybrid vehicles where available to reach 40% by 2020.	• Goal implemented through City Operations Sustainability Plan	Performance Metric: number of hybrid and AVFs, number of ultra-low emissions vehicles, number of gallons of fuel used, average fuel economy, and reduction of greenhouse gases	N/A	https://www.chulavistaca.gov/departments/clean/conservation/climate-action-plan
		Objective 4.3: Alternative Fuel Vehicles (2017 CAP)	Support citywide expansion of alternative fuel vehicle use by 4% of VMT by 2020, 11% by 2035.	• Support the installation of more local alternative fueling stations • Designate preferred parking for alternative fuel vehicles • Design all new residential and commercial buildings to be "Electric Vehicle Ready"	N/A	2035: 61,819 $MTCO_2e$	
City of Solana Beach Climate Action Plan	2017	Measure T-1	Increase EVs and AFVs VMT to 30% of total VMT.	• Support public and private sector provisions of alternative fueling stations. • Require EVCS and EV charger-ready wiring in commercial/multi-family and residential structures (both new construction and substantial remodels). • Collaborate with SANDAG to increase EVs in the region.	Assumptions: Less than 1% of Solana Beach VMT attributed to EVs and AFVs in 2010. 64,708,354 VMT driven by EVs or AFVs by 2035.	2035: 17,495 $MTCO_2e$	www.ci.solana-beach.ca.us/climate_action

				• Provide incentives for residents to increase use of EVs. • Explore grant funding for EVCS. • Facilitate the implementation of an EV car sharing fleet network to serve the City. • Explore barriers for EV charging for garage-free homes, install charging infrastructure integrated into streetlights; support use of electric bikes.			
		Measure T-5	Increase preferred parking for EVs and AFVs to 20% of eligible parking spots.	• Identify eligible on-street parking spots and spots in City-owned lots for conversion to preferred parking for EVs and AFVs. • Explore modifying the Solana Beach Municipal Code to incentivize parking stalls for EVs and EVCS as a credit toward parking requirements. • Install dedicated stalls for EV parking and EVCS at City facilities. • Conduct outreach and education for the City's businesses and commercial property owners to encourage the conversion of private parking spaces to EV and AFV preferred parking.	Assumption: 375 spaces converted, avoiding 1,337,750 VMT by 2035.	2035: 325 $MTCO_2e$	

City of San Diego Climate Action Plan	2016	2.2: Municipal ZEV	Present to City Council for consideration an update to City Administrative Regulation 90.73 to increase the number of municipal zero emissions vehicles. Increase the number of zero emissions vehicles in the municipal fleet to 50% by 2020 and 90% by 2035.	• Consider updating regulations for alternative fuel and zero emissions vehicle requirements for the City's vehicle fleet. • Consider an integrated transportation strategy that combines zero emissions vehicle deployment and infrastructure. • Present to City Council for consideration an Electric Vehicle Charging Plan.	Assumptions: No change in gasoline demand for municipal passenger fleet. Constant of 24,288 MTCO2e GHG from gasoline use. Performance metric: 90% gasoline fleet VMT converted to EVs by 2035.	2030: 18,621 $MTCO_2e$ 2035: 21,859 $MTCO_2e$	https://www.sandiego.gov/sustainability/climate-action-plan
City of Del Mar Climate Action Plan	2016	Goal 16 T4: Expand Alternative Fuel Infrastructure	Have at least one fueling station for all major alternative fuels within 5 mi. of Del Mar by 2020. Increase the percentage of VMT being driven by EVs and other alternative fuel vehicles (AFVs) to 15% of total VMT by 2020 and 30% by 2035.	• Support public and private sector provision of alternative fueling stations in Del Mar and adjacent cities. • Explore grant funding for EVCS. • Explore the potential for replacing municipal fleet with EVs when feasible. • Advocate for expansion of an EV car sharing fleet network to serve Del Mar.	Assumption: 20,383,505 VMT driven per year by EVs or AFVs by 2035.	2035: 8,593 $MTCO_2e$	www.delmar.ca.us/537/Climate-Action-Plan
		Goal 17T5: Preferential Parking for Clean Vehicles	Set aside convenient parking spaces for high efficiency and clean vehicles, including motorcycles and scooters.	• Support public and private sector provision of alternative fueling stations in Del Mar and adjacent cities. • Explore grant funding for EVCS. • Explore the potential for replacing municipal fleet with EVs when feasible.	Assumption: 20,383,505 VMT driven per year by EVs or AFVs by 2035.	2035: 56 $MTCO_2e$	

				• Advocate for expansion of an EV car sharing fleet network to serve Del Mar. • Set aside 10% of all on-street parking spots on Camino del Mar and in City-owned lots for high-efficiency and clean vehicles by 2020. • Explore modifying the Del Mar Municipal Code to incentivize parking designed for micro-vehicles and to provide a credit toward parking requirements for providing parking stalls for EVs and EVCS. • Include EV spaces in Camino Del Mar Streetscape project design. • Include dedicated stalls for EV parking and EVCS at City facilities.			
City of Carlsbad Climate Action Plan	2015	Measure L: Promote an Increase in the Amount of ZEV Travel	Promote an increase in the amount of ZEV miles traveled from a projected 15% to 25% of total VMT by 2035 (including EVCS infrastructure development and City fleet conversion actions). Use solar PV to charge ZEVs whenever possible to provide entirely emissions-free transportation.	• L-1: Construct a "PV to EV" pilot project to install a PV charging station at a city facility to charge city ZEVs. Evaluate the feasibility of incorporating more ZEV into the city's fleet. L-2: Prepare a community-wide charging station siting plan. L-3: Construct ZEV charging stations based on the community-wide charging station siting plan. L-4: Offer dedicated ZEV parking and provide	Assumption: 15% of the VMT in 2035 are projected to be from ZEVs.	2035: 54,158 $MTCO_2e$	https://www.carlsbadca.gov/services/depts/pw/environment/cap.asp

				charging stations adjacent to ZEV parking. L-5: Adopt requirements for ZEV parking for new developments. L-6: Adopt a residential energy conservation ordinance requiring the installation of EV chargers or pre-wiring in new residential construction and major renovations. L-7: Update the city's Fleet Management Program to increase the proportion of fleet low and zero–emissions VMT to 25% of all city-related VMT by 2035.			
National City Climate Action Plan	2011	Measure A2.e	Alternative Fuel Vehicles	• Develop streamlined permitting requirements and standardized design guidelines and siting criteria for all types of EVCS.	N/A	2030: 793 $MTCO_2e$	https://www.ca-ilg.org/sites/main/files/file-attachments/climate_action_plan.pdf
Riverside County Climate Action Plan	2018	R2-T7: Expand Renewable Fuel/Low Emission Vehicle Use	Projects will earn points by making EV use more accessible by providing: • Preferential parking for ultra-low emission, ZEV, and AFV. • Circuit and capacity in garages of residential units and all new commercial buildings over 162,000 sf for installation of EVCS.	• Collaboration between local and regional governments and business to foster the increased use of renewable fuels. This can be accomplished by coordinating the siting of new alternative fueling/recharging locations for example. • Preferential parking for ultra-low-, ZEV, and AFV.	Assumption: 25% of vehicles on the road will be EV in 2020, leading to reduction of passenger/light duty VMT by 23.75%.	2020: 451,928 $MTCO_2e$ (No estimate for 2030)	https://planning.rctlma.org/CAP

				• Collaboration with energy providers to ensure the availability of infrastructure to encourage the use of privately-owned ZEV. • Provide incentives for taxicabs to use gas-electric hybrid vehicles or, at a minimum, smaller more fuel-efficient vehicles.			
San Mateo County Climate Action Plan	2013	10.1 Low Carbon Fuel Infrastructure	Increase alternative fuel infrastructure in the community.	• Incentivize the installation of EVCS in public areas and in more urban neighborhoods; and where there are five parking spaces or more in a project, require at least one EVCS be installed as well as the installation of an electrical conduit within hardscape to allow additional spots to be easily added later. • Establish neighborhood EV networks that identify streets and locations for EV use. • Seek grant funding through the state and regional partnerships to fund fleet conversions to alternative and low-emissions fuels.	Assumption: Households with EVs are estimated to reduce VMT from traditional vehicles by approximately 12%. Each EVCS is estimated to cause a reduction of 8,000 VMT per year. Car sharing participants are estimated to travel 1,500 annual VMT less than the average driver. Performance target: The use of 300 EVs, installation of 500 EVCS and 40% of households participating in a rideshare program by 2035.	2035: 2,200 $MTCO_2e$	https://www.smcsustainability.org/climate-change/climate-action-plans
Santa Barbara County Climate Action	2015	Measure T3: Alternative Fuel Vehicles and Incentives	Increase the use of alternative-fuel vehicles and plan for the development of alternative-fuel infrastructure.	• Develop new EV ready ordinance requiring new one- and two-family dwellings to install conduit for future installation of an EVCS.	Performance metric: 3,500 EVCS installed by 2035.	2035: 3,650 $MTCO_2e$	www.countyofsb.org/sustainability/ecap

				• Support efforts to plan for and deploy EVs and alternative-fuel infrastructure in Santa Barbara County. • Encourage public and new commercial developments to include designated stalls for low-emitting, fuel-efficient vehicles and carpool/vanpool vehicles and to pre-wire stalls for future EVCS. • Amend zoning ordinance to ensure that alternative-fuel stations and support facilities are allowed uses in land use designations that currently allow gas and service stations. • Identify alternative-fuel projects to seek funding through the CEC.			
City of Los Angeles Climate Action Plan	2015	Air Quality: Transition Personal Transport Toward Zero Emissions	Have zero days when air pollution reaches unhealthy levels by 2025.	• Install more than 1,000 publicly available EV charging stations, with more than 100 (including DC fast chargers) on City property. • Execute four zero-emissions or PZEVs goods movement pilots within the Port of Los Angeles. • Increase the percentage of EV and ZEV to 25% by 2035. • Increase the percentage of Port-related goods movement trips that use zero-emissions technology to at least 25% by 2035.	N/A	N/A	plan.lamayor.org

				• Develop more EVCS on public/municipal property. • Work to include emission reduction credits for EV charging infrastructure in AQMD's Air Quality Investment program for large employers. • Modify Green Building Ordinance to require EV charging.			
		Lead by Example: ZEV Fleet Conversion	Ensure that the percentage of the City's light-duty vehicle purchases are at least 80% EVs by 2025 and 100% by 2035. Ensure that 50% of the city's light-duty vehicle purchases are EVs by 2017.	• Use car sharing, EVs, alternative fuels infrastructure, and low carbon/ biofuels for heavy-duty vehicles. • Reduce total fleet VMT. • Green city fleet using right sizing, car sharing, EVs, etc. • Increase City employee use of public transportation incentive programs.	N/A	N/A	
City of Los Angeles Climate Action Plan	2019	Zero Emission Vehicles	Increase the percentage of electric and zero emission vehicles in the city to 25% by 2025; 80% by 2035; and 100% by 2050.	• Distribute 1,000 used EV rebates, 11,500 L2 EVCS rebates, and 75 DCFC rebates. • Develop a zero-emission roadmap for LAX. • Develop roadmap for Fossil Fuel Free Zone by 2021; implement by 2030. • Install 10,000 publicly available EVCS by 2022 and 28,000 by 2028. • Electrify 10% of taxi fleet by 2022; 100% by 2028. • 100% zero emission school buses in LA by 2028.	N/A	N/A	plan.lamayor.org

				• 100% of urban delivery vehicles are zero emission by 2035.			
		Zero Emission Vehicles	Electrify 100% of Metro and LADOT buses by 2030	• Electrify LA Metro's Orange and Silver Lines. • Introduce 155 new electric DASH buses into fleet by 2021. • Electrify 100% of paratransit shuttle buses by 2026.	N/A	N/A	
		Lead by Example	Convert all City fleet vehicles to zero emission where technically feasible by 2028	• Install 400 EVCS at City buildings and parks. • Install EVCS at all libraries. • Install 500 additional streetlight EVCS. • Ensure 100% of the City's new light-duty purchases and new Meals on Wheels vehicles are electric. • Ensure that 100% of medium duty trash and recycling trucks are zero emission by 2028.	N/A	N/A	
City of San Mateo Climate Action Plan	2015	AF 1: Public EVCS	Utilize EVCS in public parking lots and garages, especially those with reserved parking spaces, to improve the overall feasibility of EVs and PHEVs (plug-in hybrids) for community members and can support EVs and PHEVs for use in the municipal fleet.	Install public EV charging stations in desirable, high-volume, and prominent locations (e.g., near the entrance to a downtown parking garage).	Assumption: 50 public EVCS by 2030 with 4,700 annual VMT per charging station.	2020: 40 $MTCO_2e$ (No 2030 reduction stated)	https://www.cityofsanmateo.org/2769/Climate-Action-Plan

		AF 2: Increased EV Adoption	Improve the adoption of EVs and PHEVs among residents by promoting the vehicles and promoting EVCS at residences and businesses.	• Identify and distribute resources to assist community members seeking to install an EVCS on their properties. • Amend the San Mateo Zoning Code to allow EVCS to encroach into the required parking stall area. • Decrease permit fees and/or offer expedited permitting for EVCS. • Create an additional rebate for property owners who install EVCS. • Conduct educational outreach to homeowners, commercial property owners, and developers about the benefits of EVCS. • Provide information about the benefits of EVs and PHEVs through the City's electronic media systems and at public events, including creating opportunities for public EV/PHEV test drives.	Assumption: 7% of City of San Mateo's vehicles will be EV by 2030. 3,160 households with an EV by 2030.	2020: 6,110 $MTCO_2e$ (No 2030 reduction stated)	
City of Portland Climate Action Plan	2015	Urban Form and Transportation Objective 7	Reduce lifestyle carbon emissions of transportation fuels by 20%	• Update City's EV Strategy to add 8,000 EVs and PHEVs and explore opportunities to increase infrastructure, address barriers, etc. • Support EVCS in publicly accessible locations. Consider EV-ready guidelines and codes. • Advocate for adoption of low carbon fuel standards	Metric: Reduce transportation emissions by 20% by 2030.	N/A	https://www.portlandoregon.gov/bps/49989

				• Encourage petroleum refineries to provide products not sourced from tar sands. • Support development of low carbon fueling infrastructure for fleets and the public. • Reduce black carbon source emissions.			

Electric Vehicle Ordinances

This table provides an overview of reach code ordinances that exceed CALGreen requirements to provide an example of potential requirements that the County can adopt to increase charging infrastructure in private development.

<table>
<tr><th>Title</th><th>Ordinance Description</th><th>Link</th></tr>
<tr><td>City of Carlsbad EV Ordinance (2019)</td><td>Ordinance is an amendment to the Carlsbad Municipal Code Ch. 18.21 adopting changes to 2016 CALGreen. Requires that residential new construction and major renovations install one EVSE ready space. New multifamily dwellings or major alterations must make 10% of spaces EV capable. When only one EV capable space is required, it shall have EVSE installed. When multiple EV capable spaces are required, 50% (but no less than one) shall have EVSE installed, and the rest many be a combination of EV capable and EV ready. New non-residential and hotels/motels shall comply with the following table:
<table>
<tr><th>Total Number of Actual Parking Spaces</th><th>Number of Required EV Spaces</th><th>Number of Required EVSE Installed Spaces</th></tr>
<tr><td>0-9</td><td>1</td><td>1</td></tr>
<tr><td>10-25</td><td>2</td><td>1</td></tr>
<tr><td>26-50</td><td>4</td><td>2</td></tr>
<tr><td>51-75</td><td>6</td><td>3</td></tr>
<tr><td>76-100</td><td>9</td><td>5</td></tr>
<tr><td>101-150</td><td>12</td><td>6</td></tr>
<tr><td>151-200</td><td>17</td><td>9</td></tr>
<tr><td>201 and over</td><td>10% of total</td><td>50% of required EVSE installed spaces</td></tr>
</table>
</td><td>http://edocs.carlsbadca.gov/HPRMWebDrawer/ReRecordHT/533054</td></tr>
</table>

<table>
<tr><th>Title</th><th>Ordinance Description</th><th>Link</th></tr>
<tr><td>City of Oakland (2017)</td><td>Ordinance adopted local amendments to 2016 CALGreen in the Oakland Municipal Code applicable to new multifamily and nonresidential buildings. New multifamily buildings with 3 or more units of non-residential buildings:
<table>
<tr><th></th><th>1 parking space</th><th>2-10 parking spaces</th><th>11-15 parking spaces</th><th>16-20 parking spaces</th><th>More than 20 parking spaces</th></tr>
<tr><td>Full Circuit</td><td>1 parking space</td><td>2 parking spaces</td><td>2 parking spaces</td><td>2 parking spaces</td><td>10% of parking spaces (rounded up)</td></tr>
<tr><td>Inaccessible Conduit Installed</td><td>Not applicable</td><td>Not applicable</td><td>1 parking space</td><td>2 parking spaces</td><td>Multifamily buildings: Remaining 90% of parking spaces
Non-residential buildings: Additional 10%</td></tr>
<tr><td>Electric Panel Capacity</td><td>Sufficient to supply 1 parking space</td><td>Sufficient to supply 2 parking spaces</td><td>Sufficient to supply 3 parking spaces</td><td>Sufficient to supply 4 parking spaces</td><td>Sufficient to supply 20% of spaces</td></tr>
</table></td><td>http://www2.oaklandnet.com/oakca1/groups/pwa/documents/report/oak063669.pdf</td></tr>
<tr><td>City of Palo Alto EV Supply Equipment (2014)</td><td>The EV Supply Equipment Ordinance is an amendment to the Palo Alto Municipal Code to adopt local amendments to the 2016 CALGreen standards. Requires newly constructed single-family residences to be EVSE capable, EVSE ready, or have EVSE installed. Multifamily residential structures must provide at least one EVSE ready space or install one EVSE for each residential unit. At least 25% of guest spaces must be EVSE ready or have EVSE installed (at least 5% or one EVSE must be installed). New non-residential must have at least 25% EVSE capable, EVSE ready, or EVSE installed with at least 5% (no less than one) EVSE installed. Hotels must have 30% EVSE ready spaces, with at least 10% (no less than one) EVSE installed. All types of development must have enough circuit capacity to support EVSE installed in every EVSE ready space.</td><td>https://www.cityofpaloalto.org/civicax/filebank/documents/39791</td></tr>
<tr><td>City of San Carlos Municipal Code</td><td>Section 18.05.030 of the San Carlos Municipal Code indicates that Mixed-Use Buildings in Mixed-Use Districts are eligible for an increase in floor area ratio (FAR) up to 10% with one or more of the following elements beyond what is otherwise required (subject to conditional use permit):
Car-share or electric car facilities.
Additional public open space or contribution to a parks fund.
Provision of off-site improvements. This may include off-site amenities and/or infrastructure (other than standard requirements and improvements) such as right-of-way improvements or funding for public safety facilities, libraries, senior centers, community meeting rooms, child-care or recreation.
Provision of green roofs, solar panels, and other green building measures.</td><td>https://www.codepublishing.com/CA/SanCarlos/#! /SanCarlos18/SanCarlos1805.html#18.05.030</td></tr>
</table>

Title	Ordinance Description	Link
City & County of San Francisco EV Readiness Ordinance	Ordinance is an amendment to the local Green Building Code and the Environmental Code that exceeds the requirements of the 2016 California Green Building Code (CALGreen). Group R occupancies • 100% of off-street parking in new construction and major alterations in multifamily, commercial, and municipal projects must be "EV Spaces," spaces intended for installation of EV charging equipment and charging of EVs. • Each parking space in new single- and two-family dwellings with private garages must have the circuit and wiring that is either EV Ready (full circuit) or EV Capable. • New multifamily dwellings and major alterations (3 or more units), 100% spaces must be EV Spaces. • Where a single EV Space is required, it must have a full circuit installed (EV Ready). • Where multiple EV Spaces are required, at least 10% (but no less than 2) must have a full EV-ready circuit installed. Electrical service must have sufficient capacity for installing full circuits at 20% of EV Spaces. • Installation of a DC fast charger can reduce the number of required EV Spaces by 5. Group A, B, I, and M occupancies • 100% of off-street parking spaces must be EV Spaces in new construction and major alterations. • Requirements for installing EV-ready circuits same as R occupancies. • Installation of a DC fast charger can reduce the required number of EV Spaces by 10	https://sfbos.org/sites/default/files/o0092-17.pdf

APPENDIX F: SURVEY OF FLEET POLICIES

This table provides an overview of regional municipal fleet electrification efforts and a summary of relevant examples from other jurisdictions outside of the San Diego region.

Fleet Policies		Fleet Statistics			Jurisdiction Statistics[52]	
Jurisdiction	Policies	Total Fleet	Fleet EV	% EV	Size (mi^2)	Population
City of Encinitas	Climate Action Plan (2018)[53] • Convert gasoline-fueled cars and light-duty trucks to Zero Emission Vehicles, including all-electric vehicles or other ZEV technology by 2030. o Phase 1 of the vehicle conversion plan is to have 25% of the light-duty fleet converted to hybrid/electric vehicles by January 2019. • Partner with school districts and NCTD to explore electric school bus or public transit buses.	89	5	5.6%	18.18	62,904
City of Chula Vista	Climate Mitigation Plan (2008)[54] and City Operations Sustainability Plan (2014)[55] • Transition 40% of fleet to hybrid or other alternative fuel technology by 2020. • 100% Clean Fleet Policy that all replacement vehicles purchased for fleet should be hybrid or alternative fuel.	600	15	2.5%	50.9	243,916
City of San Diego	Climate Action Plan (2016) • Increase the number of zero emissions vehicles in the municipal fleet to 50% by 2020 and 90% by 2035 o Consider updating regulations for alternative fuel and zero emissions vehicle requirements for the City's vehicle fleet. o Consider an integrated transportation strategy that combines zero emissions vehicle deployment and infrastructure. o Present to City Council for consideration an Electric Vehicle Charging Plan.	4,400	90[56]	2%	325.19	1,425,976
City of Carlsbad	Climate Action Plan (2015)[57]	TBD	TBD	TBD	37.72	115,877

[52] US Census Bureau QuickFacts, accessed August 2019 https://www.census.gov/quickfacts/fact/table/US/PST045218
[53] City of Encinitas Climate Action Plan https://www.encinitasenvironment.org
[54] City of Chula Vista Climate Mitigation Plan https://www.chulavistaca.gov/home/showdocument?id=5433
[55] City of Chula Vista City Operations Sustainability Plan https://www.chulavistaca.gov/home/showdocument?id=9725
[56] Note: City of San Diego 2018 CAP Annual Report indicates there are 90 EV in the fleet. However, per DGS analysis the number is actually 6 (0.01% of the fleet) because the City included electric carts in the total.
[57] City of Carlsbad Climate Action Plan https://www.carlsbadca/

Fleet Policies		Fleet Statistics			Jurisdiction Statistics[52]	
Jurisdiction	Policies	Total Fleet	Fleet EV	% EV	Size (mi^2)	Population
	• Update the Fleet Management Program to include low and zero-emission vehicle replacement policy. • Increase the proportion of fleet low and zero-emissions WMT to 25% of all city-related VMT by 2035.					
City of Los Angeles	Green New Deal – Sustainability pLAn 2019[58] • "ZEV first" procurement for all city fleets to ensure that 100% of new light-duty purchases are EV by 2021. • Install 400 EVCS (EV charging stations) at City buildings and parks, install EVCS at libraries, install 500 additional streetlight EVCS by 2021. • Deploy battery/solar project at LAPD Motor Transport Div. to power EV fleet by 2025. • 100% medium duty trash and recycling trucks ZEV by 2028. • 100% zero emission cargo handling equipment at the port by 2030. • 100% ZEV drayage trucks by 2035. • Continue national leadership role by adding medium and heavy-duty vehicles to the Climate Mayors EV Purchasing Collaborative.	(TBD) total (includes police and fire depts and GSD fleet)	475	TBD	469	4,094,764
		11,000 (council-controlled depts with fleet admin. by GSD)	TBD	TBD		
Los Angeles County	OurCounty (2019)[59] • 100% of new non-emergency light-duty purchases ZEV or better by 2025; 100% of medium-duty and emergency light-duty purchases ZEV or better by 2035; 100% of all vehicles in the County fleet ZEV or better by 2045. o Convert Sheriff Dept. fleet to ZEV by partnering with manufacturers to develop ZEV pursuit vehicles and transport bus. o Pilot a ZEV fire engine. • 5,000 EVCS at County facilities by 2025; 15,000 EVCS by 2030. • Regularly update fleet policy to require ZEV when available and operationally feasible. • Partner with agencies and private companies to implement "green goods movement" such as medium- and heavy-duty ZEV infrastructure.	20,000 total (includes depts with independent fleets and ISD fleet)	TBD	TBD	2,638	1,095,276
		5,000 (28 depts with fleet admin. by ISD)	599	12%		
City and County of San Francisco	EV Roadmap for San Francisco (2019) • Electrify 100% of non-emergency fleet sedans by 2022. • Electrify remaining diesel transit buses by 2035. • Establish lighthouse projects of early adoption of EV technology for all major categories of medium- and heavy-duty transportation: i.e. work with school	5,267	60	1.1%	46.87	883,305

[58] LA's Green New Deal – 2019 Sustainable City pLAn 2019 https://plan.lamayor.org/sites/default/files/pLAn_2019_final.pdf
[59] Los Angeles County OurCounty https://ourcountyla.org/wp-content/uploads/2019/07/OurCounty-Final-Plan.pdf

Fleet Policies		Fleet Statistics			Jurisdiction Statistics[52]	
Jurisdiction	Policies	Total Fleet	Fleet EV	% EV	Size (mi^2)	Population
	districts to support electric transportation for students, work with Recology to expand electric trucks for waste operations.					
City of Seattle	2017 Drive Clean Seattle Implementation Strategy[60] and 2014 Green Fleet Action Plan[61] • Purchase 100 new EVs through 2017 (40% electrification of light-duty municipal fleet); 250 EVs by 2020 (70% of light-duty); 400 EVs by 2023 (100% of light-duty). • Install 200 new EVCS for fleet vehicles in 2017/18; 300 EVCS by 2020; and 400 EVCS by 2023. • Study managed charging technology. • Participate in fleet demonstrations of EV technology in medium/heavy duty vehicles over the next five years. • Green procurement BEV first, then PHEV, then regular hybrid, then ICE last.	3,480	296	8.5%	83.94	744,955
City of Sacramento	Fleet Sustainability Policy[62] and EV Strategy (2017)[63] • Commitment for 50% of annual light-duty Fleet purchases to be ZEV by 2018 and 75% of annual light-duty Fleet purchases to be ZEV by 2020. • Commitment to test, evaluate, and, where feasible, acquire ZEVs for medium- and heavy-duty vehicle and equipment categories. • "ZEV First" commitment for vehicles and equipment, requiring the procurement of battery-electric, hydrogen fuel-cell, or other ZEV types. • 50% alternative vehicle procurement across all vehicle classes, including electric. • Promote ZEV technologies for medium- and heavy-duty vehicles: i.e. support partner agency efforts to transition bus fleets, support grant opportunities, explore ZEV freight applications.	2,498	51	2%	97.92	508,529
Alameda County	Internal fleet practices • Board direction for 30% of fleet EV by 2030.	1,200	84	7%	435.02	270,110

[60] Drive Clean Seattle 2017/18 https://www.seattle.gov/Documents/Departments/Environment/ClimateChange/Drive_Clean_Seattle_2017_Report.pdf
[61] City of Seattle 2014 Green Fleet Action Plan https://www.seattle.gov/Documents/Departments/FAS/FleetManagement/2014-Green-Fleet-Action-Plan.pdf
[62] City of Sacramento Fleet Sustainability Policy https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Fleet/Fleet-Sustainability-Policy-121217/Fleet-Sustainability-Policy-121217.pdf?la=en
[63] City of Sacramento Electric Vehicle Strategy http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVStrategy_171212_FINAL_CityOfSacramento.pdf?la=en

Fleet Policies		Fleet Statistics			Jurisdiction Statistics[52]	
Jurisdiction	Policies	Total Fleet	Fleet EV	% EV	Size (mi^2)	Population
	• Internal analysis found that 60% of fleet must be hybrid and 30% EV by 2030 (fleet does not purchase conventional gasoline vehicles unless in special circumstances). • Replace 25 retired vehicles annually with EVs. Climate Action Plan for Government Services and Operations (2010)[64] • Adopt fleet management policies and technologies to minimize emissions and improve fleet efficiency. • Expand the use of high efficiency/alternative fuel vehicles in County fleet.					
City of Atlanta	Alternative Fuel Conversion Plan (2018)[65] • Transition 20% of fleet to EV by the end of 2020. • Shared fleet and public EVCS: 69 EVCS for fleet including 20 for public use. • Informally adopted a green fleet policy to guide departments with transition to alternative fuel.	5,800	66	1.1%	133.15	498,044
City of Oakland	Oakland Energy and Climate Action Plan – 2018 Update[66] • Increase the rate of fleet vehicle replacement and replace vehicles with fuel efficient and alternative fuel models. • Expand the City's capacity to support the use of alternative fuel vehicles, such as through the installation of EV charging infrastructure. • Integrate fuel-efficient and zero-emission specialized vehicles (I.e. cargo trikes for park maintenance) into the fleet when appropriate.	1,500	26	1.7%	55.79	429,082
City of Portland	2017 EV Strategy[67] • Add 60 EVs to the City's sedan fleet to achieve 30% by 2020. • Support TriMet's efforts to transition to electric buses. 2015 Climate Action Plan[68] • Sustainable Fleet Strategy in development as of 2017 to guide vehicle selection, including electric and hybrid vehicle purchases.	3,197	196	6.1%	133.43	653,115
City of Columbus	• As part of Smart Columbus effort with other central Ohio public and private sector organizations, the city has pledged to add 200 EVs for code enforcement, janitorial staff, police, and fire administrators.	6,200	125	2%	212.5	892,533

[64] Alameda County Climate Action Plan for Government Services and Operations through 2010 https://www.acgov.org/sustain/documents/climateactionplan.pdf
[65] City of Atlanta Alternative Fuel Conversion Plan https://www.atlantaga.gov/home/showdocument?id=37470
[66] City of Oakland Energy and Climate Action Plan http://www2.oaklandnet.com/oakca1/groups/pwa/documents/policy/oak069942.pdf
[67] 2017 City of Portland EV Strategy https://www.portlandoregon.gov/bps/article/619275
[68] City of Portland Climate Action Plan Progress Report https://www.portlandoregon.gov/bps/article/636700

APPENDIX G: PUBLIC WORKSHOP STAKEHOLDER OUTREACH SUMMARY

Introduction and Overview

As part of the development of the County of San Diego Electric Vehicle Roadmap, Planning and Development Services (PDS) collected public input through a public workshop. The purpose of the workshop was to: educate stakeholders about the current status of EV adoption and charging infrastructure in the region; review current and potential strategies and tools to address EV adoption and infrastructure development in unincorporated and incorporated; solicit feedback on those potential strategies; and explain next steps in the process. This report summarizes the workshop proceedings and participant input.

Public Outreach and Workshop

Efforts to invite the public to the workshop included the following:

- Distribution of an electronic notice to select industry, public agency, environmental, and interest group contacts
- Distribution of an electronic notice to the chairpersons of the Community Planning and Sponsor Groups within unincorporated communities
- Publication of the workshop notice on the PDS Climate Action Plan webpage

PDS staff scheduled the public workshop to occur at the County Operations Center after business hours on a weekday to accommodate industry and professional representatives. The meeting was held at County Operations Center, 5500 Overland Ave, San Diego 92123; July 18, 2019, 5:30 pm - 6:30 pm

Workshop Format

Project Manager Kelly Bray served as the main facilitator and initiated the workshop with welcoming remarks and a review of the workshop's purpose and objectives. She then introduced Land Use/Environmental Planner Meghan Kelly, who began the slideshow presentation that explained the current conditions, projected need for EVs and EV charging infrastructure in the region, and the Board direction. Next, Ms. Bray presented on the EV Roadmap's main goals and potential options to be presented for Board consideration. Ms. Bray then initiated an open discussion to solicit feedback on the goals, recommendations, and options to be presented to the Board.

Summary of Public Input

Approximately 12 stakeholders attended the workshop as recorded on sign-in sheets. The following is a summary of public input during the open discussion period and submitted comment forms.

Goal 1: Electrify the County's fleet, Facilities, and Employee Commute

- Consider joining the Climate Mayors EV Purchasing Collaborative to purchase EVs for the County fleet
- Consider a green fleet policy that requires EVs be the first option at procurement
- Consider installing solar with EVCS at County facilities
- Look into UCSD's vehicle-to-grid program as an example of bi-directional charging that could be utilized with fleet vehicles

- Consider placing EVCS at new construction projects
- Commercial tenants sometimes require EVCS as a condition of moving in
- Older multi-unit dwellings are interested in installing EVCS to keep up with amenities provided at newer complexes
- Consider setting aside funds for EVCS installation in existing MUDs because electrical upgrades can be very costly
- Consider integrating solar panel installations with EVCS installations at MUDs
- Consider a motor pool ambassador program to publicize the availability of EVs for employee use
- Consider employee outreach through EV events, competitions, and information posted to intranet
- Consider cost sharing to monetize the cost of charger installation not covered by grants

Goal 2: Increase the Availability of EV Charging Infrastructure in the Unincorporated County and support Regional Efforts to Electrify the Transportation Network

- Consider online permitting, OTC permitting, and self-inspection for EVCS
- Consider including requirements for skilled personnel
- Consider battery storage
- Consider how EV charging infrastructure requirements, such as conduit installation, will keep pace with the needs of changing technology and the ability to scale up

Goal 3: Ensure that Electrification Reaches all Communities Equitably within the San Diego County Region

- Consider partnering with organizations that provide a “one stop shop” for people to obtain information about grants and other programs, like GRID Alternatives
- Consider partnering with organizations rather than conducting outreach in-house to avoid adding another layer to the process
- Community groups have knowledge of where is best to place a charger and what will work best for the community

Goal 4: Increase EV Ownership in the Unincorporated County through Education, Outreach, Regional Collaboration, and Incentives

- SANDAG supports an extension of the EV Expert
- Create distinct messaging about EVs and EV charging infrastructure for different groups of people because they have different priorities
- Ensure that people working on charging infrastructure projects know what their resources are, especially related to working with their utility company
- Consider a forum where utilities and charging equipment manufacturers can come together

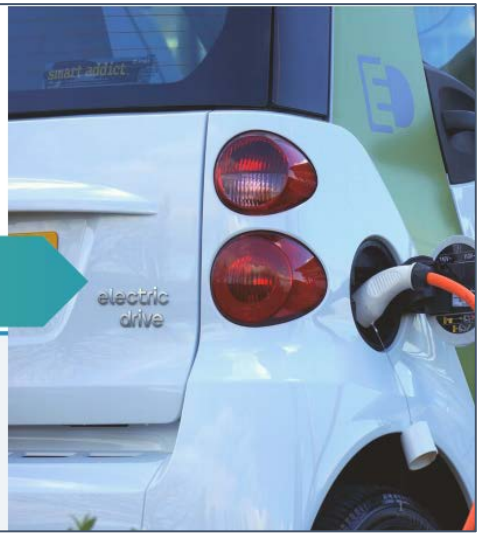
Additional Comments:

- Consider working with rideshare companies to see where drivers go and where they can charge

COUNTY OF SAN DIEGO

Electric Vehicle Roadmap Public Meeting

July 18, 2019



Overview

Presentation Overview

1. Board of Supervisors Direction
2. Existing Legislative Framework
3. County Fleet & San Diego Regional Market Conditions
4. EV Chargers in the Unincorporated County and Projected Demand
5. EV Roadmap Goals and Recommended Actions
6. Discussion

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Overview

Board of Supervisors Direction (April 10, 2019)

- Develop an EV Roadmap
  - Build on existing local studies
  - Include strategies to increase EV ownership and use
  - Result in increased EV charging station infrastructure
- Identify future grant opportunities to support the recommendations included in EV Roadmap
- Direct the Office of Strategy and Intergovernmental Affairs to advocate for legislation that increases affordability and availability of EV vehicles and infrastructure

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Overview

Regulatory Drivers

Executive Order B-16-12 & B-48-18

2025 and 2030 ZEV & Charging Infrastructure Targets

1.5 million ZEV on the road by 2025

250,000 EV chargers by 2025

200 hydrogen fueling stations by 2025

5 million ZEV on the road by 2030

County of San Diego Climate Action Plan

2025 and 2030 Charging Infrastructure Targets

Measure T-3.5: Install 2,040 Level 2 EV charging stations through public-private partnerships at priority locations in the unincorporated county by 2030

Measure T-3.4: Reduce County fleet emissions 10% by 2020 and 20% by 2030 including converting 50 fleet vehicles to EV by 2020 and 250 vehicles by 2025

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Overview

County & San Diego Regional Market Conditions

County Fleet and Charging Infrastructure

- 37 public charging stations at eight County facilities
- 35 EVs in the County fleet with 15 on order

	Fleet Size	Number of EV in Fleet	% of Fleet EV
County of San Diego	4,530	35 (15 pending)	1%
City of San Diego	4,400	90	2%
City of Chula Vista	600	15 (26 pending)	6.8%
City of Oceanside	550	2	0.03%

Regional Market

- 35,000 EVs registered in the region from 2010-2018
- Between 170,000-210,000 EVs will be on the road by 2030 to meet state targets

	Number of EVs	Residential L2	Multifamily L2	Workplace L2	Public L2	DC FC
Current Conditions	34,325	N/A	N/A	3,055 EVCS	1,377EVCS	163 EVCS
2025 Projections	110,227	5,267 EVCS	658 EVCS	4,050 EVCS	5,485 EVCS	1,980 EVCS

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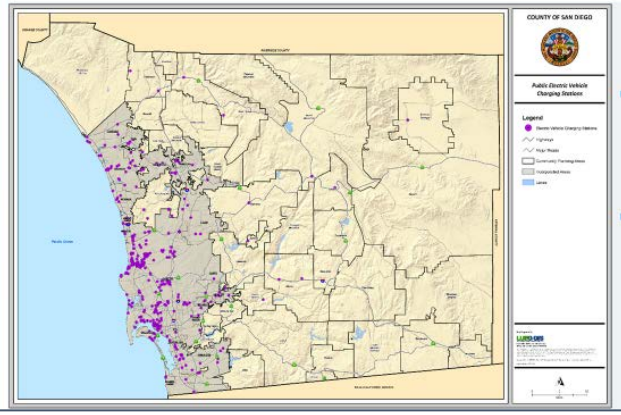
Overview

Existing Public EV Chargers in the Unincorporated County



- **1,377** public Level 2 chargers and **163** DC fast chargers in the region
- **74** public Level 2 chargers and **2** DC fast chargers in the unincorporated area

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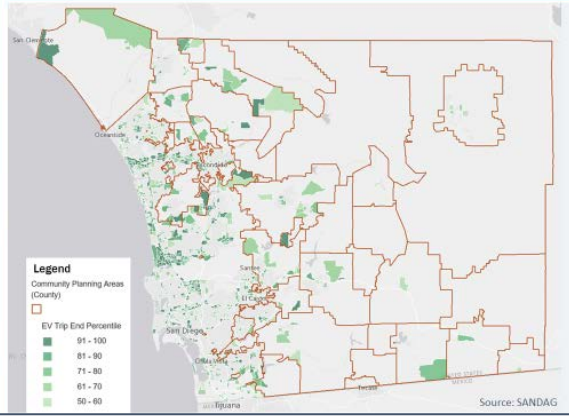
Overview

EV Chargers Projected Demand in 2025



Demand for destination charging stations in 2025:

- Highest EV trip projections correspond with dense populations due to higher likelihood of EV ownership
- In unincorporated areas, high demand at employment areas and casinos

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EV Roadmap Goals

Goal 1: Electrify the County's Fleet, Facilities, and Employee Commute

Goal 2: Increase the Availability of EV Charging Infrastructure

Goal 3: Ensure that Electrification Reaches all Communities

Goal 4: Increase EV Ownership Through Outreach and Education

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Recommended Actions: Goal 1
Electrify the County's Fleet, Facilities, and Employee Commute
Increase County's Fleet Conversion Rate
Install EV chargers at County Facilities for Public Use
Provide Employees with Incentives to Drive EVs
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Recommended Actions: Goal 2
Increase the Availability of EV Charging Infrastructure
Incentivize EV charging infrastructure in new development in the Unincorporated County
Require EV charging infrastructure in new development/major retrofits in the Unincorporated County
Increase Regional Permitting Certainty
10


Recommended Actions: Goal 3
Ensure that Electrification Reaches All Communities Equitably within the Unincorporated County and Region
Prioritize funding for EV chargers in priority communities
Utilize targeted outreach to encourage EV uptake
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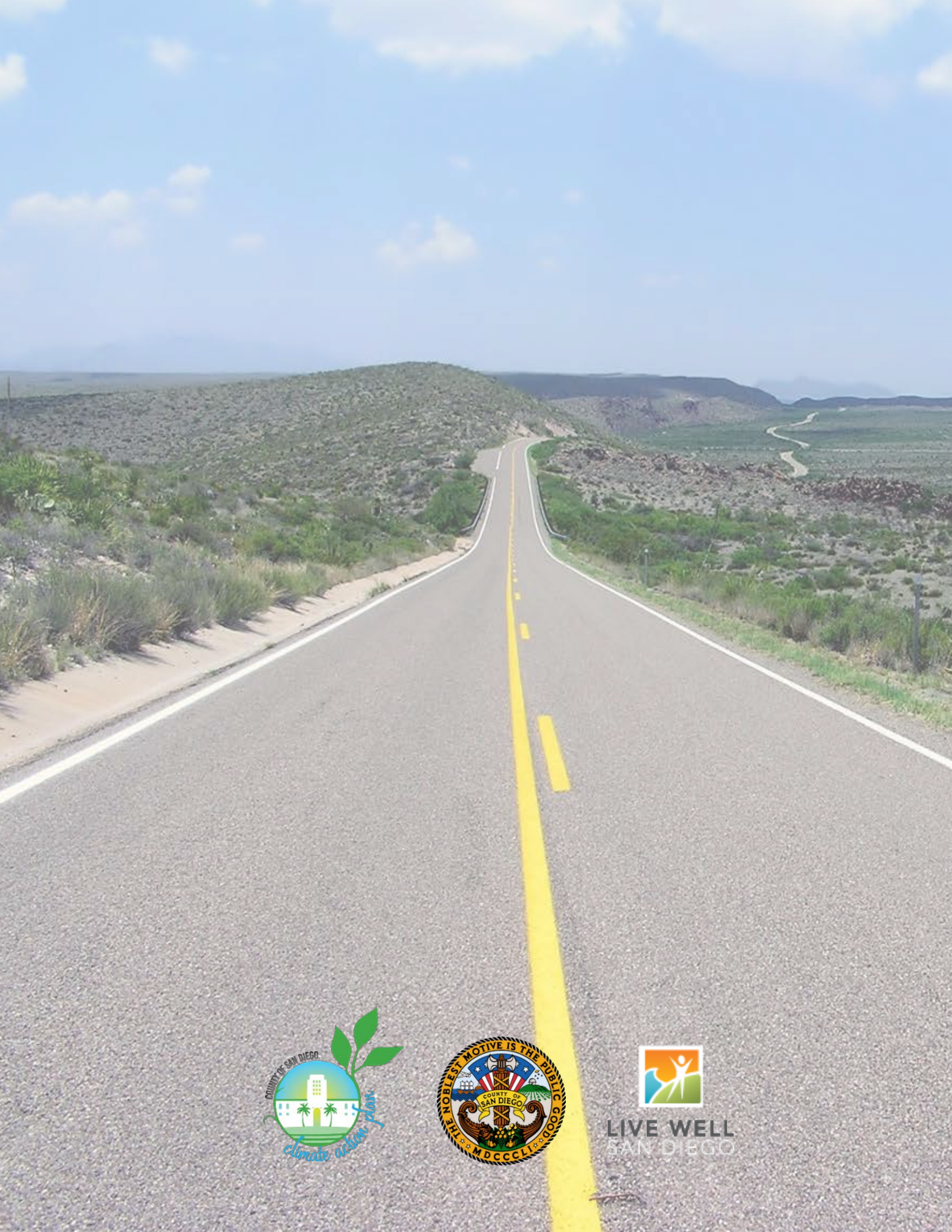
Recommended Actions: Goal 4
Increase EV Ownership in the Unincorporated County through Education, Regional Collaboration, and Incentives
Focus Outreach to Increase EV Conversion Rates
Provide EV Expertise to Increase Conversion Rates
Develop a Local EV Incentive Program to Increase Conversion Rates
12


COUNTY OF SAN DIEGO
climate action plan
THE NOBLEST MOTIVE IS THE PUBLIC GOOD
COUNTY OF SAN DIEGO
MDCCCLI
LIVE WELL
SAN DIEGO