VENTURA COUNTY

ELECTRIC VEHICLE READY BLUEPRINT

JULY 2019

VCREA
www.vcenergy.org

Community Environmental Council

Ventura County Electric Vehicle Ready Blueprint

Prepared by:
VCREA, Community Environmental Council, and EV Alliance

Funded by the EV Ready Communities Challenge Grant
from the California Energy Commission

July 2019

Acknowledgements

Ventura County Regional Energy Alliance Board of Directors

Linda Parks … Chair, County of Ventura
Carmen Ramirez … Vice Chair, City of Oxnard
Christy Weir … City of Ventura
Tim Holmgren … City of Fillmore
Laura Hernandez … City of Port Hueneme
Carlos Juarez … City of Santa Paula
Mike Judge … City of Simi Valley
Ed Jones … City of Thousand Oaks
Scott Quady … Calleguas Municipal Water District
Bernardo Perez … Ventura County Community College District
Bert Perello … Ventura Regional Sanitation District
Jackie Moran … Ventura Unified School District

Ventura County Regional Energy Alliance Staff

Sue Hughes … Executive Director
Alejandra Tellez … Program Manager
Heather Allen … Program Administrator
Kelly Cattanach … Program Administrator
Wyatt Stoker … Program Specialist
Andrew Wakelee … CivicSpark Fellow

Community Environmental Council

Michael Chiacos … Energy & Climate Program Director
Cameron Gray … Transportation & Climate Manager
Jennifer Hernandez-Munoz … Energy & Climate Program Assistant

EV Alliance

Richard Schorske … Executive Director
Sharon Tobar … Chief Financial Officer
Jane Chipman … Senior Program Manager
Sam Irvine … Program Manager

EV Ready Blueprint Partners and Coalition Members

Giles Pettifor … Port of Hueneme
Danny McQuillan … Ventura County Air Pollution Control District
Lynn Edmonds … City of Fillmore
John Proctor … City of Santa Paula
John Brooks … City of Thousand Oaks
Lars Davenport … City of Ventura
Chris Melton … County of Ventura
Alexandra Garcia … CAUSE

Lucia Marquez………..CAUSE
Adrian Gomez…………………………..……………………………..……………………………………Clean Vehicle Assistance Program
Krystalin Bullicer…………………………………………………………Housing Authority of the City of San Buenaventura
Kelly Ferguson……………………………………………………………………..…………………….Los Angeles Clean Incubator
Arcenio Lopez…………………………..…………………………………………………………..……………………………………….MICOP
Carolyn Sims…………………………………………………………………………………………..………………Southern California Edison
Leo Henggeler………..Towbes Group
Lisa Leombruni……………………………………………………………….………………University of California, Santa Barbara
David El Fattel………………………………………………………………………Ventura County Community College District
Kent Bullard…………………………………………..………………………………………..………..EV Advocates of Ventura County
Mary Haffner…………………………………………………………………………..……….….… Ventura Unified School District
Patricia Duffy……………………..……………………………………………………………………Workforce Investment Board

Special Acknowledgement to the EV Advocates of Ventura County, a volunteer group formed in 2014 to support EV development in Ventura County through advocacy, education and outreach. The volunteer group has a diverse membership of EV owners who all share a common interest in volunteering for the benefit of advancing awareness and knowledge about EVs within Ventura County.

Executive Summary and Document Guide

The Ventura County Electric Vehicle Ready Blueprint is intended to accelerate and support electric vehicle and charging infrastructure deployment throughout Ventura County. Development of the Blueprint was funded by a competitive grant award from the California Energy Commission. The project team of Ventura County Regional Energy Alliance, Community Environmental Council, and EV Alliance has collaboratively developed the Blueprint framework to spur rapid adoption of electric vehicles in the region, in alignment with the State of California's goal to deploy 5 million Zero Emission Vehicles (ZEVs) by 2030.

Electric vehicles are a truly transformative technology, as they emit zero tailpipe emissions, reduce greenhouse gas (GHG) emissions by about 70 percent per mile compared to a gasoline vehicle (up to 100 percent for the many parts of Ventura County that utilize 100 percent clean energy), and achieve over 100 miles per gallon equivalent, allowing fueling costs as low as $1.50 per gallon equivalent. As transportation makes up about half of Ventura County's GHG emissions, transitioning to ZEVs is an urgent and critical element of local climate action.

The vision for the Ventura County Blueprint is to develop replicable models for statewide transportation electrification that will make electric vehicles and other clean mobility options fully accessible to everyone in our communities. The Blueprint's comprehensive recommendations are intended to help local policymakers and community and business stakeholders take bold action to further accelerate the adoption of electric vehicles and expand access to charging infrastructure.

Ventura County's 850,967 residents live in ten cities and the unincorporated County. As of October 2018, 8,589 of the 723,425 registered vehicles in the county were pure battery electric or plug-in hybrid electric vehicles, or roughly 1.2 percent of the total. While most of these electric vehicle drivers primarily charge at home at thousands of residential charging stations, the public network is growing quickly. As of early 2019, the County hosted 54 Level 1 chargers, 306 Level 2 chargers, and 92 DC Fast Chargers. To meet Ventura County's share of California's goals, the County's roads will need to host 35,307 ZEVs by 2025 and 116,777 ZEVs by 2030 (roughly 15 percent of all vehicles). While this growth may seem daunting, 2018 saw electric vehicles achieve almost 10 percent of new vehicle sales across California. That electric vehicle market share must further accelerate to 30 to 40 percent of new vehicle sales by 2030 to achieve the state's ambitious targets. Fortunately, the 2020's are expected to bring initial purchase price parity between electric vehicles and conventional vehicles and confer substantial advantages to electric vehicle drivers in reduced Total Cost of Ownership over the lifetime of an electric vehicle.

To meet the region's anticipated demand for electric vehicle charging by 2025, the County is estimated to need 3,241 public electric vehicle charging stations. This includes 1,073 charging stations at multifamily housing developments, 800 charging stations at the region's workplaces, 1,167 public Level 2 charging stations, and 201 DC Fast Charge stations. This additional charging infrastructure is especially critical to ensuring that the almost 40 percent of Ventura County residents who live in multifamily housing have an opportunity to choose and charge electric vehicles. The Blueprint identifies the largest workplaces, destinations, multifamily properties, and other locations that should be prioritized for the next generation of charging infrastructure. It also suggests strategies for successfully accessing the many relevant funding programs administered by the State of California, Southern California Edison (SCE), and other entities.

The Plan Summary that appears at the beginning of the Blueprint provides an overview of context and barriers to electric vehicle deployment and identifies targets and strategies for increasing electric vehicle and charging infrastructure deployment for various customer segments and use cases. It includes recommended goals and actions to help the County of Ventura and its cities lead by example with their own fleets and employees, jumpstart electric vehicle charger deployment at large employers and multi-family housing developments, ensure that the benefits of clean vehicles are accessible to Ventura's Disadvantaged Communities and low-moderate income households, and proposes a fleet electrification strategy that begins with an initial focus on public agencies, electric transit, and school buses.

The Blueprint's companion Electric Vehicle Accelerator Plans provide distinct community-specific Electric Vehicles Plans for the Cities of Ventura and Oxnard, and the Port of Hueneme. The Accelerator Plans provide program strategies for helping each jurisdiction transition its own fleet to electric vehicles, catalyze greater electric vehicle adoption amongst their own employees, and develop sufficient charging infrastructure for their communities. The Port's plan takes a special look at the health and environmental impact of electrifying drayage and heavy-duty trucks and powering these trucks and off-port warehouses with renewable energy.

A comprehensive, step-by-step plan to electrify the transportation sector in Ventura County is included after the plan summary and is supported by a conceptual list of 49 projects, with high-level project descriptions, potential partners, and projected outcomes and benefits. These diverse projects range from the implementation of electric carsharing, to charging at multifamily housing, farmworker electric vehicle vanpooling, and much more. The projects will be prioritized by the Blueprint project team and local stakeholders in anticipation of the California Energy Commission's Phase 2 Blueprint Implementation funding and other potential funding sources.

The Blueprint's technical chapters include:

- Plan Summary
- Step by Step Implementation Guide
- Funding-Ready Project Concepts
- Chapter 1: Key State, Regional, and Local Electric Vehicle Goals, Policies, and Programs
- Chapter 2: Technology and Market Context for Light Duty Electric Vehicles
- Chapter 3: Charging Infrastructure for Light-Duty Electric Vehicles and Electric Vehicle-Grid-Integration
- Chapter 4: Technology and Market Context for Medium and Heavy-Duty Electric Vehicles
- Chapter 5: Accelerating Fleet Electrification
- Chapter 6: Electric Vehicle Market Acceleration
- Chapter 7: Autonomous, Connected, and Shared Electric Vehicles
- Chapter 8: Public Electric Vehicle Siting, Permitting, and Installation
- Chapter 9: Innovative Electric Mobility and "First Mile, Last Mile" Solutions
- Chapter 10: Electric Vehicle Workforce Development
- Chapter 11: Resourcing the Plan

The Blueprint development process included robust stakeholder engagement and the expert input of the Ventura County Electric Vehicle Ready Communities Coalition. The Coalition met five times over the course of the project and included more than 25 stakeholders representing local governments, Port of Hueneme, workforce development interests, affordable housing authorities, commercial property management companies, businesses, community-based organizations, and nonprofit advocates. The project team also led public outreach to more than 100 major employers and property managers, conducted three focus groups and two listening sessions (two delivered in Spanish), and collected a total of 1,200 employee responses from three workplace surveys and 47 resident responses from one multifamily housing development survey. The community survey work received 350 comments as well as obtained 447 sign-up requests for Electric Drive 805 (the regional electric vehicle readiness initiative website) updates and notifications.

Ventura County and California stand at the cusp of the largest change in transportation technology in over 100 years - as we witness the integration of electric, autonomous, connected, and shared vehicle technologies. Electric vehicles have the potential to promote social equity and shared prosperity, especially in our most vulnerable communities, by dramatically decreasing air and climate pollution and reducing mobility costs. Autonomous and shared technologies have the potential to greatly increase safety and reduce congestion. To achieve these outcomes, however, requires both a bold vision and adequate resources. To that end, the Ventura County Electric Vehicle Ready Blueprint also identifies funding sources and strategies to help attract increased funding to the region to advance Ventura's own vision of sustainable mobility. With Ventura County residents currently spending more than one billion dollars annually on gasoline expenditures, the accelerated electric vehicle transition envisioned here promises to put hundreds of millions of dollars back in local circulation as we replace harmful fossil fuels with locally generated clean renewable energy, while improving mobility for all Ventura residents.

It is our hope that Ventura County policy makers, community leaders, and the public-at-large will quickly embrace this vision and act swiftly on the Blueprint's recommendations, bringing forward a robust electric vehicle ecosystem in Ventura County.

Table of Contents

Acronym List

AB: Assembly Bill
ACES: Autonomous, Connected, Electric, Shared Vehicles
ADA: American with Disabilities Act
AFDC: Alternative Fuels Data Center
APCD: Air Pollution Control District
API: Application Programming Interface
AQIP: Air Quality Improvement Program
AQMP: Air Quality Management Plan
ARFVTP: Alternative and Renewable Fuel and Vehicle Technology Program
BEV: Battery Electric Vehicle
CAISO: California Independent System Operator
CAP: Climate Action Plan
CARB: California Air Resources Board
CARE/FERA: California Alternative Rates for Energy/Family Electric Rates Assistance
CAUSE: Central Coast Alliance United for a Sustainable Economy
CCS: Combined Charging System
CCMSIP: California Clean Miles Standard and Incentive Program
CEQA: California Environmental Quality Act
CNG: Compressed Natural Gas
CPA: Clean Power Alliance
CPUC: California Public Utilities Commission
CSUCI: California State University Channel Islands
CVAP: Clean Vehicle Assistance Program
CVRP: Clean Vehicle Rebate Program
DAC: Disadvantaged Community
DC: Direct Current
DMV: Department of Motor Vehicles
DSG: Dyer-Sheehan Group
EFMP: Enhanced Fleet Modernization Program
EVI-Pro: Electric Vehicle Infrastructure Pro
EVITP: Electric Vehicle Infrastructure Training Program
EVSE: Electric Vehicle Supply Equipment
GCT: Gold Coast Transit District
GHG: Greenhouse Gas
GIS: Geographic Information System
GO-Biz: Governor's Office of Business and Economic Development
HOV: High Occupancy Vehicle
HVIP: Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project
IBEW: International Brotherhood of Electrical Workers
ICE: Internal Combustion Engine
ICLEI: Local Governments for Sustainability
ICT: Innovative Clean Transit

kW: Kilowatt
kWh: Kilowatt Hour
LACI: Los Angeles Cleantech Incubator
LCE: Lancaster Choice Energy
LCFS: Low Carbon Fuel Standard
LCJA: Leadership Council for Justice and Accountability
LCTOP: Low Carbon Transit Operations Program
LED: Light Emitting Diode
LEED: Leadership in Energy and Environmental Design
LIC: Low-income Community
MICOP: Mixteco/Indígena Community Organizing Project
MCE: Marin Clean Energy
MMT: Million Metric Tons
$MTCO_2e$: Metric Ton of Carbon Dioxide Equivalent
MUD: Multi-unit Dwelling
MUSD: Moorpark Unified School District
NAFTC: National Alternative Fuels Training Consortium
NEV: Neighborhood Electric Vehicle
NDEW: National Drive Electric Week
NOx: Nitrous Oxide
NREL: National Renewable Energy Lab
OEM: Original Equipment Manufacturer
PAYS: Pay-As-You-Save
PCE: Peninsula Clean Energy
PHRESH: Port of Hueneme, Reducing Emissions, Supporting Health
PM: Particulate Matter
RCEA: Redwood Coast Energy Authority
RFI: Request for Information
RFP: Request for Proposal
RPH: Range Per Hour
SB: Senate Bill
SCAG: Southern California Association of Governments
SCE: Southern California Edison
SCP: Sonoma Clean Power
SUV: Sport Utility Vehicle
TCO: Total Cost of Ownership
TNC: Transportation Network Companies
TOU: Time of Use
T-TEN: Toyota's Technician Training and Education Network
UCLA: University of California, Los Angeles
VMT: Vehicle Miles Traveled
VCREA: Ventura County Regional Energy Alliance
VCTC: Ventura County Transportation Commission
VGI: Vehicle Grid Integration

V2G: Vehicle-to-Grid
V2V: Vehicle-to-Vehicle
ZAP: Zero-emission Assurance Project
ZEB: Zero Emission Bus
ZEV: Zero Emission Vehicle

Ventura Electric Vehicle Blueprint Plan Summary

Introduction

The Ventura County Electric Vehicle Ready Blueprint is intended to support electric vehicle and associated charging infrastructure development throughout Ventura County. The Blueprint highlights the existing market, funding, and policy context informing electric vehicle ecosystem development at regional and local levels for Ventura County. The Ventura County Electric Vehicle Ready Blueprint also provides a set of comprehensive recommendations to further accelerate the adoption of electric vehicles, expand access to electric vehicle charging through infrastructure improvements, and align Ventura County's transportation electrification initiatives with California's statewide electric vehicle programs, projects, and incentives.

Market, policy, and regulatory forces are beginning to drive a dynamic period of growth in the electric vehicle ecosystem in Ventura County. With longer-range battery electric vehicles now entering the marketplace at more attractive price points, electric vehicle sales could increase dramatically in the next two to five years. Further, the state of California – as well as utilities and regional public agencies - are making unprecedented levels of funding available for electric vehicle incentives and infrastructure. However, much of this funding is available only on a competitive or first-come, first-served basis. Therefore, it is crucial that Ventura stakeholders unite behind a bold vision of electric vehicle leadership in order to claim the region's fair share of available resources.

In alignment with this need, the Community Environmental Council and Ventura County Reginal Energy Alliance (VCREA) created a vision statement for the Ventura County Electric Vehicle Ready Blueprint with key stakeholders participating in the Electric Vehicle Ready Communities Coalition. The vision for the Ventura County Blueprint is to develop replicable models for statewide transportation electrification with projects, programs, and initiatives that will make electric vehicles and other clean mobility options more accessible to everyone in our communities. The goal of the Ventura County Electric Vehicle Ready Blueprint is to identify key actions and a step-by-step process that regional stakeholders can follow to achieve equitable transportation electrification, which will prioritize solutions that deliver clean mobility benefits to the region's most impacted communities. If the goal and vision of the Ventura County Electric Vehicle Ready Blueprint are fully realized, the region will have a thriving multi-modal transportation network that moves both people and goods with California's affordable and increasingly renewable electricity. Communities across Ventura County will benefit as a result, enjoying cleaner air, enhanced transportation access, and improved economic vitality.

Coordinated action by electric vehicle stakeholders will be crucial for effective implementation of the Blueprint. To sustain accelerating growth in regional electric vehicle adoption, public charging infrastructure must keep up with the anticipated increase in electric vehicle sales. There must be assurance that electric vehicle adopters are able to move about the region with full confidence in their ability to recharge conveniently as needed at workplaces, commercial and tourist destinations, along key travel corridors, and at home – including multifamily housing developments. By adopting these recommendations, Ventura County's civic leaders, businesses, and electric vehicle stakeholders will ensure a positive experience for electric vehicle drivers, and further accelerate electric vehicle adoption throughout the region's public and private transportation sectors. The recommended actions in this Blueprint will in turn enable Ventura County residents to gain the greatest possible economic, environmental, and mobility benefits from the historic shift to electrified transportation. Most importantly, accelerating the electrification of transportation will rapidly reduce carbon emissions, and help ensure that all Californians – including coming generations – can prosper in a livable climate and a sustainable world.

Electric Vehicle Blueprint Development Approach

The Ventura County Electric Vehicle Ready Blueprint reflects both an assessment of current best practice in electric vehicle ecosystem development, as well as the results of an extensive stakeholder engagement process. Stakeholder engagement included these elements:

- Convening the Ventura County Electric Vehicle Ready Communities Coalition, which met five times over the course of the project and included over 25 stakeholders representing local governments, Port of Hueneme, workforce development interests, affordable housing authorities, commercial property management companies, community-based organizations, and nonprofit advocates
- Public outreach to more than 100 major employers and property managers to promote and encourage electric vehicle infrastructure development at workplaces and multifamily housing developments
- Conducting three focus groups and two listening sessions that reached more than 100 community members, including: students at Oxnard Adult Education, young adults volunteering with CAUSE, and Spanish-speaking parents that are members of the Ventura Unified School District's English Language Advisory Committee (two of the three focus groups were delivered in Spanish)
- Leading five workplace Lunch and Learn presentations, tabling at public events, and one Electric Vehicle Ride and Drive outreach event at the County of Ventura to increase awareness of electric vehicles and promote electric vehicle adoption, which reached more than 200 County employees
- Collecting a total of 1,200 employee responses from three workplace surveys and 47 resident responses from one multifamily housing development survey, as well as 350 comments about perceived or actual barriers among people that are not considering an electric vehicle currently
- Obtaining 447 sign-up requests for Electric Drive 805 updates and notifications about electric vehicle-related news, incentives programs, community events, infrastructure development, and policies
- A survey of existing state policies, targets, and funding programs related to electric vehicles and associated charging infrastructure
- A summary of regional utility, and air quality management district programs in support of transportation electrification
- A comprehensive review of existing climate, sustainability, and electric vehicle-related plans, policies, and goals of Ventura County and its municipalities to identify additional opportunities for electric vehicle-supporting actions and recommendations.

Overarching Targets of the Ventura County Electric Vehicle Ready Blueprint

The following targets represent ambitious but attainable electric vehicle adoption and charging infrastructure goals for the period from 2020 through 2030, with a focus on the five-year benchmark year of 2025. The achievement of these goals will establish Ventura County as a regional leader in California's effort to reduce dangerous global warming pollutants and electrify the transportation system.

- **T1. Establish and meet countywide targets for electric vehicle adoption** in alignment with the statewide 2025 goal of 1.5 million ZEVs, and the 2030 goal of 5 million ZEVs. (Achieving these goals in Ventura County will require that electric vehicles comprise at least one out of every eight vehicles on the road by 2030).
- **T2. Establish and meet countywide targets for electric vehicle infrastructure** -- including both Level 2 and DC Fast Charge station development – in alignment with State goals for 2025. To meet the region's anticipated demand for electric vehicle charging, National Renewable Energy Lab (NREL) and the California Energy Commission estimate that the County will need a total of 3,241 electric vehicle charging stations. This includes 1,073 charging stations at multifamily housing developments, 800 charging stations at the region's workplaces, 1,167 public destination Level 2 charging stations, and 201 DC Fast Charge stations.
- **T3. Transition at least 20 percent of public and private vehicle fleets to electric vehicles by 2030**, in alignment with California's 2030 goal of 5 million ZEVs on the roads.
- **T4. Implement at least one electric vehicle carshare and/or rideshare pilot project by 2021** for a multifamily housing or high-density location accessible to Low-income and Disadvantaged Communities.
- **T5. Support County of Ventura employees to achieve double the rate of the Ventura region's public electric vehicle adoption by 2025.** According to the most recent California Department of Motor Vehicle data, Ventura County's current electric vehicle adoption rate is 1.19 percent. As of October 2018, only 8,589 of 723,425 registered vehicles in the county were battery electric vehicles or plug-in hybrid electric vehicles. Based on survey data collected for the Ventura County Electric Vehicle Ready Blueprint, it is estimated that the County of Ventura currently has an employee electric vehicle adoption rate of 1.5 percent.
- **T6. Set public and private fleet ZEVs goals that mirror those set by California Department of General Services, with 25 percent of new light duty vehicle (excluding light-duty safety vehicles) purchases being ZEVs by 2020 and 50 percent by 2025.** Additionally, set a goal of 75 to 100 percent of light duty purchases being ZEVs by 2030.
- **T7. Deploy electric vehicle chargers at or near the 100 largest workplaces in Ventura County by 2025.**
- **T8. Deploy at least two electric vehicle chargers at or near the 100 largest multi-unit dwellings (MUDs) and the 50 largest MUDs in Disadvantaged Communities by 2025.**
- **T9. Provide electric vehicle incentives to an additional 5,000 residents** in the region's Disadvantaged and Low-income Communities by 2025. [1]

---

[1]As of mid-2019, a total of 3,086 total Clean Vehicle Rebate Program rebates have been issued in Ventura County since the increased low-to-moderate income rebates were offered. However, only 200 of these rebates (less than 6.5 percent) have been provided to low-to-moderate income households.

T10. Deploy at least one all-electric bus at each of the transit districts in Ventura County by 2022 – and explore adoption of a 2030 target for 100 percent zero emission transit fleets for all transit districts in Ventura County by 2020.

T11. Deploy at least one all-electric school bus at each of the County's school districts by 2022 – and enable at least one district to achieve electric vehicle leadership status with 100 percent electric buses by 2025.

Summary of Context, Barriers, and Recommendations

The Ventura County Electric Vehicle Ready Blueprint has identified key barriers to transportation electrification efforts across multiple customer segments and electric vehicle use cases as well as proposed recommendations designed to accelerate electric vehicle and electric vehicle charging adoption in the 2020 to 2030 timeframe. The following is a summary of these barriers and recommendations. Additional detail is provided in each of the Electric Vehicle Blueprint Chapters.

Multi-Unit Dwellings (MUDs)

Context: Nearly half (45.5 percent) of California's population are renters. In Ventura County, 38.6 percent of the population (an estimated 329,730 out of 854,233 residents) live in rental housing. [2] Electric vehicle uptake for residents in MUDs lags substantially behind electric vehicle uptake for residents in single-family homes, even after adjusting for household income. Many MUD residents report that the difficulty of installing charging in apartment buildings is a key barrier to purchasing an electric vehicle. To increase overall electric vehicle uptake in the County, it will be essential to increase charging access for MUD residents. This can be accomplished through a combination of on-site charger deployment in MUDs, additional charging deployment at workplaces, and charging station development at other publicly accessible sites near MUDs.

Barriers to MUD electric vehicle and charging adoption: Without countervailing incentives, MUD owners are reluctant to invest in chargers due to a broad range of factors, including: 1) tenant turn over and potential risk of stranded charging infrastructure; 2) uncertainty regarding the tracking of charging costs; 3) site-specific physical challenges that result in high costs of installation, including parking constraints and local minimum parking space requirements for MUD developments; and 4) lack of financial incentives for owners to adopt charging, even when installation and equipment are provided for free.

To better understand these and other barriers in the MUD context, the Electric Vehicle Ready Blueprint's outreach team contacted 68 property managers from February to March 2019. Engagement and interest in electric vehicle infrastructure development among the contacted property managers was low compared to other stakeholder groups. Of the 68 properties contacted, only nine properties expressed even minimal interest, and no properties in Disadvantaged Communities were among this group. From the project team's contact with property owners, it is clear that special incentives and engagement efforts will be required to advance electric vehicle infrastructure deployment at MUDs in general, and especially in lower-income and disadvantaged areas.

---

[2] United State Census Bureau. 2013-2017 Census data for the State of California and Ventura County. State data: https://www.census.gov/quickfacts/ca. Ventura County data: https://www.census.gov/quickfacts/venturacountycalifornia

Recommended Actions

1. **Educate tenants on the "electric experience" to create demand for MUD charging.**
2. **Focus programs on new MUD construction and geographies with public charging gaps.**
3. **Deploy public charging at or near larger clusters of apartments and condos.**
4. **Convene utility, industry, and funding partners to coordinate MUD electric vehicle charging deployment.**
5. **Educate and outreach to engage and inspire property managers** to implement step-by-step guides for MUD charging installation.
6. **Focus investment on electric vehicle infrastructure that will serve MUD residents in Ventura County's Disadvantaged Communities.**
7. **Target MUD outreach to properties with 17 or more units** that are subject to the 2013 California Building Code for electric vehicle charging infrastructure development. (As of January 2, 2014, the California Building Code requires that all MUDs with 17 or more units shall set aside three percent of the total number of parking spaces, but no less than one parking space, to be charging station capable, i.e., have stub-outs and sufficient panel capacity to accommodate Electric Vehicle Supply Equipment (EVSE)).[3]

Resources to build on: To assess the top opportunities for onsite MUD charging, the project team identified the 100 largest MUDs in Ventura County and the 50 largest MUDs in the region's Disadvantaged Communities (see Chapter 3's Appendix for the complete dataset). Properties were assessed using these key criteria: 1) number of units; 2) proximity to a Disadvantaged Community or low-income area; 3) ownership interest in electric vehicle charging (as indicated to the Electric Vehicle Ready Blueprint's outreach team via phone or email); 4) presence of a resident Electric Vehicle Champion; 5) amount of existing charging, if any; and 6) participation in the SCE Charge Ready program. This information will be utilized to prioritize projects for potential funding under relevant state, local, and utility programs. These include upcoming Energy Commission funding programs for MUD charging infrastructure; existing and planned SCE and Clean Power Alliance (CPA) incentive programs; and Ventura County Air Pollution Control District (APCD) electric vehicle infrastructure funding opportunities.

E-Mobility for Disadvantaged Communities

Context: As defined by Senate Bill (SB) 350, state-identified Disadvantaged Communities are the most burdened census tracts in California. Relative burden is determined by a review of 20 key factors pertaining to pollution, health, and socio-economic status. In Ventura County, 36,915 people live in Disadvantaged Communities as identified by the state of California's CalEnviroScreen 3.0 website, developed by the Office of Environmental Health Hazard Assessment. Ventura County's Disadvantaged Communities are concentrated in parts of the Cities of Ventura and Oxnard.

[3] The 2013 California Building Code became effective on January 2, 2014. MUDs with 17 or more units that were permitted and constructed after this date should have the required EV charging station capable parking spaces. For more information, see 2013 Chapter 11. Section 4.106.4.2 of the California Building Code.

Barriers to electric vehicle and associated charging adoption in Disadvantaged Communities: Residents of Disadvantaged Communities are affected by many of the same barriers to electric vehicle adoption as other residents in Ventura County. However, the burden of high EVSE deployment costs, longer commute distances, and higher fuel costs have a disproportionate impact on Disadvantaged Community households. All three focus groups and one of the two listening session conducted by the Electric Vehicle Ready Blueprint's outreach team were located in Disadvantaged Communities.

Several important trends related to electric vehicle barriers emerged from focus group and listening session discussions about electric vehicles. Recurring questions and comments from the Disadvantaged Communities focus groups highlighted the following themes related to electric vehicle awareness and community barriers to electric vehicle adoption:

- **Electric vehicle charging and range concerns**: there were many questions about how long it takes to recharge an electric vehicle, the availability of charging for longer distance trips, the cost to charge, and how to locate public charging stations. There were also concerns about what happens if a person's battery runs out of charge.
- **Vehicle maintenance**: reduced maintenance was identified as a significant benefit, but battery replacement costs and warranties were among the most commonly cited and significant concerns. There were frequent questions about where to go for electric vehicle repairs, the most common repairs needed for electric vehicles, how electric vehicle components differ from internal combustion engines vehicles, and electric vehicle warranties including battery warranty periods.
- **Electric vehicle incentives**: many participants had questions about the types of electric vehicle incentives, eligibility requirements, application process, and incentive delivery. In some cases, participants asked if they needed to be a legal resident of the U.S. to apply for electric vehicle incentives.
- **Electric vehicle options and availability**: participants wanted to know more about the availability of different electric vehicle models. There was a desire for more electric Sport Utility Vehicles (SUVs) and trucks.
- **Transportation needs**: in general, participants indicated a high reliance on personal vehicles to meet their transportation needs. The need for more reliable public transit options was cited in all focus groups. Participants were interested and enthusiastic about shared electric mobility options but indicated infrequent use of Uber and Lyft due to cost and concerns about safety. Participants cited a need for more protected bike lanes to support emerging e-bike share and e-scooter options.
- **Financing and credit**: some focus group participants shared that they lack a line of credit or do not have active credit cards, which would affect their ability to secure financing for electric vehicle leases or low-interest loans for electric vehicle purchases.
- **Vehicle costs**: many participants had additional questions about the affordability of electric vehicles and the most affordable electric vehicle models.
- **Parking availability**: a lack of parking availability was cited, particularly among renters.

Findings from the Disadvantaged Community Focus Group highlight the need for multilingual education and outreach that is targeted to address specific gaps in knowledge affecting electric vehicle adoption among low-to-moderate income households in Ventura County. For specific education and outreach findings, see the later discussion on Electric Vehicle Market Acceleration. Beyond education and outreach, the Ventura County Electric Vehicle Ready Blueprint's recommendations are intended to address some of the key barriers to electric vehicle adoption for the region's Disadvantaged Communities.

Recommended Actions

1. **Enhance incentive access for Disadvantaged Community members** through multilingual education and outreach by community-based organizations and the Ventura County Electric Vehicle Ready Communities Coalition.
2. **Engage electric vehicle carsharing providers to serve Low-income Communities.**
3. **Promote used electric vehicle options** and the state's Clean Vehicle Assistance Grant program, which provides a $5,000 down payment grant for the purchase of used electric vehicles
4. **Promote electric paratransit options** and seek to identify pilot program opportunities with regional partners.
5. **Assess the potential for electric bus deployments to enhance e-mobility access** for Low-income Communities – in partnership with Gold Coast Transit District (GCT), Ventura County Transit Commission (VCTC), and other transit providers.
6. **Engage state-certified smog check locations to share information about electric vehicle rebates** and incentives that can be stacked with the Bureau of Automotive Repair's Consumer Assistance Program rebate for the voluntary retirement of a high polluting vehicle ("cash for clunkers").
7. **Track implementation of and promote California Air Resources Board's (CARB) forthcoming Zero-Emission Assurance Project battery replacement**, which will provide a rebate of up to $1,800 for the replacement of an electric vehicle battery.

Resources to Build On: SB 350 requires that the state set aside 25 percent of funding for most electric vehicle infrastructure and related clean energy programs for state-designated Disadvantaged Communities, and an additional ten percent of funding to low-income communities and households. These programs – which are often competitively awarded – can provide substantial assistance to Ventura County Disadvantaged and Low-income Communities, as identified by the California Office of Environmental Health Hazard Assessment and CARB. Electric vehicle stakeholders should seek to develop projects targeting Disadvantaged and Low-income Community residents to support California's clean energy and transportation equity goals, as set forth in SB 350.

Public Charging

Context: Recent surveys of Ventura County have identified approximately 500 public electric vehicle charging ports already deployed throughout the County. To achieve its pro-rata share of the state's goals for electric vehicle charging deployment in the region, Ventura County will require between 2500 and 3700 Public Level 2 charging ports, and 100 to 300 DC Fast Charge ports by 2025.

Barriers to public charging: Key barriers preventing increased deployment of public charging include: 1) challenges identifying appropriate sites; 2) difficulty engaging site owners or property managers; 3) low awareness of the charging station site assessment and installation process; 4) need for increased electrical capacity; 5) America with Disabilities Act (ADA) accessibility requirements; 6) high upfront cost for some installations and ongoing maintenance and operation costs; and 7) lack of knowledge about effective charging station fee structures to recover costs.

Recommended Actions

1. **Install electric vehicle charging stations at all local government parking lots** – with special emphasis on multi-use including charging opportunities for the public, employees, and fleets.
2. **Encourage use of incentives for smart networked chargers** capable of modulating charger load in response to grid signals.
3. **Develop competitive funding proposals to support public electric vehicle charging infrastructure** in the region, with matching funding developed in partnership with utilities, Electric Vehicle Service Providers, and site hosts.
4. **Enhance public signage for electric vehicle charging stations** both at the parking space and along transportation corridors.
5. **Track available funding and pursue a regional CALeVIP incentive project serving Ventura County**, which offers incentives for the purchase and installation of electric vehicle charging infrastructure at publicly accessible sites. Approximately $29.1 million in funding would be needed for a larger CALeVIP project that includes the three counties of Ventura, Santa Barbara and San Luis Obispo.[4]
6. **Create an online application and streamlined approval process for the Ventura County APCD's Electric Vehicle Charging Station Infrastructure Program**, which will facilitate quick dispersal of grant funding that can be stacked with other electric vehicle infrastructure development incentives to reduce upfront cost barriers, including the CALeVIP program.

Resources to Build On: Electrify America, EVGo, ChargePoint, and many other Electric Vehicle Service Providers are currently active in Ventura County. In addition, SCE and the Ventura County APCD, as well as the Energy Commission and CARB are providing substantial incentives for electric vehicle infrastructure deployment. By targeting high potential new public charging sites and defining a framework for collaborative development of competitive funding proposals, Ventura County electric vehicle stakeholders can attract substantial new resources to help achieve the County's ambitious public charging targets.

Workplace Charging

Opportunity: Workplace charging can help drive electric vehicle adoption and utilization in Ventura County by serving residents without access to home charging, and by enabling more electric vehicle miles

[4] The Center for Sustainable Energy administers the CALeVIP program on behalf of the California Energy Commission, so local governments in the region would not be responsible for dispersing funds or managing electric vehicle infrastructure development. The California Energy Commission seeks local government partnerships for marketing and outreach to promote CALeVIP projects and participation.

traveled for plug-in hybrid electric vehicles. Workplace charging is also an important amenity that can attract and retain employees. In some circumstances, workplace chargers can be made publicly accessible and provide electric vehicle charging to multiple users, including employees, fleet vehicles, and the general public.

Challenge: Workplace charging implementation barriers include: 1) high upfront costs for some charging station installations, including site-specific electric improvements as well as ongoing maintenance and operation costs; 2) a variety of challenges related to charging station infrastructure development for businesses that lease their offices and facilities, including limited ability of the businesses to make facility upgrades, difficulty engaging site owners or property managers to receive approval, and charging station ownership and transferability issues for leased business spaces; 3) low awareness of the charging station site assessment and installation process; 4) ADA accessibility requirements and local government minimum parking spaces requirements; and 5) lack of knowledge about effective charging station fee structures to recover costs. Workplaces and property managers for business facilities also need to navigate multiple utility, state, and regional incentive programs since there is currently no streamlined "one-stop-shop" application that allows stakeholders to access all available charging station incentive programs with the completion of a single form. In addition, workplace charging can become quickly oversubscribed – leading to access management challenges for employers and site hosts.

Recommended Actions

1. **Connect workplaces with an Electric Vehicle Coach who can facilitate access to electric vehicle infrastructure incentive programs and grant funding** – with an emphasis on dual use opportunities for electric vehicle fleets, employees, and the public.
2. **Create an Electric Vehicle Champion recognition program** to increase electric vehicle awareness among employers and acknowledge leadership in advancing California's clean transportation and climate goals.
3. **Promote innovative "charging as a service" financing models** that reduce upfront costs and operational risks for site hosts.
4. **Encourage use of incentives for smart networked chargers capable of modulating charger load in response to grid signals.**
5. **Encourage deployment of lower-cost Level 1 charging** where feasible and appropriate for sites where vehicles are parked for more than six to eight hours each day (i.e. long-dwell scenarios).
6. **Prioritize outreach, education, and support for workplaces charging infrastructure development that will meet the electric vehicle charging needs of multiple users**, including employees, fleet vehicle, and the public**.**

Resources to Build On: Workplace charging programs can leverage incentive funding from utilities, the Energy Commission, the Ventura County APCD, and other sources. In addition, some Electric Vehicle Service Providers are beginning to expand charging-as-as-service programs that reduce or eliminate up-front infrastructure costs.

Vehicle Grid Integration (VGI)

Context: Since 2014, the state of California has developed and promoted a statewide *Vehicle Grid Integration Roadmap* as a strategic framework to optimize electric vehicle charging management, to support grid resilience by minimizing charging during periods of peak electrical demand and maximizing use of renewables for electric vehicle charging. Using VGI technologies to reduce the number of charging events or the electrical load from charging during periods of peak electrical demand provides cost savings to station operators. VGI includes both managed or "smart" charging, which involves one-way energy flow in response to grid signals, and Vehicle-to-Grid (V2G) charging, in which energy can be routed back from the vehicle to the grid during peak demand periods. An increasing number of medium and heavy-duty electric trucks and buses are being factory-equipped for V2G charging. Full deployment of V2G capabilities in the light-duty sector is considered to be several years away, as relevant communication standards, business models, and regulatory frameworks are still in development. As part of the Roadmap process, the California Public Utilities Commission (CPUC), California Independent System Operator (CAISO), and Energy Commission are working with utilities and industry organizations on the necessary standards to ensure that smart charging and VGI capabilities are built into the next generation of EVSE. In the next few years, it is likely that nearly all chargers will be mandated to be responsive to grid signals that align charging with time periods when electricity is the most abundant, affordable, and clean.

Barriers to VGI adoption: The higher costs for networked "smart" chargers and V2G chargers is one challenge that could slow widespread deployment of VGI technologies. In addition, to access the full suite of economic benefits available from VGI services, appropriate communication standards, metering, telemetry, market rules, and information technology requirements must be met. Integrated data platforms are required to gather information on energy markets, EVSE utilization, billing, and other data streams, so smarting charging technologies can effectively enable electric vehicles and chargers to respond to price and grid signals. In addition, commercial relationships must be established to enable the appropriate distribution of monetary and non-monetary benefits within the VGI ecosystem, including drivers and fleet operators, EVSE owners, site hosts, and service providers, the grid operator, utilities, aggregators, and other parties.

Recommended Actions

1. **Develop VGI Pilot Projects with leading fleets and industry partners, including the local division of BMW located in Ventura County,** that would enable payments to electric vehicle owners for smart charging and VGI services.
2. **Develop school bus electrification projects,** which can enable mid-day charging from solar energy while providing clean transportation alternatives for Ventura County students.
3. **Link EVSE incentives to networked electric vehicle charging infrastructure able to respond to utility price signals and participate in virtual power plants and demand response programs**.
4. **Develop electric vehicle charging station projects that are paired with solar carports at workplaces, MUD properties, and public destinations** to enable mid-day charging from solar energy and reduce on-going costs associated with electricity demand.

Resources to Build On: Many medium and heavy-duty truck and bus manufacturers are beginning to include V2G capabilities as either a factory-enabled option or as standard equipment. For example, the

Daimler/Thomas Electric School Bus, which has a drivetrain and charger supplied by Proterra, has V2G capability standard, as does the entire vehicle line from Chanje – a Chinese-American manufacturer of medium duty trucks and step vans. In addition, Nuuve -- the San Diego based V2G company – has an inexpensive V2G based Level 2 charger that they are deploying in large-scale V2G programs with companies such as Nissan and others. Finally, many California based pilot projects, such as the Los Angeles Air Force Base V2G pilot, have pioneered many of the issues associated with linking mobile loads to the grid, and therefore the next generation of V2G projects should have improved interconnection and deliver greater benefits for grid operations.

Fleet Electrification

Current Context: Public fleets: The County of Ventura currently manages a fleet of 1,701 vehicles (including heavy-duty equipment and trailers) across multiple departments and diverse use cases. The fleet is comprised predominantly of light-duty sedans, vans, trucks, and specialized equipment, with some medium and heavy-duty trucks (a full accounting is available in Chapter 5). These fleet vehicles are predominantly manufactured after 2006, and most are on an average of a seven-year replacement cycle (some vehicles are replaced every three or more years). For detailed analysis to support public fleet electrification for the City of Oxnard and City of Ventura, see the respective Electric Vehicle Accelerator Plans for their municipalities. Private fleets: Based on available FleetSeek data, there are currently 496 fleets domiciled in Ventura County, consisting of 6,078 vehicles. These fleets include 218 trucks and 404 tractors, with the balance being primarily light-duty vehicles. The City of Oxnard hosts the largest population of private fleet vehicles, with a total of 2,018 vehicles. The Verizon company fleet of more than 1,000 vehicles is almost as large as the other top eight private fleets combined.

Barriers to Fleet Electrification: Fleet electrification is impeded by high upfront vehicle and infrastructure costs, fleet manager knowledge gaps and operational concerns, a lack of internal data and knowledge about long-term electric vehicle performance and reliability, needs for charging infrastructure development along routes and at fleet headquarters, and lower demand for fleet electric vehicles due to a limited familiarity with electric vehicles among fleet users. Inadequate electrical capacity and long distances from the electrical panel to the depot chargers, as well as the need to accommodate larger fleets, can necessitate costly electric upgrades, trenching, and other infrastructure investments. However, SCE has utility electric vehicle charging station incentive programs that can cover electrical infrastructure upgrades for many fleet electrification projects. Further, the absence of policies or clear mandates from leadership in support of fleet electrification can impede many fleet operators from transitioning to electric vehicles.

Recommended Actions

1. **Provide outreach and education to Fleet Managers on all aspects of the fleet electrification value proposition**, including: 1) distributing educational materials, documents, and electrification guidance documents geared towards public and private fleet managers; 2) facilitating webinars, Lunch and Learns, and other educational events to raise awareness and demand among vehicle users; and 3) forming working groups to promote high-level planning and share best practices.

2. **Provide Electric Vehicle Coach support that will help fleet operators access direct incentives to cover EVSE and installation costs** with an emphasis on solutions that include smart charging deployment when duty cycles allow, which will help reduce fleet charging electricity costs.
3. **Provide technical assistance with fleet transition planning**, giving priority to the region's largest fleets and fleets that operate in Disadvantaged Communities. Technical assistance could include vehicle and EVSE selection, electrical upgrades and infrastructure design, charging management, selection of the most cost-effective electric utility rate plan for electric vehicle charging, and funding support. The plans should assess electrification viability, operational benefits, high-level capital cost, vehicle duty cycle, and routing to determine the most cost-efficient electrification pathway given current electric vehicle choices in the marketplace. (Note that the analyses conducted in the City of Ventura and City of Oxnard Electric Vehicle Accelerator plans provide potential models.)
4. **Establish a ZEVs policy** requiring fleets to purchase electric light-duty vehicles based on a policy comparable to the California State Department of General Services policy which prioritizes: (1) pure ZEVs, (2) plug-in hybrid electric vehicles, and (3) hybrids. This will ensure that ZEVs and hybrids are the first options considered for new vehicles. To make the "ZEV first" policy binding, fleets should implement additional policies to: 1) require that the proposed procurement for each non-ZEV or non-plug-in hybrid electric vehicle option includes a written justification explaining why the fleet manager was unable to select a ZEV or plug-in hybrid electric vehicle; and 2) centralize fleet procurement authority with an appropriate department head, so they can review the selected vehicles proposed for procurement, approve vehicles as appropriate, and require revisions of selected vehicles if the justification for non-ZEV options is lacking.
5. **Conduct Electric Vehicle Ride and Drive events** aimed at employees and fleet operators to help induce greater demand for electric vehicles in fleets.
6. **Identify fleet electrification projects that can leverage Low Carbon Fuel Standard (LCFS) credit markets** to help reduce the cost - or potentially cover the full cost - of fleet electric vehicle charging.

Resources to Build On: The California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) has substantial resources available to buy down the cost of electric trucks and buses. Voucher size is scaled to the size of the vehicle and can include vouchers from approximately $10,000 to nearly $300,000 depending on the type of vehicle. Vouchers can also help buy down the cost of charging infrastructure. The Carl Moyer Program, administered through regional Air Quality Management Districts or APCDs, can also provide replacement funding for older diesel vehicles. In addition, SCE offers substantial incentives for fleet electrification infrastructure. Stakeholders can use the City of Oxnard and City of Ventura Electric Vehicle Accelerator Plans' fleet electrification analysis, as well as fleet data for six other regional fleet operators in Chapter 5 of the Ventura County Electric Vehicle Ready Blueprint, to advance fleet electrification across the region.

Electric Buses and Trucks

Current Context: Given their higher carbon emissions and fuel use, medium and heavy-duty trucks and buses are particularly well suited for electrification. Medium and heavy-duty electric vehicle options are growing rapidly, and most promise significant Total Cost of Ownership (TCO) savings, although upfront costs can be higher prior to the application of available incentives.

Barriers to Adoption of Electric Buses and Trucks: For fleet managers tasked with providing services at the lowest possible upfront cost, the higher initial purchase price of medium and heavy-duty electric vehicles and electric buses – combined with the potentially large investment in charging infrastructure – can be a significant barrier. In addition, many fleet managers are not familiar with the requirements of electric vehicle charge management and need assistance with strategies to minimize energy costs.

Recommended Actions

1. **Partner with leading local fleets to secure public funding for new E-Bus and E-Truck procurement**, as well as electric vehicle charging infrastructure development.
2. **Facilitate access and applications to SCE's utility incentive programs for electric vehicle infrastructure development** to advance transit and fleet electrification.
3. **Develop Electric Fleet Transition Plans with leading transit fleets**, including GCT, VCTC and other transit service providers to assess the potential for electrification to reduce emissions; operational costs savings from transit fleet electrification; and any potential impacts on fares, transit access, and ridership.
4. **Support E-Bus and medium and heavy-duty Fleet transition planning** for the region's public agencies – including school districts, and the Port of Hueneme -- to support fleet electrification.
5. **Establish fleet electrification plans and identify pilot projects for at least three freight companies** contracting with the Port of Hueneme by 2020.
6. **Commission a comprehensive E-Truck and E-Bus electrical load study** to determine electrical infrastructure requirements to support comprehensive goods movement electrification
7. **Partner with local utilities (CPA and SCE) to explore development of innovative utility-linked financing mechanisms for E-Bus and E-Truck batteries**, utilizing the "Pay as You Save" (PAYs) tariff model
8. **Collaborate with key regional transportation electrification stakeholders on regionwide goods movement electrification planning** – including the Los Angeles Cleantech Incubator (LACI), Southern California Association of Governments, SCE, Port of Los Angeles, Port of Long Beach, Port of Hueneme, and major freight companies and transportation planning agencies.

Resources to Build On: Continuing to convene the Venture County Electric Vehicle Ready Communities coalition will support ongoing collaboration with local government fleets, transit districts, and regional goods movement service providers. The coalition has already engaged staff from the GCT and the Port of Hueneme. The Port of Hueneme, City of Oxnard, and Electric Drive 805, and other key stakeholders can collaborate to integrate key recommendations from the Ventura County Electric Vehicle Ready Blueprint into the Port of Hueneme, Reducing Emissions, Supporting Health (PHRESH) clean air plan, which is currently in development for publication in 2020. The Port's PHRESH clean air plan will incorporate Port wide goals and target setting for reductions of criteria pollutants and GHG emissions. Ventura County APCD and electric vehicle stakeholders should work with the Port to build relationships with the region's largest goods movement operators, so they can support medium and heavy-duty fleet electrification. To address upfront cost and planning barriers, eligible fleets can gather funding and program support from SCE Fleet electrification programs, as well as state incentives such as the HVIP and the LCFS program. Additional information on these programs can be found in Chapter 4 and Chapter 11.

Electric Vehicle Market Acceleration

Context: Electric vehicle adoption and electric vehicle charging deployment can be accelerated through a combination of education and outreach activities and incentives designed to catalyze and support electric vehicle adoption among Ventura County's diverse communities and stakeholders. Electric Drive 805, local governments, and utility staff can work closely with the Ventura County Electric Vehicle Ready Communities Coalition and local stakeholders to: 1) provide guidance on electric vehicle options tailored to drivers and fleet operators; 2) inform workplaces, property managers, and local government staff about electric vehicle charging solutions to support decision-making about infrastructure development and charging management practices; 3) facilitate information sharing about available incentives for electric vehicles and charging infrastructure development; 4) provide guidance and support to drivers and stakeholders that are applying for electric vehicle incentives; and 5) act as a clearinghouse for multilingual electric vehicle resources and information that will support communitywide electric vehicle adoption and broad access to electric vehicle charging.

Barriers to Successful Education and Outreach Engagement: Education and outreach efforts can fall short if they do not effectively communicate information, fail to address important issues or questions, or are not aligned with the needs of community stakeholders. Monolingual English-language outreach for electric vehicle and charging stations also contributes to significant language access barriers, highlighting the need for multilingual outreach efforts. Outreach efforts must meet the targeted audiences at the point of need -- in their places of work, primary languages, and with respect and understanding of important cultural values. To achieve the greatest positive impact, electric vehicle engagement strategies should be designed with the target audiences in mind and focus groups should be conducted to inform the design of outreach materials and strategies.

Recommended Actions

- **Sustain the Electric Vehicle Ready Communities Coalition** to scale up regionwide initiatives to accelerate transportation electrification.
- **Conduct Ride and Drive campaigns and Electric Vehicle showcases** throughout the County at existing community events and at locations targeted to key stakeholders – including workplaces, local governments, high-density urban centers, multifamily properties, and the meeting locations of organized community groups.
- **Partner with the Electric Vehicle Advocates of Ventura County for awareness activities and events**, so target audience can engage directly with local electric vehicles owners.
- **Target incentives and pilot project funding to accelerate electric vehicle adoption by mobility service providers,** including ride-hailing and shared micromobility companies.
- **Create a Ventura County Electric Drive 805 campaign** in partnership with key electric vehicle stakeholders to expand electric vehicle-focused outreach and engagement activities, including the Electric Vehicle Ready Communities Coalition, Ventura local governments, SCE, CPA, Electrify America, other Electric Vehicle Service Providers, local dealers, the Ventura County APCD, VCREA,

non-governmental organizations, and community-based organizations. The campaign should address the following: a) dealership and sales training and incentives (including strategies to increase incentives for sales people to move electric vehicles); b) sales and marketing strategies to accelerate electric vehicle deployment; c) Ride and Drive events; and d) incentive program awareness campaigns, and other relevant strategies. The campaign planning team should assess best practices in electric vehicle education and outreach, such as PlugStar (by Plug-in America), the MyGreenCar smartphone app for electric vehicle selection, the GRID Alternatives one-stop-shop application for electric vehicle incentives, and other strategies, tools, and best practices. The campaign should utilize key performance indicators to evaluate and continuously improve the success of electric vehicle engagement activities.

- **Collaborate with community-based organizations to expand multilingual electric vehicle outreach and engagement and pilot projects** that will expand awareness of electric vehicles among households that speak a language other than English as their first language. (The Los Angeles Department of Transportation Vision Zero application defines community-based organization engagement activities that can inform a program model for Ventura.)
- **Incorporate electric vehicle awareness and engagement activities into municipal budgets** to help ensure that funding is prioritized and aligned with each city's electric vehicle goals and community needs
- **Pilot test an EVSE Concierge service** in partnership with utilities and Electric Vehicle Service Providers to provide a "hassle-free" residential charging installation experience. To launch the service, SCE and/or CPA electric vehicle program staff could work with Electric Vehicle Service Providers and auto Original Equipment Manufacturers (OEMs) to develop a hassle-free residential charger program that will pilot test: a) flat rate pricing for residential installations; and b) "white glove" service that is inclusive of all key design, permitting, construction, user orientation, and troubleshooting tasks.
- **Partner with CPA to design an optimized electric vehicle support pilot program for Ventura County.** Ventura electric vehicle stakeholders have a unique window of opportunity to provide input into future CPA Electric Vehicle Programs. This optimized program design could: a) streamline incentives administration; b) optimize education and outreach in alignment with the Ventura Go Electric Vehicle Campaign; c) provide fleet transition assistance; d) support MUD charging; e) target electric vehicle awareness to reach low-to-moderate income households, with special emphasis on the region's Disadvantaged and Low-income Communities; and f) launch an electric vehicle group purchasing program that makes it simpler and less costly to buy an electric vehicle (potentially building on the Choose Electric Vehicle procurement platform developed by D+R International and the Yenter Group).
- **Use electric vehicle outreach and engagement activities to support community-informed electric vehicle infrastructure development planning**, using The Greenlining Institute's Clean Mobility Equity Framework and practices similar to those used for the Los Angeles Department of Transportation's Dignity-Infused Community Engagement approach. [5]
- **Create a package of toolkits to support transportation electrification and regional electric vehicle charging infrastructure development** including a) fleet electrification toolkits targeting public agencies, transit, and goods movement; b) MUD charging toolkits targeting property

[5] Los Angeles Department of Transportation. *Dignity-Infused Community Engagement - Vision Zero Los Angeles*. Accessed: June 12, 2019. More information available at: http://visionzero.lacity.org/dignity-infused-community-engagement/

managers to support multifamily residential electric vehicle charging infrastructure development; c) workplace charging toolkits targeted to support electric vehicle charging infrastructure development with the region's employers; and d) local government toolkits targeted to support policy development and public electric vehicle charging infrastructure development.

- **Create and fund, for at least three years, a Ventura County Electric Vehicle Coach** who will assist key stakeholders with electric vehicle charging infrastructure development and provide direct support to help the region's drivers transition to electric vehicles.

Resources to Build On: Electric vehicle stakeholders and local governments should partner or collaborate with Electric Drive 805, the regional Electric Vehicles Collaborative for the counties of Ventura, Santa Barbara, and San Luis Obispo. Resources and targeted information to promote regional electric vehicle adoption and charging infrastructure development are available at ElectricDrive805.org. Local utilities and Electrify America are also launching broader marketing, awareness, and education campaigns. Regional electric vehicle stakeholders can use the promotions to support local and regional electric vehicle market acceleration. There are also numerous decision-support tools available that can help inform purchasing decisions about electric vehicles, including the MyGreenCar smartphone application, FuelEconomy.gov cost calculators, and buyers guides from non-governmental organizations, including Plug-In America. National Drive Electric Week also provides a unique opportunity for local governments, non-governmental organizations, and organized community groups (such as the Electric Vehicle Advocates of Ventura County) to share information about electric vehicles, promote electric vehicle adoption, host Ride and Drive events, and broaden awareness about electric vehicle charging access in local communities.

Shared and Autonomous Vehicles

Context: With the advent of ride-hailing services such as Uber and Lyft, and the deployment of shared vehicles from companies such as ZipCar, Envoy, and Green Commuter, Californians are gaining access to an increasingly broad array of shared mobility services. Shared mobility solutions can reduce individual car ownership and trip frequency – and should prices decrease over time could increase mobility for the people without cars. If the per-mile cost of shared mobility services declines with market growth, shared mobility options could greatly increase transportation access for lower-income households and Disadvantaged Communities. Many experts also predict that self-driving autonomous vehicles will arrive in the next five to seven years, ushering in a new paradigm in transportation. Autonomous vehicles have the potential to reduce traffic accidents and markedly increase transportation safety. Shared autonomous vehicle solutions, as opposed to individually-owned personal automobiles, could also create significant reductions in traffic congestion. Both shared and autonomous vehicles will require thoughtful regulation and guidance from federal, state, and local governments to fulfill their potential to reduce travel costs, improve safety, and alleviate congestion.

Challenges Presented by Shared Vehicles: Ride-sharing companies present new transportation and electrification challenges, including: 1) increased trip frequency; and 2) increases in vehicle miles traveled and emissions. The electrification of ride-hailing services has lagged in part because daily vehicle miles traveled for many drivers is relatively high, and the costs for longer-range battery electric vehicles has been higher than comparable conventional vehicles.

Recommended Actions

1. **Collaborate with key partners to bring innovative electric car share and rideshare services to Ventura County**. Potential partners could include Uber, Lyft, the LACI, SCE, CPA, and Electric Vehicle Service Providers such as Electrify America and EVGo.
2. **Explore opportunities to develop autonomous and electric vehicle pilot programs serving Ventura County** – in collaboration with the Los Angeles Department of Transportation, LACI, and other relevant agencies and industry partners
3. **Track the University of California, Davis Three Revolutions Future Mobility Program and implementation of the Los Angeles Urban Mobility in the Digital Age strategy**, to inform regional policy development and integration of information technologies into the region's transportation infrastructure and systems.

Resources to Build On: As mentioned in the recommendations section, local governments can track research and policy guidance for autonomous, connected, electric, and shared vehicles from the University of California, Davis Three Revolutions Future Mobility Program website and other sources. The Los Angeles Urban Mobility in the Digital Age strategy also provides strategies that can help local government plan for the integration of information technologies with transportation systems and infrastructure.

Siting, Permitting and Installation

Context: Ventura County local governments have the opportunity to facilitate local EVSE development by streamlining permitting processes, adopting more rigorous building "reach codes," and strategically siting new installations to support charging at multifamily residences, at workplaces, along transportation corridors, and in areas where significant infrastructure gaps exist.

Reach codes will increase mandated electric vehicle charging station "make readies" and actual deployment of electric vehicle chargers in new construction and major remodels. Early and robust action to strengthen local codes above CALGreen state building code minimums can save substantial resources for future EVSE installations, as providing the needed conduit and wire during the construction or major remodel is the least-cost approach (e.g., approximately $200 per EVSE enabled). The cost to retrofit buildings with electric vehicle charging stations or make-readies after building construction is completed can exceed several thousand dollars.

Barriers to siting, permitting, and installation: Key factors that can complicate EVSE siting and installation are 1) stakeholder willingness; 2) availability of electrical capacity; 3) proximity to existing charging or other geospatial considerations; 4) ease of permitting and site approval; 5) property ownership arrangements; 6) accessibility and security; and 7) availability of public and private funding. Many stakeholders still do not consider EVSE to be a financially viable commitment given the time and costs associated with its installation. Recommendations that facilitate the EVSE planning process and that support efficiency and cost-effectiveness will be crucial to increasing electric vehicle infrastructure building throughout the County.

Although AB 1236 required that cities and counties adopt streamlined permitting processes for EVSE by September 30, 2017, three of the ten cities within Ventura County are currently not in compliance. While all local governments in Ventura County have adopted EVSE building specific code language into local building codes, the jurisdictions may not adopt EVSE language in their zoning ordinances. Lastly, best practices (according to firms such as Energy Solutions and ICF) show that jurisdictions should include electric vehicle parking violation language in the municipal/county code to ensure that vehicles do not over-stay in EVSE-equipped spaces. Our research found that only two of the ten cities in the Ventura County region have parking violation language integrated into their municipal code. Many municipalities lack the staff time and/or expertise to develop EVSE reach codes. However, a coordinated regional effort on reach codes could spread the costs for technical expertise among multiple jurisdictions and enhance standardization within the County. Permit streamlining opportunities also exist that could be enabled by coordinated action across jurisdictions.

Recommended Actions

1. **Streamline EVSE permitting processes** by 1) approving all zoning and land use classifications for electric vehicle charging in local ordinance; 2) providing digital and online permit submission options; 3) establishing and communicating standard permit approval times by building type; 4) identifying a point of contact for the EVSE permitting process; 5) clearly defining required materials for permit application; 6) including Permit Process Language in local ordinance; 7) maintaining reasonable – and flat – charger permit fees; 8) waiving plan requirements for simple installations such as single-family residential charging; and 9) establishing phone and online inspection request systems.
2. **Integrate CALGreen language in local ordinance** to bring local communities into compliance with AB 1236, so that all municipalities in Ventura County will see increased deployment of electric vehicle charging stations in new construction.
3. **Develop a countywide initiative to implement Reach codes that increase EVSE requirements** for new buildings and major remodels. Ventura County can build on the multi-county Reach Code effort ongoing in Alameda, Santa Clara, and San Mateo Counties, coordinated by TRC.
4. **Develop an interactive, map-based Electric Vehicle Planning tool** that will assist in public and private EVSE development and that can be used to locate existing electric vehicle charging infrastructure, largest MUDs and workplaces, major public destinations, and Disadvantaged and Low-income Communities.
5. **Track private and public sector funding opportunities** to bring electric vehicle charging infrastructure to areas where it is needed most. Utilize Electric Drive 805 website to present up to date funding information for stakeholders to consider in their EVSE planning.
6. **Prioritize public charging development strategically** to increase overall electric vehicle adoption and serve communities throughout the Ventura County region. EVSE siting should focus on 1) locations with heavy vehicle turnover, including grocery stores and shopping centers; 2) locations with longer vehicle dwell time such as multi-unit apartments, workplaces, airports, and transit hubs; 3) site proximity to disadvantaged community or low-income area as identified by CARB for AB 1550; and 4) site distance from existing electric vehicle charging stations

Innovative Micromobility Solutions

Context: For short distance trips, micromobility solutions are increasing rapidly, driven by the rapid growth of bicycling and bikeshare, the use of neighborhood electric vehicles (NEVs), and new forms of electric mobility such as e-bikes, e-scooters, e-skateboards, and other personal transportation devices. With 60 percent of all trips being less than five miles, micromobility solutions have great market potential and could provide affordable and convenient commuting solutions as well as "first mile, last mile" options for transit riders.

Barriers facing First Mile, Last Mile mobility solutions: While micromobility solutions such as e-scooters and e-bike sharing programs can bridge last mile transportation gaps, the segment faces key challenges, including: 1) providing sufficiently durable equipment to tolerate heavy use and vandalism; 2) reaching and equitably serving low income communities; 3) developing sustainable business models; and 4) providing sufficiently secure and accessible, traffic-separated bike infrastructure to enable safe utilization of e-bikes and other new e-mobility devices.

Recommended Actions

1. **Accelerate build out of safe biking and pedestrian infrastructure**, prioritizing infrastructure needed to improve safety and reduce conflicting uses of sidewalk right of ways.
2. **Adopt a Vision Zero policy** that brings together transportation engineers, police officers, advocates, and policymakers to work together towards creating safer streets. Emphasis should be placed on transportation policies, programs, and projects that will protect the region's most vulnerable road users, including children, older adults, and people walking and bicycling to support safe infrastructure development for all road users.
3. **Include robust funding for new bike and pedestrian infrastructure in a future transportation sales tax** being considered by the VCTC.
4. **Collaboratively develop a shared bike/e-bike/e-scooter program** using best practices for sustainability, safety, equity, and high utilization. Pilot projects for micromobility options can help local governments and transit agencies collect community input and improve shared mobility programs before full scale launch.
5. **Develop shared micromobility programs that enhance First Mile, Last Mile transit access** for Ventura County residents, and include micromobility depots at key transit locations.
6. **Implement a set of data policies, specifications, and tools (such as application programming interface (APIs)) that will allow local governments to obtain key mobility-as-a-service data** in real time or at regular intervals throughout the day.
7. **The County of Ventura and local governments should engage Los Angeles Department of Transportation** to explore the possibility of using their Mobility Data Specification given the important transportation linkages between Ventura County and the Los Angeles metropolitan region.
8. **Local governments should develop curb-use data and explore demand-based approaches for curb use management** that will help create safer, more "complete" streets and better accommodate emerging micromobility solutions, as well as electric vehicles and transportation network companies (TNCs).

Resources to Build On: Since 2007, significant investment has been made in Ventura County's bicycle infrastructure, which will lead to safer bikeways and likely attract at least some of the estimated 13,554 commuters that the County estimates can practically shift to bicycles (with or without electric assist). These improvements are also creating safer corridors and increased opportunities for more usage of e-bikes, e-scooters, and other micromobility devices. In 2017, $14 million was approved for Ventura County bicycle and pedestrian infrastructure, a historic high.[6] This influx of new funding is coming because of the recently passed SB 1 gas tax, which authorized unprecedented new funding for bicycle and pedestrian infrastructure. This funding increase also coincides with new state Department of Transportation goals to double walking and triple biking rates by 2020, while cutting bicycle and pedestrian fatalities by ten percent per year.

Electric Vehicle Workforce Development

Context: With electric vehicle sales on a steep increase – along with charging infrastructure deployment – related employment opportunities are growing rapidly. These include jobs focused on electric vehicle design, assembly, sales, repair, in charging installation and electrical contracting, and in utilities. In Ventura County, electric vehicles-related employers include BMW Group's Engineering and Emission Test Center in Oxnard; Volkswagen Research and Development Center in Oxnard; and Haas Automation, a machine toolmaker that supplies NASCAR teams as well as mainstream auto OEMs. Volkswagen, Kia, Hyundai, and Mitsubishi all have Ventura County dealerships. Many of these career pathways are supported by an increasing breadth and depth of training programs at the Community College and University level, as well as in apprenticeship programs, such as the electrician apprenticeship pathway offered by the IBEW.

Barriers to workforce development and career access: Workforce opportunities in electric vehicle-related fields often require basic skills and knowledge in electrical concepts, with many technician positions requiring expertise in computers and software systems. To access higher-paying positions, lower-skill individuals need to develop their basic math and literacy skills to master electrical concepts. At the same time, to create career connections for educationally disadvantaged individuals, workforce development institutions must outreach directly to schools and community organizations that serve Disadvantaged Communities, and link trainees and job seekers directly with employers.

Recommended Actions:

1. **Develop an *E-Mobility and Advanced Transportation Economic Development Action Plan:*** To attract additional electric vehicle-related economic activity to the region, it is recommended that the Economic Development Collaborative of Ventura County develop an *E-Mobility Economic and Workforce Development Action Plan* in collaboration with Electric Drive 805 and other key stakeholders.
2. **Explore development of a SCE Vehicle Workforce Collaborative** linked to the Los Angeles Transportation Electrification Partnership and Electric Drive 805.
3. **Pro-actively develop workforce training program strategies for Disadvantaged & Low-income Communities** as part of a comprehensive regional workforce initiative, identify specific strategies to serve residents within the state-designated Disadvantaged Community census tracts in the cities of both Oxnard and Ventura (the only two cities with Disadvantaged Communities in Ventura County).

Resources to Build On: Multiple electric vehicle-related community college and technical school programs are active throughout the region and can provide support to workforce training and educational efforts.

---

[6] Wilson, Kathleen. "Ventura County Puts Funding Muscle Behind Bicycle and Pedestrian Paths." Ventura County Star. November 11th, 2017. Accessed April 7th, 2019. https://www.vcstar.com/story/news/2017/11/09/ventura-county-puts-funding-muscle-behind-bicycle-and-pedestrian-paths/785511001/

Ventura County electric vehicle-related employers in Ventura include the BMW Group Engineering and Emission Test Center in Oxnard, the Volkswagen Research and Development center in Oxnard, Hass Automation, and the Port of Hueneme.

Resourcing and Funding

Context: Public funding support for transportation electrification can help overcome cost barriers to electric vehicle adoption and electric vehicle charging infrastructure deployment. There are multiple programs supporting electric vehicle and charging investment that Ventura County stakeholders can pursue. These include federal programs and incentives, California Energy Commission and CARB programs, the LCFS program, the SCE Charge Ready Program, Electrify America Settlement Funds, Ventura APCD funding, local government resources, and local industry and site host investments and matching resources. Additional program details can be found in Chapter 11 of this report.

Barriers to Resourcing and Funding: Successfully resourcing and funding the Ventura County Electric Vehicle Ready Blueprint will require extensive collaboration, coordinated action, the development of competitive grant applications, stakeholder outreach and engagement, and site host participation.

Recommended Actions

1. **Develop an Electric Vehicle Funding Project Team** to plan for key funding initiatives and to monitor Energy Commission, CARB, and other funding initiatives.
2. **Identify specific targets of potential investment within the MUD residential sector,** including DC Fast Charge plaza sites that could serve both MUD residents and on-route corridor charging.
3. **Proactively collaborate with regional stakeholders to develop a Green City planning framework** that could be used both for Electrify America's Green City funding opportunities, and for potential regional bond issues and public and private sector investment generally. (Preparing for Green City funding opportunities could also help position the region for the California Sustainable Growth Council's Transformative Climate Communities funding awards.)
4. **Explore regional partnerships in the freight and port/maritime sectors**. Continue working with the Port of Hueneme, Ventura County APCD, and VCTC to engage the region's private goods movement operators and build partnerships for grant-funded pilot projects through the Air Quality Improvement Program (AQIP) Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project, and other relevant initiatives.
5. **Develop an outreach strategy to ensure local fleets, workplaces, MUDs, and residents are aware of first-come, first-served funding** through programs such as HVIP and Charge Ready.
6. **Develop projects serving the region's low-income areas and Disadvantaged Communities** that lack access to affordable public electric vehicle charging currently (e.g. Fillmore and Santa Paula)

Table 11: Summary of City and County Electric Vehicle-Related Programs

City and County Electric Vehicle-Related Policies and Programs						
Agency	**Energy or Climate Action Goal?**	**GHG Goals**	**EV & EVSE Deployment Goals and suggested planning targets for 2030** [7]	**EV-Ready Building Code**	**Permit Streamlining Ordinance Language**	**Parking violation (Non EV in EV space)**
Ventura County [8]	Yes, being developed currently as part of the 2040 General Plan Update	Community proposed: 41 percent below 2015 by 2030 61 percent by 2040 80 percent by 2050	EV: Currently, no specific EV goals. However, fuel efficiency goals have been stated EVSE: draft CTM 6.5 Support EVSE installations at County facilities Proposed EV goal: 116,777 Proposed EVSE goal: 5,420	Yes	Yes	No (but has signage language)
Oxnard [9]	Energy Action Plan, 2013	Community: 10 percent below 2005 by 2020	Oxnard General Plan Policy SC-3.6 Targets for ZEVs: Meet or exceed state ZEV targets, no specific numbers given EV: 20,985 EVSE: 1,333	Yes	Yes	Yes
City of Ventura [10]	CAP in progress, currently have a Municipal Environmental Strategy	None stated	Municipal goal of reducing fuel use by 5 percent annually from 2007. EV: 16,392 EVSE: 689	Yes	Yes	No
Thousand Oaks [11]	Sustainability Plan for Municipal Operations, 2018, CAP in progress	None stated	Municipal Sustainability Plan Goal B.2: Develop a policy to prioritize EVs whenever feasible Goal B.4 Consider EV Buses EV: 18,098 EVSE: 818	Yes	Yes	Yes
Simi Valley [12]	City of Simi Valley Climate Action Plan, 2012	Reduce emissions to 1990 levels by 2020	Encourage EV charging and provide preferential EV parking	Yes	No	No

[7] EV targets are from the State of California's 5 million ZEV by 2030 goal, scaled for vehicle ownership per city. EVSE deployment goals are from the 250,000 level 2 charger, 10,000 DCFC by 2025 goal scaled for population.

[8] Draft Ventura County 2040 General Plan Pg. B-15 https://vc2040.org/images/2040_General_Plan_Files_-_May_2019/Appendix_B_CAP_2019-05-09.pdf

[9] City of Oxnard Energy Action Plan, April 2013

[10] City of Ventura Environmental Sustainability Strategy, 2012 https://www.cityofventura.ca.gov/DocumentCenter/View/822/Environmental-Strategy-PDF?bidId

[11] City of Thousand Oaks Sustainability Plan for Municipal Operations, 2018, pg. 74 https://www.toaks.org/home/showdocument?id=18211

[12] City of Simi Valley Climate Action Plan, 2012. VCREA staff note this plan is not monitored or updated https://www.simivalley.org/home/showdocument?id=6906

			New construction meets, exceeds, or establishes building standards for municipal properties EV: 18,698 EVSE: EVSE: 805			
Camarillo	None reported	None stated	EV: 11,440 EVSE: 430	Yes	Yes	No
Fillmore	None reported	None stated	EV: 2,417 EVSE: 100	Yes	No	No
Moorpark	None reported	None stated	EV: 5,407 EVSE: 234	Yes	Yes	No
Ojai	None reported	None stated	EV: 2,609 EVSE: 48	Yes	Yes	No
Port Hueneme	None reported	None stated	EV: 2,609 EVSE: 142	Yes	No	No
Santa Paula	None reported	None stated	EV: 4,300 EVSE: 192	Yes	Yes	No

Electric Vehicle and Charging Deployments – as of 1/1/2018 DMV Registration

Agency	**Pop.** [13]	**Total registered vehicles** [14]	**# EVs & Percent EVs**	**Percent EV**	**Agency Fleets**		**# Public L2 Chargers**	**DC Fast Chargers** (non-Tesla)	**DC Fast Chargers** (Tesla)
					Total Fleet (all types)	**# EVs**			
Ventura County Unincorporated	99,121	81,985	BEVs :444 PHEVs: 448 TOTAL: 892	1.088	1701	11	-	-	-
Oxnard	210,037	129,825	BEVs: 208 PHEV: 252 TOTAL:462	.356	850	20	52	4	18
City of Ventura	108,511	101,411	BEVs: 400 PHEVs: 378 TOTAL: 778	.767	289	4	90	5	4
Thousand Oaks (includes DMV Newbury Park)	128,995	111,963	BEVs: 758 PHEVs: 969 TOTAL: 1,727	1.542	174	3	57	8	44
Simi Valley	126,878	115,679	BEVs: 458 PHEVs: 870 TOTAL: 1328	1.148	Not reported		14	5	-
Camarillo	67,845	70,776	BEVs: 351 PHEVs: 377 TOTAL: 728	1.029	Not reported		53	4	-

[13] US Census. Retrieved from: https://www.census.gov/data.html

[14] CA Department of Motor Vehicles. DMV Statistics. Retrieved: https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics

Fillmore	15,812	14,953	BEVs: 27 PHEV: 36 TOTAL: 63	.421	Not reported		Not reported	Not reported	Not Reported
Moorpark	36,802	33,451	BEVs: 175 PHEVs: 235 TOTAL: 410	1.226	Not reported		16	-	-
Ojai	7,582	19,665	BEVs: 132 PHEVs: 113 TOTAL: 243	1.236	38	1	12	-	-
Port Hueneme	22,327	16,138	BEVs: 23 PHEVs: 44 TOTAL: 67	.415	Not reported		4	-	-
Santa Paula	30,313	26,602	BEVs: 44 PHEV: 46 TOTAL: 90	.338	Not reported		2	-	-
TOTAL (County-wide) [15]	**854,223**	**722,448**	**BEVs: 3015** **PHEVs: 3768** **TOTAL: 6783**	**.939**	**3,052+**	**39+**	306	**26**	**66**

[15] Totals don't add above based on merging of multiple data sources, the 722,448 total EV adoption is based on CVRP data.

Standalone Step-by-Step Implementation Guide

Realizing the Vision for Equitable, Clean, and All-Electric Transportation

Development of the Ventura County Electric Vehicle Ready Blueprint was guided by a vision for cleaner air, equitable access to clean transportation solutions, and regional leadership towards California's climate goals. Prioritizing and resourcing the Ventura County Electric Vehicle Readiness Blueprint implementation will reduce GHGs emissions, enhance air quality, and improve public health for current and future generations.

According to October 2018 Department of Motor Vehicle data, Ventura County had 8,639 ZEVs, or 1.2 percent of Ventura County's 723,425 registered vehicles.[16] To achieve the region's share of California's 5 million by 2030 ZEVs targets, which are closely linked to local air quality improvements and state climate goals, Ventura County will need 35,307 ZEVs by 2025, and 116,777 ZEVs by 2030.[17] The good news is that recent ZEV sales across California have reached nearly ten percent of new vehicles sales, but steady increases to 30 to 40 percent of new vehicles sales by 2030 will be needed to achieve the 2030 goal. To achieve California's charging infrastructure goals, Ventura County will also need to develop a network of more than 3,240 electric vehicle charging stations at or near multifamily residential properties, workplaces, and public destinations by 2025. Developing a robust regional electric vehicle charging network will ensure that electric vehicle drivers have access to convenient electric vehicle charging options.

At the same time, transit operators will need to begin a transition to electric buses to achieve the state's 2040 target for 100 percent zero-emission bus fleets. Entities such as the Port of Hueneme, transit and school districts, and goods movement companies will also have an opportunity to secure a share of billions of dollars of statewide funding for zero-emission E-Trucks and goods movement equipment electrification. Investing in clean, all-electric trucks, buses and goods movement equipment will reduce emissions of particulate matter (PM), a criteria air pollutant that has disproportionate health impacts on Ventura County's disadvantaged, low-income, and rural communities.

The following implementation guide provides a high-level step-by-step summary of key actions that will position Ventura County as a statewide leader in transportation electrification. Following these step-by-step actions will put Ventura County on a path that makes clean, affordable, and all-electric transportation options accessible to everyone in the region.

Local Government Leadership

Local governments in the region can model the way forward with transportation electrification by transitioning 15 to 20 percent of all fleets to electric vehicles by 2030, achieving double the rate of public electric vehicle adoption among local government staff by 2030 (e.g. 25 percent of all staff are electric vehicle owners by this year), and by making charging infrastructure available at all local government

[16] Zero-emission vehicles include all-electric, plug-in hybrid, and hydrogen fuel cell vehicles. California Department of Motor Vehicles. California Motor Vehicle Fuel Types by County, October 1, 2018. Accessed online June 28, 2019. Available at https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics

[17] As weighted by vehicle registration.

facilities (including public parking lots). Taking the following steps will help local governments accomplish these outcomes and support transportation electrification across the region.

1. Adopt “electric vehicles first” purchasing policies for local government fleets that are modeled after the California Department of General Services policies.
2. Assign fleet pool electric vehicles with longer ranges to employees with the highest mileage, which will help maximize the return on investment and emissions reduction benefits of electric vehicles in local government fleets.
3. Deliver trainings and education materials to familiarize staff with fleet electric vehicles, with a focus on increasing utilization and demand for electric vehicles in the fleet.
4. Install electric vehicles charging stations at all local government parking lots – with a special emphasis on projects that can provide charging to multiple users (e.g. the public, fleet operators, and employees).
5. Implement low and balanced fees for electric vehicles charging station use. Balanced fees will allow station managers to recover costs from electric vehicles charging station installation and operation, while still providing electric vehicle charging at a price that will encourage frequent station use and generate a steady stream of revenue from electric vehicles drivers.
6. Enhance public signage for electric vehicles charging stations both at the parking space and along transportation corridors.
7. Hire or appoint a staff member to serve as an Electric Vehicle Coach who will help community members transition to an electric vehicle and support electric vehicles charging infrastructure development at workplaces, multifamily housing, and public destinations.
8. Conduct regular outreach, education, and engagement events (such as National Drive Electric Week electric vehicle showcases and test drive events) that are targeted to reach local government employees and help them transition to an electric vehicle.
9. Provide appropriate incentives such as reserved parking spaces or bonus vacation days for local government staff that purchase or lease an electric vehicle since their decision to drive electric supports regional clean air and sustainability goals.
10. Provide transportation electrification resources in collaboration with Electric Drive 805, including toolkits for fleet managers and bilingual outreach materials for employees.

Expanding Public and Workplace Charging

Widespread access to affordable and convenient electric vehicle charging will enable more drivers to transition to a clean, fuel efficient electric vehicle, particularly for potential electric vehicle drivers that are unable to charge at home. Taking the following steps will advance equitable access to electric vehicle chargers at public locations and workplaces throughout the region.

1. Adopt and implement a local government policy for “One Mile, One Charger”, which will facilitate the expansion of publicly accessible electric vehicle charging infrastructure to ensure that residents are never more than one mile from electric vehicle charging stations.
2. Provide streamlined, low-cost permitting for workplace and commercial electric vehicle charging station installations in alignment with the mandate established in 2015 when California Assembly Bill (AB) 1236 (Chiu) was signed into law.

3. Use electric vehicle outreach and engagement activities to support community-informed electric vehicle infrastructure planning and development, which will help ensure that new charging stations are installed at the locations that will best serve current and future electric vehicle drivers.
4. Launch an Electric Drive 805 Champion program that will recognize workplace and business electric vehicle leaders in the region. Recognition can be based on a variety of factors, such as the number of charging stations installed per employee, workplace activities to promote electric vehicle awareness among their employees and introducing employee incentive programs that promote electric vehicle ownership.
5. Provide workplace charging resources in collaboration with Electric Drive 805, including toolkits that are designed to help workplace managers, business owners, and commercial property managers install electric vehicle charging stations, access incentives for electric vehicle infrastructure development, and implement best management practices.
6. Engage the 100 largest workplaces to advance access to electric vehicle charging for commuting employees and provide resources that will facilitate participation in incentives programs for electric vehicle charging infrastructure development (e.g. SCE Charge Ready program, Ventura County APCD, Electrify America, etc.).
7. Help charging station managers for workplaces and public destinations implement low and balanced fees for electric vehicle charging station use. Balanced fees will allow station managers to recover costs from electric vehicle charging station installation and operation, while still providing electric vehicle charging at a price that will encourage frequent station use and generate a steady stream of revenue from electric vehicle drivers.
8. Provide or facilitate access to local government incentives, such as the Ventura County APCD's electric vehicle charging infrastructure grants, that will help workplaces and local governments fund the development of electric vehicle charging stations, with an emphasis on infrastructure projects that will close gaps in the region's electric vehicle charging station network.
9. Prioritize electric vehicle charging infrastructure development in areas that will increase access to electric vehicle charging in the region's disadvantaged, rural, and lower-income communities - including the City of Oxnard, the City of Ventura's Westside neighborhood, and the Santa Clara Valley.
10. Conduct regular outreach, education, and engagement events (such as National Drive Electric Week electric vehicle showcases and test drive events) at workplaces and community events that will promote electric vehicle adoption among employees and the broader community.
11. Help employers design workplace electric vehicle incentive programs such as reserved parking spaces or bonus vacation days for employees that purchase or lease an electric vehicle.

Electric Vehicle Charging at Multifamily Residential Developments

According to United State Census data, 38.6 percent of Ventura County's population (an estimated 329,730 out of 854,233 residents) live in rental housing. Taking the following steps will help expand electric vehicle charging infrastructure at multifamily housing developments across the region, which will allow more renters to choose an electric vehicle as their next automobile. Electric vehicle infrastructure at multifamily residential developments will also allow property managers to implement new electric carshare and vanpool services that will attract residents who want to forgo personal automobile ownership.

1. Adopt policies to support electric vehicle charging infrastructure development at multifamily residential properties. For example, a local government could set a target to deploy at least two electric vehicle charging stations at each of the 20 largest multifamily residential developments in their jurisdiction before 2025.
2. Provide streamlined, low-cost permitting for multifamily residential electric vehicle charging station installations in alignment with the mandated established in 2015 when California AB 1236 was signed into law.
3. Launch an Electric Drive 805 Champion program that will recognize multifamily property owners and management companies that are regional electric vehicle leaders. Recognition can be based on a variety of factors, such as the number of charging stations installed per resident, implementing engagement activities that promote electric vehicle awareness, and implementing innovative electric rideshare programs for residents.
4. Provide resources to support electric vehicle charging station infrastructure development at multifamily housing developments in collaboration with Electric Drive 805, including toolkits that are designed to help property managers and owners install electric vehicle charging stations, access incentives for electric vehicle infrastructure development, and implement best management practices.
5. Engage the property managers and owners of the region's 100 largest multifamily properties to promote electric vehicle charging infrastructure development for renters and facilitate property manager/owner participation in incentive programs for electric vehicle charging infrastructure development (e.g. SCE's Charge Ready program and Ventura County APCD's electric vehicle charging infrastructure grants).
6. Help property managers and owners implement low and balanced fees for electric vehicle charging station use. Balanced fees will allow property managers/owners to recover costs from electric vehicle charging station installation and operation, while still providing electric vehicle charging at a price that will encourage frequent station use and generate a steady stream of revenue from residents with electric vehicles.
7. Provide increased local government incentives and facilitate access to existing utility incentives for multifamily residential electric vehicle charging infrastructure development, which will help property managers/owners cover the upfront costs for electric vehicle charging station installations that serve their residents.
8. Prioritize and offer increased local incentives for electric vehicle charging infrastructure development at public destinations (such as shopping centers) located within a half mile of high- and medium-high density housing developments.

Support the launch of new electric car share, vanpool, and rideshare services at multifamily residential properties, which will attract residents who want to forgo personal automobile ownership and/or increase transportation access for residents that cannot afford to own a personal automobile. Conduct targeted outreach and engagement to promote electric vehicle charging station installations for all new MUD) construction in the region and existing MUDs with 17 or more units that were subject to the 2013 California Building Code "electric vehicle -ready" requirements since these locations with have the lowest costs for electric vehicle infrastructure development. All new construction and developments subject to the 2013 California Building Code requirements must have three percent of the total number of parking spaces, but no less than one parking space, be “electric vehicle-ready” (i.e. have electrical infrastructure and pre-wiring for electric vehicle charging stations).

Continue engagement with the region’s housing authorities and nonprofit housing corporations to expand resident electric vehicle education and electric vehicle charging infrastructure development. The Housing Authority of San Buenaventura has demonstrated early leadership with electric vehicle charging infrastructure development and resident engagement activities.

Prioritizing Disadvantaged, Low-Income, and Rural Communities
Special emphasis and attention need to be placed on transportation electrification policies, projects, and programs that will deliver direct benefits to the region’s Disadvantaged Communities that currently bear a disproportionate burden of the region’s pollution, as well as low-income households and rural communities. The following steps will help local government meet environmental justice mandates and support equitable access to clean transportation solutions, so no community is left behind.

1. Adopt and implement policies that will support targeted and effective outreach to the region’s disadvantaged, low-income, and rural communities. Effective outreach activities will 1) provide all informational materials in the multiple languages spoken throughout Ventura County, and 2) use messaging and engagement approaches that are culturally appropriate for reaching the intended audiences.
2. Build and fund collaborations with community-based organizations that have established extensive relationships and trust with the disadvantaged, low-income, and rural communities their organizations are already serving. The Greenlining Institute’s Clean Mobility Equity Framework and Los Angeles Department of Transportation’s Vision Zero Dignity-Infused Community Engagement program provide models for implementing community-led transportation electrification planning with the region’s disadvantaged, low-income, and rural communities.
3. Build collaboration with Electric Drive 805 to conduct multilingual outreach and engagement that incorporates grassroots tactics, including peer-to-peer outreach with local community groups, civic institutions, social service providers, healthcare providers, and schools serving the region’s low-income, disadvantaged, and low-income communities. Electric Drive 805 is a coalition of local governments, APCDs, and transportation electrification advocates dedicated to achieving a rapid, equitable transition to electric vehicles in the 805 Region.
4. Provide multilingual resources to 1) support electric vehicle charging station infrastructure development at key locations in disadvantaged, low-income, and rural areas; and 2) promote awareness of electric vehicle options, available electric vehicle incentives, and electric vehicle charging locations in these areas.
5. Conduct regular and multilingual electric vehicle outreach, education, and engagement events in the region’s disadvantaged, low-income, and rural communities. Emphasis should be placed on information sharing, as well as activities that will allow planners and decision-makers to collect community input on unmet transportation needs and preferred transportation electrification solutions.
6. Engage the property managers and owners of the region’s 50 largest multifamily properties in Disadvantaged Communities to promote electric vehicle charging infrastructure development and

facilitate property manager/owner participation in incentive programs for electric vehicle charging infrastructure development (e.g. SCE's Charge Ready program and Ventura County APCD's electric vehicle charging infrastructure grants).

7. Provide increased local government incentives and facilitate access to existing utility incentives for electric vehicle charging infrastructure development in the region's disadvantaged, low-income, and rural communities. Increasing awareness and access to electric vehicle charging infrastructure incentives will help property managers/owners and workplaces cover the upfront costs for electric vehicle charging station installations in these areas.
8. Prioritize and offer increased local incentives for electric vehicle charging infrastructure development in the region's disadvantaged, low-income, and rural communities. Special emphasis should be placed on electric vehicle charging infrastructure development at multifamily housing developments and public destinations in these areas of Ventura County.
9. Provide low-cost or no-cost electric vehicle charging solutions in the region's disadvantaged, low-income, and rural communities. For example, partnerships could be developed with entities such as Volta or Adopt-A-Charger who offset or fully cover charging station costs by providing recognition, branding, and/or station advertising rights to a private charging station sponsor.
10. Support the launch of new electric carshare, rideshare, and farmworker vanpools services in the region's disadvantaged, rural, and low-income communities, which will help increase familiarity with electric vehicles and expand access to electric mobility options for households that cannot afford or do not want to own a personal electric vehicle.
11. Pilot a new electric vehicle education program at certified smog check locations, which will share multilingual informational materials about electric vehicle options, as well as utility electric vehicle rebates and state electric vehicle incentives that can be stacked with the financial assistance from the California Bureau of Automotive Repair Consumer Assistance Program. The BAR Consumer Assistance Program provides financial support for the retirement of eligible high-polluting vehicles and vehicles that fail to pass a smog check.
12. Track implementation of and promote CARB's forthcoming Zero-Emission Assurance Project (ZAP) battery replacement, which will provide a rebate of $1,800 for the replacement of an electric vehicle battery. With state incentives, it is possible to purchase some used electric vehicles for less than $5,000 but the costs to replace a used electric vehicle's battery were cited as a major barrier among low-to-moderate income residents considering a used electric vehicle. The ZAP battery replacement rebate will help cover some or all of an electric vehicle's battery replacement costs.

Public Transit and School Bus Electrification

In 2018, the CARB approved a first-of-its-kind regulation in the U.S. that sets a statewide goal for public transit agencies to gradually transition to 100 percent zero-emission bus fleets by 2040. Beginning in 2019, $130 million will be invested to electrify transit, school, and shuttle buses in California as part of the settlement for Volkswagen's diesel emission scandal, in addition to other funding sources. The following steps will help Ventura County seize the opportunity for transit electrification investments and lead the way to 100 percent zero-emission bus fleets.

1. Work with all eight transit operators, 20 school districts, and interregional transit providers (such as Metrolink) in Ventura County to adopt policies and targets that will position Ventura County as a leading region for transit electrification and zero-emission bus deployment.
2. Conduct load studies with SCE and CPA to inform regional grid planning and electrical infrastructure updates that will be needed for region-wide transit electrification.
3. Develop a regional Zero-Emission Fleet Transition Plan with all eight transit operators, 20 school districts, and interregional transit providers that will establish planning and implementation actions to achieve zero-emission targets across the region.
4. Develop targeted Electric Fleet Transition Plans for each transit fleet operator and school district in Ventura County. Fleet electrifications will evaluate emissions reduction benefits, operational cost savings, funding needs, and potential impacts on transit services (including route coverage, rider fares/fees, and overall ridership).
5. Build collaboration with the region's eight transit operators, 20 school districts, and interregional transit providers to pursue competitive funding opportunities for transit electrification planning, zero-emission electric bus procurement, and infrastructure development for electric transit services. The 2019 Volkswagen Mitigation Trust first-come, first-serve funding opportunity for Zero-Emission Transit, School, and Shuttle Bus (anticipated October 2019) presents an opportunity to begin this collaboration building.
6. Identify at least one school district leader that will adopt an ambitious target to deploy 100 percent electric buses by 2025 and build collaboration to help the district leader securing funding and resources for implementation.
7. Support engagement with electric transit and school bus manufacturers to help the region's transit operators and school districts identify the most appropriate electric bus models for their operations.
8. Conduct electric bus pilot demonstrations with the region's transit operators and promote the demonstrations with a media campaign.
9. Fund and launch zero-emission bus projects for all eight transit operators and all 20 school districts before 2029, including building charging infrastructure and procuring buses.

Electric Trucks and Zero-Emissions Goods Movement

Medium and heavy-duty trucks with diesel engines are a significant source of particulate matter, a criteria air pollutant that has disproportionate health impacts on disadvantaged, low-income, and rural communities living along or near major goods movement corridors in Ventura County, such as the U.S. 101 Freeway, arterial roads in the City of Oxnard, and Highway 126 in the Santa Clara Valley. The Port of Hueneme is the regional hub for goods movement and a major economic engine for Ventura County, but criteria pollutant emissions from Port operations currently have a disproportionate impact on Low-income and Disadvantaged Communities in the City of Oxnard. As part of the Volkswagen diesel emission scandal settlement, $160 million will be invested in zero-emission Class 8 freight trucks, port drayage trucks, and marine projects beginning in 2019. Regional stakeholders can take the following steps to accelerate the regional transition to zero-emission electric trucks and goods movement which will improve air quality, protect public health, and reduce greenhouse gas emissions.

1. Implement key recommendations in the Port of Hueneme Electric Vehicle Accelerator Plan, including establishing targets for Port and goods movement electrification in the Port of

Hueneme's PHRESH clean air plan. Targets should seek to position the Port as a national leader in goods movement electrification and achieve a net reduction in criteria pollutant and GHG emissions - even if the Port expands its operations.

2. Build collaboration and create new public-private partnerships between goods movement companies, local governments, and the Port of Hueneme to track and pursue competitive funding opportunities for zero-emission Class 8 freight trucks, port drayage trucks, and marine projects. The 2019 Volkswagen Mitigation Trust funding opportunities will present an opportunity to begin this collaboration building (anticipated between Quarters 2 and 4 of 2019).
3. Conduct load studies with SCE and the CPA to inform regional grid planning and electrical infrastructure updates that will be needed for region-wide transit electrification.
4. Develop a regional Electric Goods Movement Transition Plan with the Port of Hueneme, major goods movement companies, and workforce development stakeholders that will support goods movement electrification across the region.
5. Develop targeted Electric Fleet Transition Plans with the region's largest goods movement companies that identify pilot projects and early opportunities for medium and heavy-duty electric truck deployment.
6. Identify at least one major goods movement company that will adopt an ambitious target to deploy 100 percent zero-emissions trucks by 2035 and build public-private collaboration to help the leader secure funding and resources for implementation.
7. Support ongoing engagement with manufacturers of electric Class 8 freight trucks, electric port drayage trucks, and stationary electric port equipment to help the region's goods movement stakeholders identify the best zero-emission or near zero-emission options that can meet their operational needs.
8. Launch new truck electrification pilot projects with at least three major goods movement companies by 2030 and secure resources to continue public-private collaboration that will advance zero-emission goods movement in Ventura County.

Electric Vehicle Awareness & Market Acceleration

According to University of California, Davis research conducted in 2016, fewer than 35 percent of households were aware that the State offers electric vehicle rebates and less than half of all people could name a single electric vehicle model that was currently available.[18] The researchers conclusions were clear: Californians are not deciding they don't want electric vehicles. Rather, they remain to a great extent unaware of electric vehicles and anything about them. Extensive public outreach and engagement to promote electric vehicle adoption and infrastructure development will be needed to advance transportation electrification in Ventura County, so the region can reduce GHG emissions, improve air quality, protect public health, and help households lower their transportation costs. The following steps will help create broad electric vehicle awareness and expanded infrastructure development, which will be crucial to delivering the many benefits of transportation electrification.

[18] Ken Kurani and Scott Hardman. "Automakers and Policymakers May Be on a Path to Electric Vehicles; Consumers Aren't." UC Davis Institute of Transportation Studies. February 2018. Accessed July 2, 2019. Available at: https://its.ucdavis.edu/blog-post/automakers-policymakers-on-path-to-electric-vehicles-consumers-are-not/

1. Develop and adopt policies that establish a clear local government mandate to support broad public outreach and engagement that will expand electric vehicle awareness.
2. Prioritize funding and staffing to support electric vehicle outreach, education, and engagement activities. Incorporating electric vehicle awareness into fiscal year budgets on a recurring basis will help ensure that there is a reliable and continuous stream of funding to support these activities.
3. Create and fund a regional Electric Vehicle Coach. Electric Vehicle Coaches will coordinate electric vehicle awareness activities, help local entities navigate the process of planning for electric vehicle adoption, and facilitate charging infrastructure development. The Electric Vehicle Coach will also be available to provide direct consumer assistance (e.g. helping people identify the electric vehicle options that meet their needs, answering questions about electric vehicle incentives, and sharing information about electric vehicle charging stations).
4. Develop, implement, and iteratively update a set of key performance indicators that can be used to evaluate and continuously improve the success of electric vehicle engagement activities over time.
5. Deliver all electric vehicle awareness outreach and engagement activities in the multiple languages spoken throughout the Ventura County region and use messaging and engagement approaches that are culturally appropriate for reaching the intended audiences.
6. Develop multilingual resources and media campaigns to increase awareness of electric vehicle options, facilitate access to available electric vehicle incentives, and help people learn about electric vehicle charging locations in their communities.
7. Create a package of toolkits to support transportation electrification and regional electric vehicle charging infrastructure development including: 1) fleet electrification toolkits targeting public agencies, transit, and goods movement; 2) MUD charging toolkits targeting property managers to support multifamily residential electric vehicle charging infrastructure development; 3) workplace charging toolkits targeted to support electric vehicle charging infrastructure development with the region's employers; and 4) local government toolkits targeted to support policy development and public electric vehicle charging infrastructure development.
8. Launch a 2020 Ventura County-focused Electric Drive 805 campaign in partnership with key electric vehicle stakeholders, including the Electric Vehicle Ready Communities Coalition, Ventura local governments, SCE, CPA, Electrify America, electric vehicle service providers, local automobile dealerships, the Ventura County APCD, VCREA, and relevant non-governmental organizations. The campaign could include: 1) dealership and sales training; 2) the launch of new or increased local electric vehicle incentives; 3) sales and marketing strategies to accelerate electric vehicle deployment; 4) electric vehicle showcases and Ride and Drives (i.e. test-drive events); and 5) utility and or CPA promotional campaigns linking customers to resources, incentive applications, and best practices.
9. Conduct at least two annual, brand-neutral electric vehicle showcases and/or test-drives at existing community events.
10. Partner with the EV Advocates of Ventura County for community outreach activities and events, so members of the public can engage directly with local electric vehicle owners and learn from their experience. The EV Advocates of Ventura Count is a volunteer group formed in 2014 to support electric vehicle development in the region through advocacy, education and outreach.

11. Partner with CPA to design an optimized electric vehicle support pilot program, including: 1) streamlined incentives administration; 2) education and outreach in alignment with Ventura County-focused Electric Drive 805 campaign; 3) fleet transition assistance; 4) support multifamily residential charging infrastructure development; 5) targeted electric vehicle awareness to low-to-moderate income households; and 6) launch a group purchasing program that provides limited-time discounts on new, leased, and/or used electric vehicles.
12. Track the One-Stop-Shop electric vehicle incentive application pilot project. CARB and GRID Alternatives are currently developing the One-Stop-Shop application for the pilot project, which will allow low-income consumers in select areas to apply for all available electric vehicle incentives with a single form.

Simplify and Streamline Permitting for Electric Vehicle Infrastructure Development

Local permitting processes that impose high fees, are unnecessarily burdensome, or create projects delays can significantly impede electric vehicle charging infrastructure development. In 2015, state AB 1236 established requirements for California's cities and counties to streamline their permitting systems for residential and nonresidential electric vehicle charging stations. Local governments can take the following steps to simplify and streamline their permitting process in alignment with AB 1236, which will facilitate electric vehicle charging infrastructure development in the region.

1. Waive plan requirements for simple installations - especially single-family residential charging installations that tend to be as simple and straightforward as a typical water heater installation.
2. Streamline electric vehicle charging permit process in alignment with AB 1236 by: 1) approving all zoning and land use classifications for electric vehicle charging in local ordinance; 2) providing digital and online permit submission options; 3) establishing and communicating standard permit approval times by building type; 4) identifying a point of contact for the EVSE permitting process; 5) clearly defining required materials for permit application; 6) including Permit Process Language in local ordinance; 7) maintaining reasonable – and flat – charger permit fees; 8) waiving plan requirements for simple installations such as single-family residential charging; and 9) establishing phone and online inspection request systems.
3. Give special attention to support ADA compliant site plans for electric vehicle charging stations for all multifamily residential and nonresidential electric vehicle charging station projects by 1) providing clear and detailed information about ADA requirements in streamlined permitting forms and checklists; and 2) providing staff or possibly Electric Vehicle Coach support that will help applicants address site-specific ADA requirements in their plans.
4. Update parking requirements in zoning ordinances to ensure that publicly accessible electric vehicle charging spaces are counted towards any minimum parking requirements for multifamily residential, commercial, mixed use, or office land use zones.

Preparing for Emerging Electric Mobility Options

Emerging technologies and rapid growth in the mobility-as-a-service market are already disrupting California's transportation sector. The transportation innovations contributing to the disruptions include shared e-bikes and e-scooters; transportation network companies such as Uber, Lyft, and Lime; electric vehicle car share and rideshare services, such as BlueLA and Green Commuter; and rapidly advancing development of electric vehicles that are automated (i.e. self-driving) and interconnected via information technology. The emergence of these mobility options presents local governments with exciting opportunities to improve transportation, as well as the potential for severe pitfalls. Advanced planning and preparedness will put local governments in the best position to successfully regulate, launch, and manage a variety of emerging clean mobility options for public good. There is a strong nexus between regional transportation electrification and many emerging mobility options. The following steps will help Ventura County plan and prepare for shared mobility options that support regional transportation electrification.

1. Adopt a Vision Zero policy that brings together transportation engineers, police officers, advocates, and policymakers to work together towards creating safer streets. Emphasis should be placed on transportation policies, programs, and projects that will protect the region's most vulnerable road users, including children, older adults, and people walking and bicycling to support safe infrastructure development for all road users.
2. Include robust funding for new bike and pedestrian infrastructure in a future transportation sales tax being considered by the VCTC.
3. Engage Los Angeles Department of Transportation to explore the possibility of using their Mobility Data Specification since there are important transportation linkages between Ventura County and the Los Angeles metropolitan region.
4. Conduct a multilingual community engagement process to involve residents in the development of requirements, policies, and pilot programs for electric bikeshare, electric scootershare, and/or electric carshare programs; special emphasis would be placed on equitable deployment of electric micromobility models to be used within the city.
5. Implement regulations specific to shared electric bikeshare, electric scootershare, and/or electric carshare programs based on findings from the community input process and existing local government mandates. In some cases, local governments have chosen to implement administrative regulations instead of ordinance regulations since administrative rulemaking is more expeditious, which can make it easier to adapt rules based on emerging needs.
6. Implement set of data policies, specifications, and tools (such as APIs) that will allow local governments to obtain key mobility-as-a-service data in real time or at regular intervals throughout the day.
7. Develop a Request for Proposal (RFP) to solicit bids from operators for the shared mobility services that a local government would like to launch. An RFP-based process gives local governments the most power to launch shared mobility services with operators that can conform to established regulations, data policies, and any criteria established during the Community Engagement Process (see prior project description) that will support greater public benefits.
8. Launch shared electric mobility pilot projects using best practices for sustainability, safety, equity, and utilization. Potential models include the City of Santa Monica's Bikeshare program and Shared Mobility Program, as well as the BlueLA all-electric car share service.
9. Track the University of California, Davis Three Revolutions Future Mobility Program and implementation of the Los Angeles Urban Mobility in the Digital Age strategy, to inform regional policy development and integration of information technology into the region's transportation infrastructure and systems.

10. Track the rulemaking and implementation for Senate Bill (SB) 1014, the Electrify California Ride-Hailing Act (e-CAr), SB 1014 requires the CPUC, in consultation with the CARB and California Energy Commission, to establish the California Clean Miles Standard and Incentive Program (CCMSIP) to increase the use of zero-emission vehicles by ride-hailing companies, including TNCs such as Uber and Lyft.
11. Engage with Uber, Lyft, LACI, SCE, CPA, and Electric Vehicle Service Providers to explore local and regional incentive models that will encourage TNCs and their drivers to adopt/deploy electric vehicles for the transportation service they provide in the region.
12. Track federal, state, and local policy development for automated and connected vehicles. The University of California, Davis Three Revolutions Future Mobility Program may serve as a good starting point for the region's transportation planners.
13. Build collaboration with Los Angeles Department of Transportation, Los Angeles Metrolink, LACI, and the region's transit operators to identify, prepare for, and launch mobility-as-a-service pilot projects that use automated and connected electric vehicles. Pilot project development should include a community engagement process that places special emphasis on the region's disadvantaged, low-income, and rural communities.

Electric Vehicle Workforce Development

The transition to electric vehicles will present new economic development and jobs growth opportunities. It will also require new workforce development and training programs for electric vehicle auto technician services, manufacturing and design, infrastructure development, and electric vehicle-related utility services. The following steps will support electric vehicle-focused workforce development and training that will provide a pathway for local community members to fill local transportation electrification jobs.
Work with the region's local government fleet operators, transit operators and school districts to identify electric vehicle automotive technician workforce development and training needs.

1. Build collaboration with the Ventura County Workforce Development Board, Economic Development Collaborative, Port of Hueneme, and major goods movement companies to identify workforce development opportunities and needs related to transportation electrification in the goods movement sectors. The collaboration should seek to proactively develop workforce training programs serving the region's disadvantaged, low-income, and rural communities.
2. Convene meetings to discuss electric vehicle -related workforce development, training needs, and job opportunities with BMW Group's Engineering and Emission Test Center in Oxnard; the Volkswagen Research and Development Center in Oxnard; Haas Automation in Oxnard; solar installation companies that provide electric vehicle infrastructure development services; and electric vehicle charging station vendors and service providers.
3. Engage LACI to explore the development of a *Southern California Electric Vehicle Workforce Collaborative* linked to the Los Angeles Transportation Electrification Partnership.
4. Work with the Ventura County Community College District and other local colleges/universities, such as California State University, Channel Islands, to support additional electric vehicle training curriculum development based on regional needs and job opportunities, including incorporating training for electric vehicle infrastructure development into solar installation training classes.

5. Engage education institutions from outside the region, such as University of California, Davis and University of California, Los Angeles, to increased electric vehicle-related technology and information transfer to educational and workforce institutions.
6. Develop an E-Mobility Economic and Workforce Development Action Plan with the Ventura County Workforce Development Board, Economic Development Collaborative, Port of Hueneme, and Ventura Community College District.
7. Facilitate public-private educational partnerships for electric vehicle-related programs that provide pathways to high-quality jobs, such as Toyota's Technician Training and Education Network program (T-TEN) and Tesla's START student automotive technician program. Partnerships should focus on electric vehicle-related training and education that is aligned with local and regional job development needs.

Vehicle Grid Integration (VGI)

VGI technologies can deliver "smart charging" services that can optimize electric vehicle charging management, support grid resilience by minimizing charging during periods of peak electrical demand and maximize use of renewables for electric vehicle charging. The state of California has developed and promoted a statewide *Vehicle Grid Integration Roadmap* as a strategic framework to advance VGI research, development, and deployment across the state. The following steps can be taken to plan, prepare for, and integrate VGI technologies into the Ventura County's electric vehicle charging network.

1. Develop VGI Pilot Projects with leading fleets and industry partners, such as BMW, that would enable payments to electric vehicle owners for smart charging and vehicle-grid integration services.
2. Develop electric vehicle charging station projects that are paired with solar carports at workplaces, MUD properties, fleet centers, and public destinations to enable midday charging from solar energy and reduce on-going costs associated with electricity demand.
3. Provide increased local and regional incentives for VGI-ready or VGI-enabled electric vehicle charging infrastructure. For example, the Ventura County APCD electric vehicle charging infrastructure grant awards could be increased for projects that install charging stations that are VGI-ready or are already equipped with VGI.

Funding

The project team that developed the Ventura County Electric Vehicle Readiness Blueprint envisions a future where the region leads the way to cleaner air and California's climate goals with clean, affordable, and all-electric transportation options that are accessible to everyone in Ventura County's diverse communities. We are committed to charting the path forward with innovative projects, policies, and programs that support regional transportation electrification, community air protection, and equitable access to clean mobility options. Few, if any, of the actions highlighted in this step-by-step guide can be successfully implemented without a steady and reliable stream of funding to support staff time, resource development, infrastructure build out, and ongoing collaboration. Opportunity blossoms where resources flow. The following steps will help local governments, non-governmental organizations, community-based organizations, and electric vehicle stakeholders cultivate the financial means to realize the vision for regionwide transportation electrification in Ventura County that will directly involve community members in building a clean mobility future.

1. Sustain the Ventura County Electric Vehicle Ready Communities Coalition formed to support the Electric Vehicle Readiness Blueprint development, so partners can continue to collaborate, plan for all of the above goals, and build strategic alliances that lead to funding awards.
2. Identify and continually monitor federal, state, and local funding sources to ensure that eligible entities in the Ventura County region are aware of competitive or first-come, first-serve funding opportunities that will support regional transportation electrification.
3. Develop a Green City planning framework that can be used to apply for Electrify America funding and will support the pursuit of additional funding opportunities - especially the Sustainable Growth Council's Transformative Climate Communities grant awards.
4. Expand local and regional sources of funding for electric vehicle charging infrastructure development, in balance with regional priorities, budgets, and funding streams.
5. Create an online application and streamlined approval process for the Ventura County APCD's Electric Vehicle Charging Station Infrastructure Program. Streamlined and rapid dispersal of their agency grant funding will facilitate electric vehicle infrastructure development and could attract additional state incentives to the region (such as CALeVIP).
6. If the state budget allows, engage the California Energy Commission and the Center for Sustainable Energy to launch a regional CALeVIP incentive project serving Ventura County before the end of 2020. A regional CALeVIP project would offer incentives for the purchase and installation of electric vehicle charging infrastructure at publicly accessible sites.
7. Build collaboration with CPA to establish new electric vehicle pilot projects and incentive programs as their capacity for this work expands.
8. Seek strategic partnerships with SCE and CPA that can help fund coordinated electric vehicle marketing, outreach, and education activities throughout the region.
9. Incorporate electric vehicle awareness and engagement activities into local government annual budgets and work plans, in alignment with their electric vehicle goals and infrastructure development needs.

Funding-Ready Project Concepts

A total of 49 funding-ready project concepts were developed out of the stakeholder engagement and collaboration process for the Electric Vehicle Ready Blueprint project. This list includes proposals for electric vehicle charging infrastructure development, pilot concepts for electric micromobility projects, education and outreach activities, and equitable community engagement processes. Projects would also provide assistance to advance transportation electrification with school districts, transit operators, the Port of Hueneme, and goods movement and freight companies. Numerous stakeholders supported the development of project concepts, including local government staff, the Ventura County APCD, SCE staff, affordable and non-profit housing agencies, workforce development agencies, school districts, transportation innovators (including the LACI and their portfolio companies), the Ventura County Community College District, the Port of Hueneme, members of the community, and local electric vehicle drivers and advocates.

While many of the place-based project concepts below can be applied to additional areas of Ventura County in partnership with other local jurisdictions, this list represents months of conversation and idea development with the Ventura County Electric Vehicle Ready Communities Coalition, as well as input obtained from one-on-one meetings with other key stakeholders. The list of project concepts is intended to support implementation of recommendations and goals that have been collaboratively developed during Ventura County Electric Vehicle Ready Blueprint Round 1 project.

Through the Round 1 project, numerous stakeholders and collaborators highlighted the need for a person or entity that can provide guidance on a wide-range of regional electric vehicle matters – such as responding to inquiries from community members who want to know more about electric vehicles, assisting in municipal planning efforts to support electric vehicle infrastructure goals, or sharing information about the range of funding options available for electric vehicle projects. The Electric Vehicle Coach concept was developed in response to this request and is represented throughout the project matrix not only as a fundable project for priority implementation, but also as a potential implementer or partner for other funding-ready projects.

Many of the Electric Vehicle Ready Communities stakeholders also voiced strong support for enhanced community equity in planning for transportation electrification and clean mobility solutions. In listening sessions with more than 100 community members, there was a consensus that strengthening public transportation, expanding bike infrastructure, and electrifying transit services (including school buses, public transit, paratransit, and light-duty rideshare vehicles) would create a greater overall benefit than focusing on personal electric vehicle adoption alone. Projects in the region's Disadvantaged Communities are emphasized in response to this and in anticipation of continued grant funding opportunities that will prioritize projects in these areas. Projects such as community-led planning for micromobility, assistance to schools in securing funding to purchase electric buses, and carshare services for residents at affordable housing properties will also support the statewide vision for equitable access to clean mobility solutions.

Communitywide outreach about electric vehicles and development of a comprehensive electric vehicle charging network were identified as a crucial need for advancing transportation electrification in Ventura County. Expanding local knowledge about available electric vehicles, incentives, and charging options that make driving an electric vehicle more affordable will be crucial to achieve widespread electric vehicle adoption in the region – especially among low-income households where transportation decisions often play a critical role in financial well-being. Numerous funding-ready projects are intended to meet this fundamental need, including electric vehicle showcases, workplace engagement, outreach activities at existing community events, new local rebates that would help make driving electric vehicles an affordable option for more low-income households, the Electric Vehicle Coach, community-based Electric Vehicle Ambassadors, multiple electric vehicle charging station installations that will close gaps in the region's current charging network, and Electric Vehicle Block Parties to highlight new station openings and provide electric vehicle test-drives to local residents.

The 49 projects represented provide a robust starting point for equitable transportation electrification across Ventura County. The project list is not definitive nor entirely comprehensive and the projects are not binding in any way. They do not represent a firm commitment by the entities listed as potential implementers or partners. However, the project team did verify that potential implementers and partners would support the projects if funding for implementation is forthcoming. The list of project concepts can be used to develop more detailed project proposals as funding opportunities arise. The project team intends to continue direct collaboration with the region's diverse stakeholders to help secure federal, state, and local resources that will allow the region to realize a vision for a clean, equitable, and electric transportation future.

The List of Funding Ready Projects is available in spreadsheet form at:

https://www.vcenergy.org/electric-vehicle-blueprint/

Ventura County Electric Vehicle Ready Blueprint

Chapter 1: Key State, Regional, and Local Electric Vehicle Goals, Policies, and Programs

Introduction

Public and private sector electric vehicle incentives, charging infrastructure, and market acceleration programs are expanding rapidly throughout California. These include expanded initiatives at the state, regional, and local levels, as well as utility and industry-sponsored programs from SCE, Electrify America, and others. During the 2019-2023 period – which is the immediate time horizon of this Electric Vehicle Readiness Blueprint – available resources for electric vehicle infrastructure and vehicle incentives are expected to further expand. However, most of the funding programs for both infrastructure and vehicle incentives will be distributed on a competitive or first-come, first-served basis. To maximize the resources made available to Ventura County, local stakeholders must present a compelling vision for electric vehicle ecosystem development. The Ventura County Electric Vehicle Ready Blueprint is intended as a foundation for this unifying countywide vision and action plan.

It is equally important that electric vehicle readiness programs and policies be fully integrated into municipal and County Climate Action Plans, General Plans, and plans for newly constructed and newly renovated commercial and residential developments. It will be essential to develop effective collaborative relationships with SCE, CPA, Electrify America, and individual electric vehicle service providers and e-mobility companies, such as EVGo, ChargePoint, Envoy, and many others. Additionally, strong community engagement in the planning process is critical to ensure that everyone in the region has equitable access to clean mobility solutions and will benefit from clean transportation improvements.

In the following Chapter, the full range of public and private sector electric vehicle support programs are reviewed. Taken as a whole, these programs have enormous potential to accelerate the achievement of the County's climate, energy, and transportation goals – and to fully realize Ventura County's Electric Vehicle Ready Blueprint as a means to enhance clean mobility across the region.

State of California Electric Vehicle Goals and Policies

According to the most recent data available, the transportation sector emits 41 percent of the total GHGs in California and approximately 83 percent of smog-forming Nitrous Oxide (NOx).[19] With a state population of over 40 million, California hosts more than 25 million automobiles, and over five million trucks and commercial vehicles.[20] In response to the crisis of climate change and persistent non-attainment of federal air quality standards in large areas of the state, California has adopted increasingly robust measures to accelerate emissions reduction. These goals and mandates have been accompanied by increased funding from the State's Cap and Trade revenues, formally known as the Greenhouse Gas Reduction Fund, to accelerate the shift to clean and renewable fuels in both the energy and transportation sectors. However, the State is only at the very beginning of the decarbonization of the transportation sector, with electric vehicles still representing only a very small proportion of the total vehicle population, despite encouraging growth in year over year sales.

---

[19] CARB. *California Green House Gas Inventory.* Retrieved from: https://www.arb.ca.gov/cc/inventory/data/data.htm

[20] California Department of Motor Vehicles. December 2017. *Registered Vehicle Statistics.* Retrieved from: https://www.dmv.ca.gov/portal/wcm/connect/5aa16cd3-39a5-402f-9453-0d353706cc9a/official.pdf?MOD=AJPERES

The following chart describes the key state goals for GHG, air quality and electric vehicles, which will in turn help guide Ventura's regional action on electric vehicle ecosystem development.

Table 2: GHG, Fuel, Air Quality, and Clean Mobility Equity Goals and Milestones Relevant to California

Policy Basis	Objectives	Goals and Milestones
Assembly bill (AB) 32	GHG reductions	Reduce statewide GHG emissions level to 1990 levels by 2020
Senate Bill (SB) 32	GHG reductions	Reduce GHG emissions to 40 percent below 1990 levels by 2030
Executive order B-30-15	GHG reductions	Reduce GHG emissions to 80 percent below 1990 levels by 2050
SB 350	GHG reductions, equity	Mandated low-income barriers study for clean transportation; established 2030 GHG reduction target of 40 percent below 1990 levels
SB 535	Equity	Allocate 25 percent of climate investments to state-designated disadvantaged communities
LCFS	GHG reductions	Reduce carbon intensity of transportation fuels in California by 10 percent from 2010 levels by 2020, and 20 percent from 2010 levels by 2030
State Alternative Fuels Plan	Petroleum reduction	Reduce petroleum fuel use by 15 percent below 2003 levels by 2020
CARB NOx Standards	Air quality	70 percent reduction in NOx by 2023, 80 percent reduction in NOx by 2031, carb optional low-NOx standard is a 90 percent reduction from the current standard
Executive Order B-16-2012	ZEV mandate	Accommodate 1 million electric vehicles by 2020 and 1.5 million by 2025
Executive Order B-48-18	ZEV mandate update	Deploy at least 5 million ZEVs in California by 2030 Install 250,000 Electric Vehicle chargers, 10,000 DC Fast Chargers, and 200 hydrogen refueling stations by 2025
AB 1550	GHG investment plan, Disadvantaged Communities	Allocate 25 percent of climate investments to low-income communities and households

Meeting these ambitious goals will require accelerated retirement of high-polluting internal combustion engine vehicles and their replacement with ZEV technologies – including battery electric vehicles, plug-in hybrid electric vehicles, and fuel cell electric vehicles. To enable that transition, the State has developed an expanding suite of incentives, programs, and policies, summarized below.

Electric Vehicle Policy Leadership in California and Key Enabling Programs

The role of California's Air Resources Board has been critical to vehicle electrification efforts for more than two decades in California. As an independently governed department within the California Environmental Protection Agency, CARB sets regulatory standards for air quality within the state. The strict vehicle emissions standards established by CARB have been adopted by a coalition of 13 other states and the District of Columbia. CARB has also led the nation through emissions-related initiatives such as the ZEV Mandate and the establishment of the LCFS, which have provided substantial incentives for the manufacture of electric vehicles. In addition, even broader transport decarbonization programs are now in the planning stages to further boost electric vehicle adoption in the State. Policy goals establish by SB 350 also aim to advance equitable access to clean mobility options, while simultaneously benefiting Disadvantaged Communities through direct investment mandates and goals.

California Low Carbon Transportation Investment Programs

In 2007, AB 118 (Nunez) created the AQIP. The program, extended in 2013 by AB 8 (Perea), distributes approximately $100 million dollars per year for low-carbon vehicle incentives and infrastructure, of which a substantial portion is allocated to electric vehicle initiatives. The AQIP program is supported by the Low Carbon Transportation Program and appropriates funds from the State's Cap and Trade Program to accelerate the transition to advanced technology and low carbon freight and passenger transportation, with a focus on California's designated Disadvantaged Communities. The program is administered by CARB in collaboration with the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP), managed by the California Energy Commission.

The ARFVTP is focused primarily on GHG reduction within the transportation sector, while the AQIP is primarily responsible for reducing specific transportation-related criteria air pollutants, such as NOx (the primary contributors to smog), and diesel-related PM that is implicated in asthma and lung disease. Together the CARB and California Energy Commission programs have jointly contributed funds toward California's Clean Vehicle Rebate Program (CVRP) which is focused on light-duty electric and fuel cell vehicles, as well as the HVIP to accelerate the purchase of cleaner, more efficient trucks and buses. Both programs are highlighted in more detail throughout this report.

Through AB 118 and various CARB technology demonstration programs, the State has also invested in electric vehicle charging infrastructure, regional electric vehicle, fuel cell electric vehicle, and alternative fuel vehicle planning, in-state manufacturing, development and demonstration of advanced hybrid and fully electric truck and bus models, and vehicle-grid integration.

Vehicle Emissions, Fuel Standards, and the ZEV Mandate

In 2012, California implemented Executive Order B-16-2012, known as the ZEV Mandate. The ZEV Mandate requires that by 2025, at least 15 percent of new car sales conform to the ZEV emissions performance criteria created by CARB, which can be met by both plug-in electric and fuel cell electric vehicles. The ZEV mandate establishes minimum thresholds for the production of qualified ZEVs and establishes a structure of financial penalties and credit trading for manufacturers that fail to meet required thresholds - while rewarding automobile manufactures that exceed the requirements.

In January 2018, Executive Order B-48-18 was passed to extend the state's support of ZEVs, calling for the deployment of at least five million ZEVs in California by 2030, and for the installation (by 2025) of 250,000 electric vehicle chargers, including 10,000 DC fast chargers, and 200 hydrogen refueling stations. State policy makers at the California Energy Commission, CARB, and CPUC are currently working on guidance documents and program strategies to help fund this infrastructure, and to target specific customer segments and geographies for charging deployment. These guidance documents will be published in 2019 with updates anticipated in subsequent years.

SB350 Clean Energy and Pollution Reduction Act of 2015

In 2015, Governor Brown and the California Legislature passed the Clean Energy and Pollution Reduction Act of 2015 (SB 350, De León, Chapter 547, Statutes of 2015). SB 350 clearly articulates that transportation electrification and equitable access to clean mobility options are foundational elements of California's strategy to meet air quality, public health, and climate goals, while advancing economic prosperity, social equity, and energy security. Clean Mobility options promoted by SB 350 include:

- Active transportation such as biking and walking
- Zero-emission and near zero-emission light-duty cars and trucks
- Zero-emission and near zero-emission transit and school buses
- Zero-emission and near zero-emission cars near public transit for public use, ride share, car share, vanpools, bike share, and mobility hubs, etc.
- Supporting infrastructure for vehicle charging and fueling and safe biking and walking, etc.

Public Participation: In 2016, CARB began a public engagement process to bring local community members into the SB 350 decision making process. In May 2017, the Governor's Office also established an SB 350 Task Force comprised of 15 state agencies to implement recommendations. The Task Force is currently focused on implementing recommendations that directly address barriers to clean transportation and energy access for low-income residents and Disadvantaged Communities. [21]

CARB Programs: AQIP and Low Carbon Transportation Program

AQIP focuses on reducing criteria pollutants and diesel emissions with concurrent GHG reductions and is supported by appropriations from the Low Carbon Transportation Program portion of Cap and Trade Funds. AQIP has provided clean vehicle deployment incentives through HVIP, as well as loans to assist fleets in diesel modernization projects. The AQIP also provides grants for projects addressing railroads, port vessels, and other applications. AQIP funding through FY 2017-18 is summarized below.

[21] California Air Resource Board. Accessible Clean Transportation Option SB350. Retrieved from: https://ww2.arb.ca.gov/our-work/programs/accessible-clean-transportation-options-sb-350/about

Table 3: AQIP Allocations in Fiscal Year 2017-2018

AQIP Project	Cumulative Project Allocations (millions)
Truck Loan Assistance	**$126**
CVRP[2]	**$146**[2]
HVIP[2]	**$64**[2]
Low NOx Engine Incentives	**$10**
Agricultural Equipment Trade Up in San Joaquin Valley	**$4***
Advanced Technology Demonstration/Vehicle Testing	**$6***
Lawn and Garden Equipment Replacement	**$3***
Off-Road Hybrid Equipment Pilot	**$2**
Zero-Emission Agricultural Utility Equipment	**$0.1**
TOTAL	**$362***
Air Quality Improvement Fund Other funding sources[1]	$269 $93.3

[1]Includes a total of $93 million from other funding sources: $53 million from the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program or Fund to support CVRP and HVIP in various fiscal years, $10 million appropriated to Truck Loan Assistance Program in FY 2013-14 as a loan from the Vehicle Inspection and Repair Fund (VIRF) per SB 359 (Corbett, Chapter 415, Statutes of 2013), and $30 million transferred by the Legislature from VIRF to meet CVRP demand in 2014 per SB 852 (Leno, Chapter 25, Statutes of 2014) and SB 862 (Committee on Budget and Fiscal Review, Chapter 36, Statutes of 2014).
[2]CVRP and HVIP also received Low Carbon Transportation funds in FY 2013-14 through 2017-18.

The Fiscal Year 2018-19 Funding Plan for Clean Transportation Incentives provides a total of $483 million in clean transportation investments. The Legislature specifically appropriated $455 million of this total to continue and build on investments from previous years in the following categories:

- $200 million for CVRP, with the requirement that $25 million of this total be dedicated to increased rebates for low-income recipients
- $75 million for the Enhanced Fleet Modernization Program (EFMP) and EFMP Plus-up Pilot Project/Clean Cars 4 All, Financing Assistance, Clean Mobility Options, replacement of school buses, and light-duty equity pilot projects authorized pursuant to SB 1275
- $55 million for the Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project, including projects for ships at berth
- $125 million for clean truck and bus vouchers through the HVIP [22]

[22] California Air Resources Board. (September 21, 2018). *Proposed Fiscal year 2018-2019 Funding Plan for Clean transportation Incentives for Low Carbon Transportation Investments and the Air Quality Improvement Program.*

Table 4: Proposed Project Allocations for FY 2018-2019 Funding Plan

Project Category	Allocation* (millions)
LIGHT-DUTY VEHICLE AND TRANSPORTATION EQUITY INVESTMENTS	
CVRP (including increased Rebates for Lower Income Applicants)	$200
Transportation Equity Projects	$75
Light-Duty Vehicle and Transportation Equity Investment Total	**$275**
HEAVY-DUTY VEHICLE AND OFF-ROAD EQUIPMENT INVESTMENTS	
Clean Truck and Bus Vouchers (HVIP + Low NOx Engine Incentives)	$125
Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project	$55
AQIP-FUNDED HEAVY-DUTY INVESTMENTS	
Truck Loan Assistance Program	$25.6
Diesel Particulate Filter Retrofit Replacements	$3
Heavy-Duty Vehicle and Off-Road Equipment Investment Total	**$208.6**
TOTAL	**$483.6**

*Does not include any adjustments for project administration.

Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP)

The $100 million annual investments in clean vehicle technologies provided by California's ARTVP is funded through vehicle and vessel registration fees, special vehicle plates, and smog-abatement fees. Table 4 below summarizes cumulative ARFVTP awards as of September 2018. Key areas of investment in transportation electrification include cumulative funding of $94.9 million for 8,832 electric vehicle charging stations, $140 million for 64 hydrogen fueling stations, $32 million in support of the CVRP light duty vehicle incentives and HVIP truck and bus incentives (further supplemented by CARB funds), and $11.4 million in regional alternative fuel readiness programs.

Table 5: ARFVTP Awards as of September 1, 2018

Funded Activity	Cumulative Awards to Date (in Millions)*	# of Projects or Units
Alternative Fuel Production		
Biomethane Production	$61.3	21 Projects
Gasoline Substitutes Production	$29.5	14 Projects
Diesel Substitutes Production	$68.3	24 Projects
Renewable Hydrogen Production	$4.0	1 Project
Alternative Fuel Infrastructure		
Electric Vehicle Charging Infrastructure**	$94.9	8,832 Charging Connectors
Hydrogen Refueling Infrastructure	$140.6	64 Fueling Stations
E85 Fueling Infrastructure	$13.7	59 Fueling Stations
Upstream Biodiesel Infrastructure	$4.0	4 Infrastructure Sites
Natural Gas Fueling Infrastructure	$22.0	64 Fueling Stations
Alternative Fuel and Advanced Technology Vehicles		
Natural Gas Vehicle Deployment***	$82.8	3,127+ Vehicles
Propane Vehicle Deployment	$6.0	514 Trucks
Hybrid and ZEV Deployment (Including CVRP, HVIP, and Low-Income Mobility Incentives)	$32.0	10,700 Cars and 150 Trucks
Advanced Technology Freight and Fleet Vehicles****	$126.3	48 Demonstrations
Related Needs and Opportunities		
Manufacturing	$43.6	21 Manufacturing Projects
Workforce Training and Development	$31.5	17,440 Trainees
Fuel Standards and Equipment Certification	$3.9	1 Project
Sustainability Studies	$2.0	2 Projects
Regional Alternative Fuel Readiness	$11.4	52 Regional Plans
Centers for Alternative Fuels	$5.6	5 Centers
Technical Assistance and Program Evaluation	$5.7	n/a
Total	**$789.2**	

Source: California Energy Commission. *Includes all agreements that have been approved at an Energy Commission business meeting or are expected for business meeting approval following a notice of proposed award. For canceled and completed projects, includes only funding received from ARFVTP, which may be smaller than initial award. Due to rounding, "total" may not match sum of rows. **Includes $38.8 million for the California Electric Vehicle Infrastructure Project to provide EV incentives throughout California, which will fund a yet-to-be-determined number of EV chargers. ***Funding includes both completed and pending vehicle incentives, as well as funds reserved for future incentives. ****Includes projects from the former Medium- and Heavy-Duty Vehicle Technology Demonstration category.

For FY 2019-2020, Energy Commission staff have proposed an investment of $95.2 million under the ARFVTP, summarized in the table below. Virtually all this funding will be awarded on a competitive basis – with applications typically outpacing available funds by a multiple of three or more.

Table 6: Proposed AB 118 (ARFVTP) Investment Plan Allocations for FY 2019-2020 (in millions)

Category	Funded Activity	2019-2020
Zero-Emission Vehicle Infrastructure	Electric Vehicle Charging Infrastructure	$32.7
	Hydrogen Refueling Infrastructure	$20
	Manufacturing and Workforce Development	$5
Advanced Technology and Alternative Fuel Vehicle Support	Advanced Freight and Fleet Technologies	$17.5
	Natural Gas Vehicles and Infrastructure	-
Alternative Fuel Production	Low-Carbon Fuel Production and Supply	$20
	Total	$95.2

Source: California Energy Commission

To date, the ARFVTP program has supported 550,000 ZEVs in California, roughly half of all such vehicles in the United States.[23] California's electrification efforts are also being supported by nearly $800 million in investments in charging infrastructure and related activities by the state's investor-owned electric utilities, approved by the CPUC under the authority of SB 350 (De León, Chapter 547, Statutes of 2015).[24]

Building Code Title 24 Part 6 (Energy Code) and Part 11 (CALGreen) Requirements

Title 24 and local codes and standards are also accelerating the adoption of electric vehicles through policies that lower costs and streamline the installation of charging stations. The latest CalGreen codes and local "reach codes" (that may exceed CalGreen requirements) focus on electric vehicle-ready electrical infrastructure for new residential and commercial buildings as well as major remodels. Recommendations for expanding code requirements at the local level have been made by the Luskin Center for Innovation at University of California, Los Angeles for the Southern California Association of Governments (SCAG), which includes Ventura County. Core recommendations include a proposed requirement that pre-wiring "stub-outs" be provided at the time of any ownership change for all multi-unit developments. Building code requirements are highlighted in more detail in Chapter 8 of this report.

---

[23] California Air Resources Board. (September 21, 2018). Proposed Fiscal year 2018-2019 Funding Plan for Clean transportation Incentives for Low Carbon Transportation Investments and the Air Quality Improvement Program.

[24] California Energy Commission. (November 2018). *2019-2020 Investment Plan Update for Alternative and Renewable Fuel and vehicle Technology Program*. Retrieved from: https://www.energy.ca.gov/altfuels/2018-ALT-01/documents/

Ventura County Clean Transportation Policies and Goals

In California, state policy sets the long-term goal for electric vehicle and infrastructure adoption. However, city and county government in concert with relevant regional and local public agencies – such as Air Quality Management Districts, APCDs, Councils of Government, and transportation agencies – have a responsibility to set aligned local electrification goals and strategies – working in collaboration with community members, utilities, advocacy groups, and industry stakeholders. The air quality and climate related goals and standards of Ventura County agencies are described below.

Regional APCDs and Ventura NOx and Reactive Organic Gases Forecasts

The *2016 Ventura County Air Quality Management Plan* (AQMP) was adopted by the Ventura County APCD pursuant to the federal Clean Air Act Amendments of 1990. The Plan presents Ventura County's 1) strategy to attain the 2008 federal 8-hour ozone standard; 2) attainment demonstration for the federal 8-hour ozone standard; and 3) a "reasonable further progress demonstration" for the federal 8-hour ozone standard. The report identified Ventura County's NOx and Reactive Organic Gasses emissions forecasts by source as summarized in the tables below. On-road emissions of NOx are expected to decline substantially due to the combined impact of electric vehicles and improved emissions performance of internal combustion engine vehicles.

Table 7: Summer Planning Day NOx Emission Forecast

Major Emission	NOx (tons/summer day)					
Category	2012	2018	2020	2025	2030	2035
On-Road Vehicles	12.62	7.29	6.01	3.50	2.76	2.33
Other Mobile Sources	5.35	4.80	4.59	4.23	4.09	4.08
Mobile Equipment	3.43	2.89	2.66	2.03	1.74	1.66
Other Fuel Combustion	2.38	1.96	1.89	1.89	1.89	1.91
Electric Utilities	0.48	0.46	0.47	0.49	0.50	0.51
Petroleum Industry	0.17	0.14	0.13	0.13	0.12	0.12
ERC Balance	0.00	0.82	0.82	0.82	0.82	0.82
NOx Total Emissions	**24.44**	**18.36**	**16.57**	**13.09**	**11.93**	**11.43**

Notes:
Based on ARB CEPAM v1.04 (June 2016).
Data rounding may affect displayed values and totals.
OCS not included.

The Ventura County AQMP notes that transportation emissions reductions will be achieved through a suite of Transportation Control Measures designed to reduce motor vehicle emissions. These include:

- Trip Elimination
- Vehicle Substitution (substituting cleaner for dirtier vehicles)
- Vehicle Miles Traveled (VMT) reduction
- Vehicle Occupancy (increasing shared riding)

- Technological Improvements[25] (vehicle efficiency and emissions reductions, including via Electric Vehicles.)

The plan specifically references "technological improvements such as clean-fuel/electric vehicles" as central to regional emissions reduction, as well as vehicle emission controls, and Intelligent Transportation Systems such as signal synchronization and freeway management systems.[26] Electric vehicle adoption strategies developed by the Electric Vehicle Ready Blueprint will complement and inform future Vehicle Substitution Transportation Control Measures promoted by the Ventura County AQMD, and accelerate accomplishment of both local air quality goals and statewide ZEVs objectives.

Regional Transportation Plans

A broad range of regional planning documents have been published to help guide the development and operation of transportation infrastructure and services in Ventura County. These include the *Ventura County Coordinated Public Transit-Human Service Transportation Plan* (2016), the *Ventura County Transportation Commission -- Comprehensive Transportation Plan* (2013), the *Ventura County Congestion Management Program Plan* (2009), the *Ventura County Transit Investment Study* (2009), as well as agency specific plans from Gold Coast Transit and Metrolink. These reports are not specifically focused on the electric vehicle ecosystem, but they do provide additional policy context for the countywide electric vehicle planning process. Key components of each report are contextualized below, with the full reports accessible through their sponsoring agencies.

Ventura County Transportation Commission (VCTC), Comprehensive Transportation Plan (2013)
VCTC is a regional transportation planning body that directs the transit agencies within Ventura County and provides funding to its member agencies, the cities within Ventura County, and the County itself. In 2013, the VCTC released the *Ventura County Comprehensive Transportation Plan*, prepared by MIG, Inc. The document established the following vision statement to guide countywide transportation planning: "*A connected and integrated transportation system that provides convenient, safe and accessible options. This system is inclusive of all community members and needs, balancing all interests. It is intended to be built from a sustainable plan that reflects local priorities."*[27]

The report identified the following key challenges facing Ventura County:

- **Land use policies** acknowledge growth and focus it within the incorporated cities, resulting in open spaces between communities that create challenges to providing transit and cycling choices
- **The dominant mode of travel is by car**, and travel is predominately inter-city, accounting for approximately 80 percent of work trips, rather than inter-county, which accounts for approximately 20 percent of work trips
- **Public transit is provided by multiple operators** with differing service levels creating a challenge for riders

---

[25] Ventura County Air Pollution Control District. (February 24, 2017). *2016 Ventura County Air Quality Management Plan.*

[26] Ventura County Air Pollution Control District. (February 24, 2017). *2016 Ventura County Air Quality Management Plan.* P. 47.

[27] MIG, INC. (August 20, 2013). Ventura County Comprehensive Transportation Plan.

- **Bike and pedestrian systems** are developed within cities but have limited connections to other cities
- **Vehicle travel will increase** from 18 million annual miles today to nearly 22 million miles by 2035
- **Roads will be in dire need of repair** with a $1.3 billion shortfall projected over the next 30 years
- **Environmental issues** such as GHGs, air quality, treating urban runoff and preserving wildlife corridors will be more in the forefront, requiring additional resources be devoted to these purposes
- **Fuel prices and vehicle fuel efficiency** continue rising but federal fuel taxes have remained flat, so revenues are insufficient to maintain local streets, state highways or increase capacity on the freeway corridor; California passed SB 1 in 2017 to increase the state fuel tax and generate new revenues for roadway improvements and maintenance
- **Efficient freight movement** is critical to the health of the Port of Hueneme and Oxnard area
- **Limited roadway capacity:** Roadway capacity is limited in the region and must accommodate all user types
- **Absence of locally sourced funding,** as noted in the Comprehensive Transportation Plan, the County lacks a local source of revenues for self-investment in transportation. The 2012 Regional Transportation Plan/Sustainable Communities Strategy for Southern California indicates that 70 percent of funds for transportation improvements are expected to originate in the six county SCAG region, but Ventura is the only county without a local source. In fact, Ventura County is the most populous county in California without a dedicated local transportation funding source. [28]

In part due to the lack of local revenue sources, funding shortfalls have been identified for road improvement, expanded transportation services, Highway 101 and State Route 118 widening, bicycle lane networks, and goods movement out of the Port of Hueneme. Moreover, the Transportation Plan does not propose any locally sourced spending on electric vehicle infrastructure. The 2018 voter rejection of Prop 6 affirmed the increased state gas tax, established with the signing of SB 1, and SB 1 resources will help improve the local transportation funding outlook. However, it remains the case that (unlike Los Angeles, for example) Ventura County does not have its own dedicated transportation improvement tax that would be additive to state and federal sources.

Ventura County Congestion Management Program, 2009

The *Ventura County Congestion Management Program* provides local agencies and private developers with strategies and tools to manage traffic congestion in the County. VCTC is the designated Congestion Management Agency responsible for implementing the County's Congestion Management Plan, which is updated every two years. [29] While the Congestion Management Plan makes no specific reference to electric vehicle adoption, key plan components are relevant to electric vehicle readiness planning. Specifically, the Plan:

- Mandates the maintenance of a land use and traffic flow database
- Articulates strategies for demand management and optimization of street and road use

---

[28] COH & Associates. Ventura County Transportation Commission. (July 10, 2009). *2009 Ventura County Congestion Management Program.*

- Encourages public transit services that meet local and regional mobility needs - including carpooling, vanpooling, walking, and biking
- Defines measures to support the smooth flow of goods through the county
- Defines the regional planning and management roles of VCTC, local cities and county agencies, the Ventura County APCD, Ventura Council of Governments, SCAG, and California Department of Transportation.

Ventura County Coordinated Public Transit - Human Service Transportation Plan (2016)
Prepared in response to federal mandates in the *Fixing America's Surface Transportation Act* -- the *Ventura County Coordinated Public Transit – Human Services Transportation Plan* targets prioritized planning for seniors, persons with disabilities, and low-income residents. Key challenges identified in the report reference issues relevant to electric mobility, including electric buses and electric ride share, car share, and ride hailing services. Key challenges identified in the report include:

- **Difficulty planning trips** due to confusing information
- **Inconsistent service patterns** (weekday and weekend service shifts)
- **Challenges aligning service and schedules** between the multiple transit operators in the county
- **Unserved areas** including Mandalay Bay, travel from Seaward Ave towards Harbor Blvd; from Santa Paula and Fillmore to Ventura; and in the Pleasant Valley are near Route 101, from Camarillo to Thousand Oaks, in Ojai, and travelling to out-of-county medical destinations
- **Affordability issues** despite programs such as the Gold Coast Transit District's Senior 75+ free fare and Veterans half-price fare, [30]

The report includes recommendations for addressing the following key issues:

- Information gaps
- Capacity building of human service transportation programs
- Fixed route schedule coordination and service levels
- Transit affordability
- Capital and Infrastructure investment
- Dial-A-Ride service coordination

Ventura County Transit Investment Study (2009) and Electric Vehicle Charging Siting Opportunities
The *Ventura County Transit Investment Study* was published by VCTC to inform funding allocations for enhance transit services for County residents. Echoing many of the same themes as the *Ventura County Coordinated Public Transit Plan* referenced above, the study recommended:

- Improved linkages among various transit systems
- Cooperation among existing service agencies
- Incremental transit improvements that ignore jurisdictional boundaries
- Modifying organizational structures of service providers to offer countywide transit options
- Competition for limited funds by local agencies

[30] AMMA Transit Planning. Mobility Partners. Ventura County transportation Commission. (April, 2017). *Ventura County Coordinated Public transit-Human Services Transportation Plan, 2016 Revision.*

The *Transit Investment Study* also identifies major transit facilities which provide siting opportunities for electric vehicle charging stations and other electric mobility resources. These include:

- Shared Amtrak and Metrolink stations in Oxnard, Camarillo, Moorpark, and Simi Valley
- The Oxnard Transportation Center and the Thousand Oaks Community Transportation Center
- Ventura Bus Transit Center located at the Pacific View Mall
- Park and Ride lots
- Facilities operated by Gold Coast Transit in Oxnard, and the Public Works Departments of Ojai, Simi Valley, and Thousand Oaks
- Privately owned and operated transit storage yards.

Climate Action Planning Goals

To date, local Climate Action Plans (CAPs) and accompanying emissions inventories are deployed to varying degrees in Ventura County. Countywide efforts are underway to build upon a 2015 report by the VCREA titled *Climate on the Move*. The report was developed with funding support from SCE and Southern California Gas Company and provided an inventory of community-level GHG emissions and climate action templates for each local government member in Ventura County. *Climate on the Move* provides emission data from 2010-2012, 2020 emission forecasts, and GHG reduction target options. As of early 2019, the countywide Energy Action Plans are in development, along with CAPs for the cities of Ventura and Thousand Oaks and the County of Ventura, which build off the emission baselines created for *Climate on the Move*.[31] The City of Simi Valley also developed a CAP in 2011.

The *Climate on the Move* report recommends emission reduction targets aligned with the state goals of 40 percent below 1990 levels by 2030, and 80 percent below by 2050 - as established by SB 32 in 2015. However, these goals have not been formally adopted by the County of Ventura nor any municipalities in the county. Also, reduction targets are likely to be updated as a result of California's latest statewide emission reduction targets -- as well as the CAP planning process currently underway in the cities of Ventura and Thousand Oaks and in the County of Ventura.

In 2012, total county emissions totaled 7.2 million metric tons (MMT) of carbon dioxide equivalent (CO_2e). Of these, 36 percent was attributed to energy use and natural gas combustion, 10 percent from landfills, wastewater and other sources, and 54 percent from motor vehicles. Of the motor vehicle emissions, 25 percent was attributed to fuel burned on state highways, and 29 percent was attributed to fuel burned in off-road vehicles and on city and county roads, as shown in the table and figure below.

[31] https://www.vcenergy.org/wp-content/uploads/Climate_on_the_Move_Final.pdf

Figure 1: Ventura County Region 2012 GHG Emissions

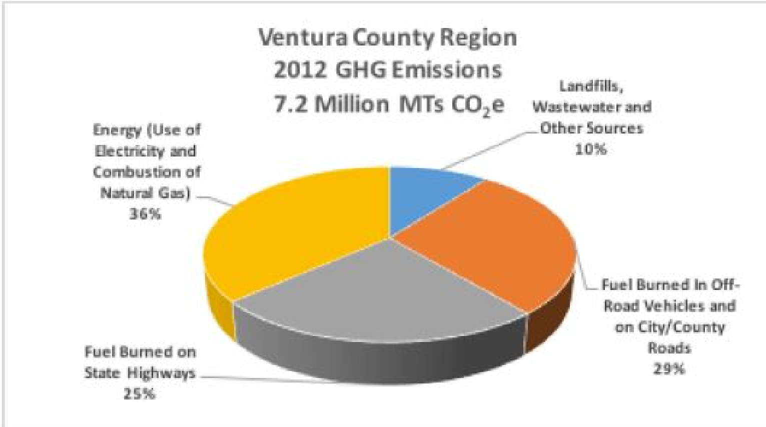


Table 7: Community GHG Emissions by Sector for Ventura County

Sector	2010 (MT CO2e)	2011 (MT CO2e)	2012 (MT CO2e)
On-Road Transportation (City/County Roads and State Highways)	3,431,902	3,365,498	3,298,797
Non-Residential Electricity Use	1,180,013	1,193,681	1,203,290
Other Emissions*	695,653	708,326	744,191
Residential Natural Gas Use	652,908	661,374	606,383
Residential Electricity Use	544,774	550,843	528,023
Off-Road Vehicle Use	508,966	511,592	517,748
Non-Residential Natural Gas Use	267,807	295,166	299,306
Total	**7,282,023**	**7,286,479**	**7,197,738**

*Includes emissions from gases with high global warming potential, methane and nitrous oxide from wastewater treatment plants and landfills.
**Values in this table and others may not add due to rounding.

Source: Climate on the Move: Report by the Ventura County Regional Energy Alliance (2015)

The *Climate on the Move* report also forecasts that emissions in Ventura County will be 8.2 percent lower in 2020 than in 2010, largely due to state requirements for renewable energy and clean fuels and vehicles. Within that total, emissions from the use of electricity will be reduced by 12 percent over 2010, and from on-road vehicles by 9.5 percent, while emissions from natural gas combustion will increase by 3.6 percent. Total emissions from on-road and off-road vehicles from 2010 to 2012 are shown in the tables below.

Table 8: GHG Emissions from On-Road Vehicles in Ventura County

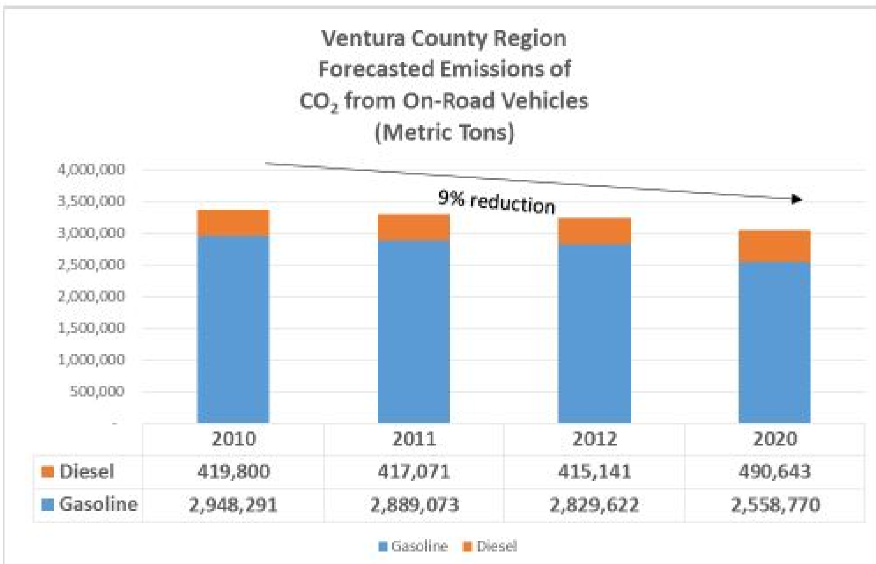
Year	MT CO_2e Total On-Road Emissions	MT CO_2e On-Road Emissions on State Highways
2010	3,431,902	1,845,677
2011	3,365,498	1,810,638
2012	3,298,797	1,774,753

Table 98: GHG Emissions from Off-Road Vehicles & Equipment in Ventura County

Year	MT CO_2e Total Off-Road Emissions
2010	544,774
2011	550,843
2012	528,023

The projected reduction of 9 percent between 2012 and 2020 is illustrated in the figure below.

Figure 2: Forecasts and Targets: Emissions from On-Road Vehicles



Source: Climate on the Move: Report by the Ventura County Regional Energy Alliance (2015)

Municipal Emission Reduction and Sustainability Plans

In addition to the CAPs now underway at the County level, other municipalities in Ventura County have produced sustainability plans that address aspects of energy, buildings, and transportation. These include plans from the Cities of Simi Valley (2010), Thousand Oaks (2018), Oxnard (2013), and Ventura (2012). Key elements are highlighted below.

City of Simi Valley, Green Community Action Plan, 2010
Transportation Elements

- Support enhanced fuel efficiency through alternative fuel options, and renewable sources of energy, for city facilities, operations and the community
- Alt fuels should comprise at least 20 percent of City's fleet by 2020 (current fleet composition is 6 percent hybrid, 2 percent electric, 12 percent Compressed Natural Gas (CNG), 8 percent diesel, and 71 percent gasoline)
- Support alternatives to single occupant automobile travel through processes and programs that reduce dependency on automobiles and improve transportation infrastructure

- Enhance regional transportation connections that originate or end outside of City boundaries for the efficient movement of goods and people

Energy Elements

- Renewable energy provides at least 20 percent of the city's power needs by 2020
- City facilities use 20 percent less energy than used in baseline year 2006, by 2020
- New construction meets, exceeds, or establishes building standards for municipal properties
- Purchasing and contracting decisions contribute to environmental sustainability
- Support and promote actions that advance community towards carbon-neutrality
- Encourage and attract economic development related to industries that provide material or technologies that support alternative energy systems that utilize alternative energy sources

City of Thousand Oaks, Sustainability Plan for Municipal Operations, 2018
Transportation Elements

- Sustain a city carpooling/vanpooling program for employees in which the city currently provides 16 CNG, four hybrid and two gasoline vehicles. The program is utilized by 89 staff. (Note that the City fleet fuel type composition is 17 percent hybrid, 16 percent diesel, 8 percent electric, 24 percent CNG, and 35 percent gasoline)

Energy Elements

- Participation in SCE's Direct Install Energy Efficiency program through VCREA
- Adoption of an Energy Action Plan (in 2012)
- Direct Access energy contract extended through 2020 to enable the top 15 City energy users to access third party renewable energy resources in the wholesale power market
- Power Purchase Agreement for an onsite 584 kilowatt (kW) solar array and cogeneration plant powered by biogas produced from wastewater
- Joining CPA to purchase clean energy for municipal and community facilities (launched for residential customers in February 2019, launched for non-residential customers in May 2019.) Note that the CPA is committed to greening its power mix over time, thereby steadily reducing the GHG intensity of electricity used to power electric vehicles.

ChargePoint EVSE: Thousand Oaks has also recently approved a "piggyback" agreement using the National Joint Powers Authority contract with award to ChargePoint, Inc. for the purchase of 11 electric vehicle charging stations plus installation. [32]

City of Oxnard, Energy Action Plan, 2013

The Oxnard Energy Action Plan articulates the following key energy efficiency and renewable energy goals, including:

- Develop a 2005 baseline and 2020 projections of energy consumption and associated GHGs
- Develop energy reduction targets and implementation steps

[32] City of Thousand Oaks. Electric Vehicle Charging station Donation and Deployment. Retrieved from: http://71.165.173.171/WebLinkPublic/DocView.aspx?dbid=0&id=1445557&page=1&cr=1

- Develop energy reduction and renewable energy programs and related outreach and stakeholder engagement programs.

The Oxnard General Plan also calls for the development of "programs to support electric vehicle infrastructure."[33] Additional recommendations of the Plan include development of energy efficiency performance standards and renewable generation goals applicable to both the public and private sectors. The full array of clean transportation and Energy Assistance Programs are indicated below. Program Number C6 to support renewable energy generation has potential to further reduce EV-related carbon intensity; and Program Number C7 to increase electric vehicle infrastructure should lead to greater charging access for Oxnard residents.

Table 10: Oxnard Community Energy and EV Programs

Program Number	Title	Implementation Timeframe	Annual Electricity savings by 2020 (kWh/yr)	Annual Natural gas savings by 2020 (therms/yr)	Annual GHG emissions savings by 2020 (MT CO2e/yr)
C-1	Additional Outreach to Commercial And Industrial Sector	2015	5,993,400	520,200	1,260
C-2	Additional Outreach to Residents	2015	1,458,000	120,600	300
C-3	Establish Partnerships between City Green Team and Local Agencies	2015	Supporting program	Supporting program	Supporting program
C-4	Implement Alternative Financing Mechanisms	2015	Supporting program	Supporting program	Supporting program
C-5	Recycled Water Outreach and Education Program	2015	Supporting program	Supporting program	Supporting program
C-6	Promote Renewable Energy Generation	2015	2,367,600	0	480
C-7	Support Electric Vehicle Infrastructure	2015	0	0	120
C-8	INCF Neighborhood Vintage Assessment Program	2016	952,000	79,000	200
C-9	Create Commercial PACE Program	2016	11,263,500	279,500	2,400
C-10	Create Residential PACE Program	2016	6,683,500	301,500	1,400
C-11	Expedite Permitting	2016	3,621,500	0	750
C-12	Develop Outreach to Agricultural Sector	2020	187,200	0	40
C-13	Promote Green Jobs in the Community	2020	Supporting program	Supporting program	Supporting program
C-14	Require Point-of-Sale Energy Use Disclosure	2020	782,900	64,800	170
C-15	Develop Renewable Energy Ordinance	2020	804,500	0	170
C-16	Develop Partnerships for Renewable Energy Generation	2020	0	0	19,710
C-17	Expand Business/Multi-Family Recycling Assessment Outreach	2015	Supporting program	Supporting program	Supporting program
	Total annual savings by 2020		34,114,100	1,365,600	27,000

Note: Annual electricity and natural gas values, including total, are rounded to the nearest 100 from raw data. GHG emissions values are rounded to the nearest ten.

[33] Oxnard, 2006. City of Oxnard 2030 General Plan (2011), Background Report. (2006).

City of Ventura Environmental Sustainability Strategy, 2012

The City of Ventura has one of the largest public fleets in the County, with the City's Fleet Services department currently managing more than 600 vehicles and small equipment resources. The original Sustainability Strategy, prepared in 2012, called for the City to reduce fuel use and VMT by city fleet vehicles, to increase renewable energy sources at city facilities, and to promote shared trips, as indicated in the Fleet Programs report below.

Table 11: City of Ventura Clean Fleet and Employee Ride Sharing Programs

	Responsible	Goals		Timeline	Cost	Funding	Status
Planned Projects/Activities	Responsible Division	Reduce Fuel	Reduce Miles Traveled	Short, Medium, Long*, or Ongoing		Funded or Unfunded	
Increase the amount of fuel efficient vehicles used for non-patrol vehicles at the Police Department. This could also be implemented for Fire Suppression support vehicles.	Fleet	X		Ongoing		Funded	
Prioritize high fuel use vehicles for replacement based on fuel use as main priority.	Fleet	X		Ongoing		Unfunded	Per Fleet Policy
Encouraging ride sharing to and from work as well as to meetings and conferences.	Env. Sust.	X	X	Ongoing			Bring to Green Team in FY13
Provide training to employees to encourage fuel efficient and safe driving behavior.	Fleet & Env. Sust.	X	X	Ongoing			Bring to Green Team in FY13

*Short (active in FY13), Medium (3-5 years), Long (5+ years)

Summary

The State of California has provided policy guidance and substantial funding to enable municipal and county governments – along with regional transportation and air quality districts -- to make significant progress toward the state's ambitious climate, renewable energy, and clean transportation goals. However, the existing local array of Climate Action, Energy, Transportation, Air Quality, and General Plans do not yet present a cohesive strategy for accelerating transportation electrification throughout Ventura County. By articulating Countywide goals for transportation electrification – and a set of strategies for advancing these goals – the *Ventura County Electric Vehicle Ready Blueprint* is intended to fill this gap. Accordingly, the Plan presented in the following chapters is designed to support existing local and county decarbonization goals, while also establishing a comprehensive action planning framework that will in turn inform the next generation of local and countywide plans addressing the key areas of transport electrification that are under local control, such as local building codes related to electric vehicle charging infrastructure, and electrification of public agency fleets.

Chapter 1 References

AMMA transit Planning. Mobility Partners. Ventura County transportation Commission. (April, 2017). *Ventura County Coordinated Public Transit-Human Services Transportation Plan, 2016 Revision.*

California Air Resources Board. (September 21, 2018). Proposed Fiscal year 2018-2019 Funding Plan for Clean transportation Incentives for Low Carbon Transportation Investments and the Air Quality Improvement Program.

California Air Resources Board. *2016 Edition: California GHG Emissions Summary*. (Accessed October 12, 2016). Retrieved from: https://www.arb.ca.gov/cc/inventory/pubs/reports/2000_2014/ghg_inventory_trends_00-14_20160617.pdf

California Air Resources Board. (September 21, 2018). Proposed Fiscal year 2018-2019 Funding Plan for Clean transportation Incentives for Low Carbon Transportation Investments and the Air Quality Improvement Program.

California Energy Commission. (November 2018). 2019-2020 Investment Plan Update for Alternative and Renewable Fuel and vehicle Technology Program.

City of Thousand Oaks. *Climate Action Planning.* (Accessed November 20th, 2018). Retrieved from: https://www.toaks.org/departments/public-works/sustainability/climate-action-planning

City of Simi Valley. *Live Green*. (Accessed, November 2018). Retrieved from: https://www.simivalley.org/departments/city-manager-s-office/live-green

City of Simi Valley. *Green Community Action Plan.* (August 30th, 2010). Retrieved from: https://www.simivalley.org/home/showdocument?id=3848

City of Ventura. (2012). City of Ventura Environmental Sustainability Strategy.

COH & Associates. Ventura County Transportation Commission. (July 10, 2009). *2009 Ventura County Congestion Management Program.*

Gold Coast Transit. *About GCTD – Organizational Information.* (Accessed November 20th, 2018). Retrieved from: http://www.goldcoasttransit.org/about-gct

Jacobs. Ventura County Transit Investment Study. (December 4, 2009). *Ventura County Transit Investment Study.*

Luskin Center. (2017). Southern California Plug-in Electric Vehicle Readiness Atlas: 2017 Update.

MIG, INC. (August 20, 2013). Ventura County Comprehensive Transportation Plan.

Ventura County Air Pollution Control District. (February 24, 2017). *2016 Ventura County Air Quality Management Plan.*

Oxnard, 2006. City of Oxnard 2030 General Plan (2011), Background Report. (2006).

Southern California Edison. *Charge Ready Program Fact Sheet.* Retrieved from: https://www.sce.com/wps/wcm/connect/ff4d5544-c304-495f-9251 372a0f4b6031/4950_SCE_ChargeReadyFactSheet_20160412.pdf?MOD=AJPERES

Southern California Edison. *Electric Vehicle Rates*. Retrieved from: https://www.sce.com/wps/portal/home/business/rates/electric-car-business rates/!ut/p/b1/hc9Ba4NAEAXg35KDx7jP3ZJqbyuIrpVao6S6l6LFbgTjBmMrcxIT1E0nZub_gezBBJciK78rtR5dDormzPWa7eLdvngUghbNexIdznyLMiijhlEygmgF-G47_-G5EzkvnemcDZvFKWcToH_vqRQoQbL4pdi-LhBzgvCCMJ5AlDIIleEk5Z8DqCv44MiRStbq6PFzwrmK2IrKvPu7s2vflpvh2F_eDJgYBxHU2mt2tr80DsD9ypbfRhIfivJfpejEUtZHcfFCb4ibhg!/dl4/d5/L2dBISEvZ0FBIS9nQSEh /

Southern California Edison. *Electric Vehicle Rates, Rebates and Incentives.* Retrieved from: https://www.sce.com/wps/wcm/connect/ee16c3df-7b97-450b-83b1-627d527d3479/16635-2_April2015new.pdf?MOD=AJPERES

Southern California Edison. *Charge Ready 2 EV Charging Infrastructure Proposal.* Retrieved from: https://www.edison.com/content/dam/eix/documents/innovation/electric-transportation/charge-ready-2-ev-charging-infrastructure-proposal.pdf

Ventura County Regional Energy Alliance. (2015). *Climate on the Move.* Retrieved from: https://www.vcenergy.org/wp-content/uploads/Climate_on_the_Move_Final.pdf

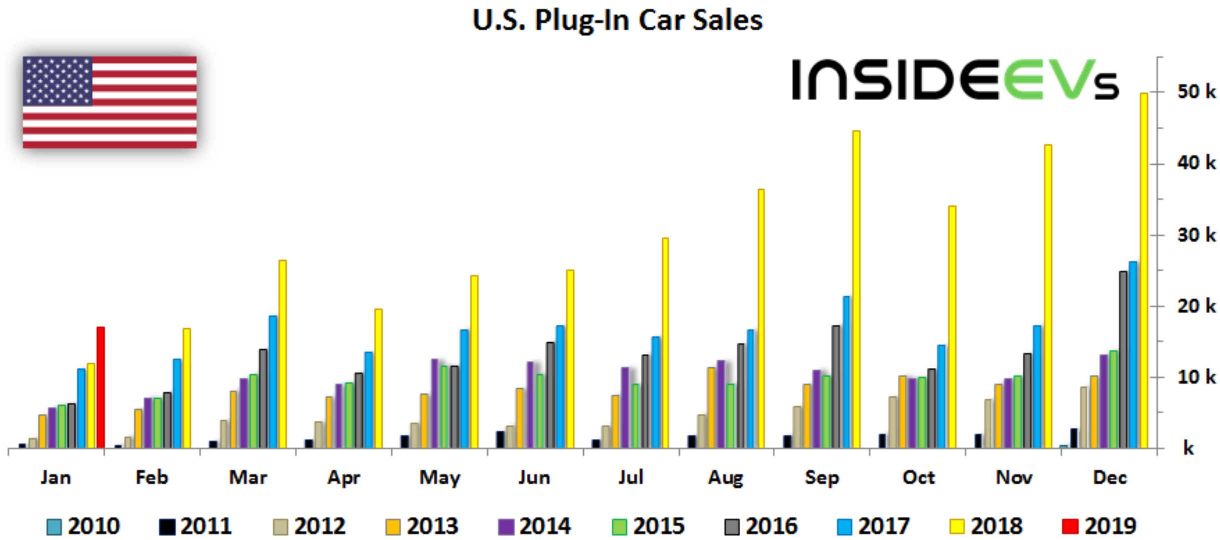
Ventura County Electric Vehicle Ready Blueprint

Chapter 2: Technology and Market Context for Light Duty Electric Vehicles

Outlook for Electric Vehicle Product Diversity, Price, and Performance

Consumer interest in electric vehicles – including both plug-in hybrid electric vehicles and battery electric vehicles – has boomed in the last several years. In 2018, total domestic electric vehicle sales reached over 360,000, an 81 percent increase over 2017.[34] Monthly year over year growth in the market has also steadily increased as shown in the figure below.

Figure 1: US. Plug-In Car Sales[35]



The compound rate of growth of electric vehicle adoption in California is likely to put the state on track to meet its goal of 1.5 million cumulative electric vehicle sales by 2025 (Executive Order B-16-12) and 5 million electric vehicles by 2030 (Executive Order B-48-18). Electric vehicle sales will need to grow by 21 percent annually to reach the 5 million electric vehicle goal. The 81 percent growth rate that occurred in 2018 is impressive, but high rates of compound growth will be difficult to maintain in later years as a result of market saturation.

In recent years, the strong growth rate of electric vehicle sales in California has been due to the combined impact of government incentives and mandates, improved price and performance of electric vehicles, and improved charging infrastructure. Globally, with this rate of growth, approximately eight in 10 cars sold in 2030 are expected to be electric vehicles, according to Bloomberg New Energy Finance.[36] The consulting firm Wood Mackenzie estimates that the current rate of growth will result in a global stock of 280 million electric passenger cars by 2040, with the US accounting for a cumulative 71 million electric vehicles, and California likely comprising one-third of the US total, or more than 20 million electric vehicles. The 2040

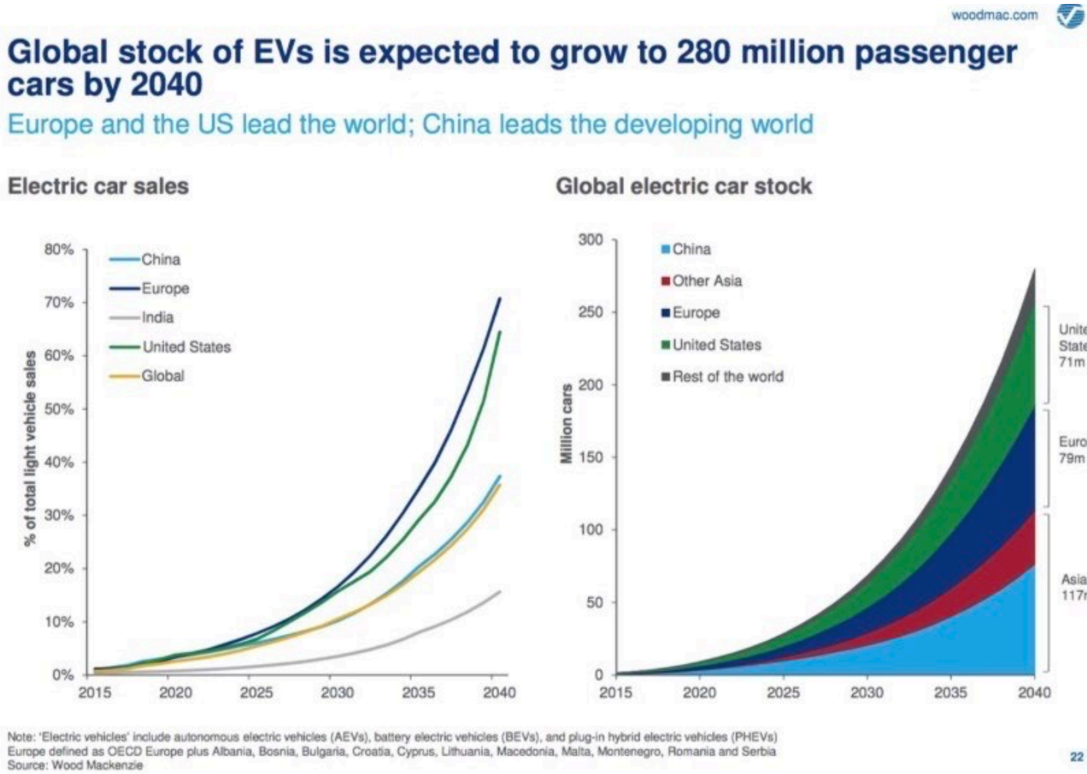
[34] Steven Loveday. (January 6, 2019). *Inside EVs.* "December U.S. plug-in EV sales will climb again, but how high?" Retrieved from: https://www.greentechmedia.com/articles/read/us-electric-vehicle-sales-increase-by-81-in-2018

[35] Inside EVs. Monthly Plug-In EV Sales Scorecard. Retrieved from: https://insideevs.com/monthly-plug-in-sales-scorecard/

[36] Bloomberg New Energy Finance. Electric Vehicle Outlook, 2018. Retrieved from: https://about.bnef.com/electric-vehicle-outlook/

estimate would be consistent with electrification of approximately two-thirds of the California vehicle fleet.

Figure 2: Global Stock of Electric Vehicles by 2040



Electric Vehicle Product Diversity and Performance Trends

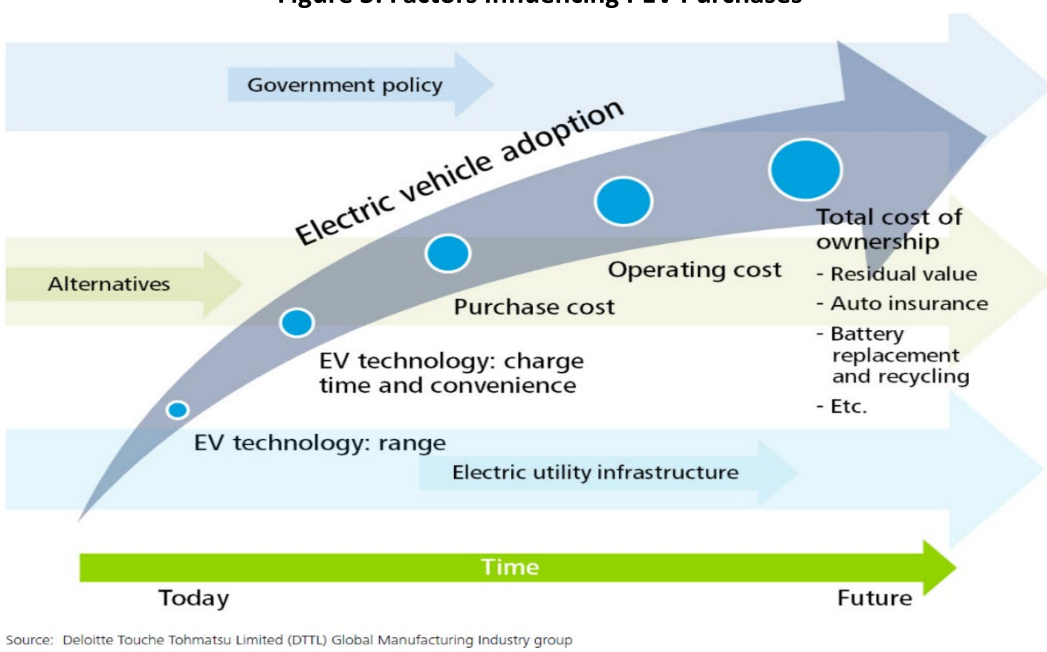
Prospects for accelerated electric vehicle uptake in California and beyond are driven foremost by enhanced product diversity, performance, and declining cost. As of 2019, an electric vehicle model is now offered by nearly every automobile manufacturer. A total of 43 electric vehicle models are now available in California – and there is a configuration and range option to meet most driving needs. With 512,000 electric vehicles having been sold in the state, according to California Department of Motor Vehicles (DMV) data, there is also a robust used vehicle market as well. There are several battery electric sedans with 220 – 250+ mile all-electric range available for under $38,000 with incentives. These include the Chevy Bolt, Kia Niro, and the Tesla Model 3. There are also an increasing number of attractive plug-in hybrid options, such as the Honda Clarity (with a 45-mile electric range), and the Mitsubishi Outlander SUV with a 22 mile all electric range, both available for approximately $35,000 prior to incentives. Finally, major automakers from Volkswagen to Daimler to Volvo have announced plans to electrify vehicles across their entire fleet and are investing tens of billions of dollars in new battery and assembly facilities. (See the comprehensive table of U.S. electric vehicles sales by manufacturer in the appendix of this report).

Automakers are also competing on vehicle performance metrics including range, charge time, and design features. In the light duty segment, vehicle range is now extending over 320 miles in the Tesla Model S and the Porsche Taycan. Charging rates and times are increasing from the previous high of 150 kW (good for ~250 miles of range in 45 minutes of charging) to 350 kW (good for 250 miles of range in just 20 minutes). Currently, most electric vehicles on the market are in the sedan and SUV categories; however, Ford recently announced future production of an electric version of its popular F-150 pick-up truck. New electric vehicle maker Rivian and Tesla have also announced forthcoming pick-up truck models, with 400 – 500 miles of all electric range promised by 2022. Electrification of the pick-up truck has been heralded by many analysts as a key "cross-over point" for mass market acceptance of electric vehicles, given the vast numbers of pick-ups sold in the U.S.

Light Duty Electric Vehicle Pricing Trends

The market growth of electric vehicles is driven by variety of important factors, shown in Figure 3, including declining total costs of ownership, consumer desire, government policy, and reduction of range anxiety. Of all these factors, upfront purchase price parity is likely the leading factor in the transition to mass adoption.

Figure 3: Factors Influencing PEV Purchases



[37]

With state and federal incentives and operational cost savings, many electric vehicles have already achieved price parity with equivalent internal combustion engine vehicles on a TCO basis. However, *up-front purchase price parity* has not yet been achieved. Fortunately, battery prices are dropping more than 10 percent or more per year. [38] As this trend continues, it is anticipated that most electric vehicles will be at or near price parity with internal combustion engines by the mid-2020s even without incentives. While federal tax credits are being reduced for Tesla and General Motors, tax credits are generally available to further reduce costs by up to $7,500 for most original equipment manufacturers, complemented by an additional discount of $1,500 to $5,000 through the CVRP. As of mid-2019, advocacy efforts are underway

---

[38] Nicolaz Zart. *Clean Technica, f* "Batteries Keep on Getting Cheaper." Retrieved from: https://cleantechnica.com/2017/12/11/batteries-keep-getting-cheaper/

to extend the federal tax credits and "refill" the accounts of automakers that have expiring credits, with the united support of both the electric utility and auto industries, but the fate of these efforts is uncertain.

The used vehicle market is also expanding – providing further opportunity for electric vehicle adoption across consumer income levels. A three-year-old Nissan Leaf with relatively low mileage and approximately 70 miles of driving range can be purchased for well under $10,000. Chevy Volts with reasonable mileage are available for under $15,000. The Clean Vehicle Assistance Program (CVAP) offers up to $5,000 in down-payment assistance to income-qualifying applicants on new <u>or</u> used vehicles. In addition, some utility and Air District programs permit electric vehicle incentives and rebates to be applied to used electric vehicles, and "stacked" with CVRP funds. Regionally specific incentives can further reduce the equipment and installation costs of charging infrastructure.

Total Cost of Ownership for Electric Vehicles vs. Conventional Vehicles

In the light-duty segment, the total cost of ownership for battery electric vehicles can be comparable to or less than either internal combustion engines or plug-in hybrid electric vehicle alternatives, especially if battery electric vehicles are purchased on the used market. However, if vehicles are purchased new, then annual VMT must be high enough to rapidly amortize the electric vehicles' higher up-front investment across a greater number of miles (thereby capturing more of the fuel savings). According to analyses by electric vehicle rental fleet operators such as EverCar, the break-even point for total cost of ownership advantage with EVs is reached when battery electric vehicles are driven at least 12,000 miles a year. At 20,000 miles per year or more the operating cost advantage becomes even more compelling.

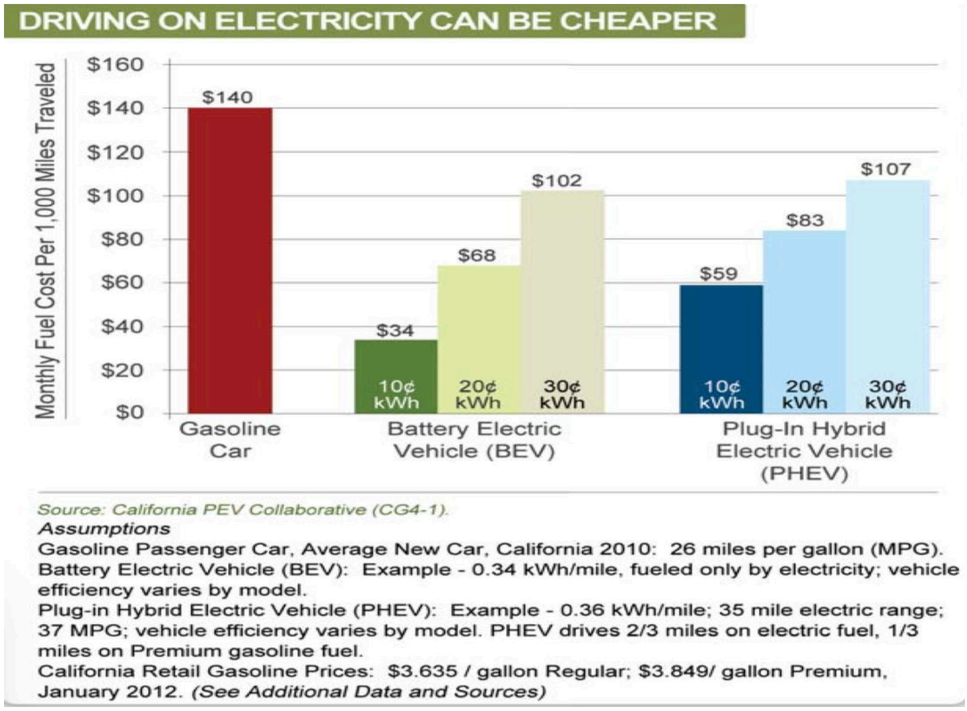
Cost savings can be realized through reductions in electric vehicle fueling cost, as well as from reduced maintenance costs. The California Plug-in Electric Vehicle Collaborative provides the following fuel cost assumptions, demonstrating potential savings as a result of switching to electric vehicles from internal combustion engine vehicles. For Ventura County residents paying 22 cents per kilowatt hour (kWh) during off-peak hours,[39] lower electric charging costs translate to savings of about $70 per 1,000 miles traveled. For income qualified customers on CARE/FERA rates, the savings can be up to 30 percent higher.[40]

---

[39] SCE. TOU Rates. retrieved form: https://www.sce.com/residential/rates/Time-Of-Use-Residential-Rate-Plans

[40] SCE. CARE & FERA Rates: Retrieved from: https://www.sce.com/residential/assistance/care-fera

Figure 4: Monthly Fueling Costs per 1,000 Miles Traveled



Comparing Costs for a Compact Battery Electric Vehicle verses a Compact Internal Combustion Engine: Operational and maintenance costs of electric vehicle ownership are also reported as lower than those of internal combustion engine vehicles. The following table below presents an estimate of the relative operating cost differential between a battery electric vehicle and an equivalent internal combustion engine vehicle, with the Nissan Leaf and Nissan Versa as the comparison vehicles. In this example, six years and 18,000 miles per year is the identified usage pattern, and over the six-year hypothetical use period, average fuel costs of $3.50 per gallon and off-peak electricity rates of $0.22 per kWh are used for comparative purposes. Of course, different results will be obtained with different projections for mileage, fuel and energy costs, and residual values, as well as different purchase prices. Because of all these variables, it is recommended that buyers take advantage of one of the many online electric vehicle cost calculators, such as those available through the Department of Energy's Clean Cities website, to project the "all-in" cost of ownership of various electric vehicle options given currently prevailing purchase prices and operational costs. [41]

[41] see http://www.afdc.energy.gov/tools for calculator option

Table 1: Operating Cost Comparison of a Battery EV verses a Compact Internal Combustion Engine [42]

	Internal Combustion (ICE)	Battery Electric Vehicle (BEV)	Comparison Results ICE Vs. BEV
Vehicle Description and Fuel Price Assumptions	Type: 5 passenger sedan Range 400 mi. with 16 Gallon tank Gasoline: $3.50/Gallon Fuel Cost/Tank: $56 / 400 mi	Type: Nissan LEAF ~1kWh = 4 mi. driving distance Range: 96 mi. w/ 24kWh battery Electricity cost: $0.22/kWh off-peak rate	Term: 6 Yrs. Usage: 18,000 mi. / Year Total Mileage: 108,000
Fueling Cost Per Mile	$0.140 Avg. 25 miles per gallon – reg. gas Cost per mi: $56/400 Mi. = 14 cents/mile	$0.055 5.6 per kWh. 1 kWh = 4 Mi. of driving distance = 0.055 cents per mile	2.5x less expensive
Lifetime Fueling Cost (6 yrs./108k miles)	$15,120	$5,940	$13,6089,180 savings in 6 Yrs.
Estimated routine service and engine wear lifetime costs	$6000	$2000	$4000 savings in 6 yrs.
Insurance costs	$6000	$5000	$1000/6Yrs
DMV Smog costs	$400	$0	$400/6 Yrs.
TOTAL	$27,520	$12,940	$14,580/6 Yrs.

The example in the table above projects a battery electric vehicle operating cost advantage of $14,580 over six years, given annual mileage of 18,000 miles per year. With fewer miles driven, savings would be less. Charging infrastructure costs must also be factored into the initial purchase price of electric vehicles. Such costs can add anywhere from a few hundred dollars to more than $1000 depending on the type of charger, the existing electrical capacity, and the installation location and complexity.

For consumers, the typical Level 2 residential installation (enabling a 4 to 6-hour recharge) can cost as little as $300 for the equipment and $200 for installation, to $1000 or more for combined equipment and installation costs. Key cost variables include the potential need for new panel capacity, or a longer conduit run from the panel to the charging station. Some of this outlay can be defrayed by utility rebates. For fleet managers, installation costs are typically much higher, with large variations based on layout, capacity needs, and trenching requirements. However, there are also utility rebates and competitive grant funds available to support fleet charging infrastructure. For example, SCE has generous *Charge Ready* programs for fleets and for business and residential customers that can pay for most or all of the "make-ready"

[42] *Electrifying Your Business.* Business Council on Climate Change and Bay Area Council. Accessed November, 2018
at http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf.

infrastructure as well as a substantial portion of equipment and installation costs. Finally, many charging infrastructure providers offer favorable financing to reduce or eliminate up-front capital expenditures.

Incentive Outlook for Light-Duty Electric Vehicles

Lower electric vehicle pricing is supported by the availability of state and federal vehicle incentives. In California, the state and regional electric vehicle incentive outlook is positive in the near-term, while federal incentives depend largely on political developments in Congress and the Executive Branch. With robust funding from California's Greenhouse Gas Reduction Fund – also known as "Cap and Trade revenue" – the number and scale of financing programs, rebates, and discounts on electric vehicles and electric vehicle charging infrastructure has been expanding for all vehicle segments. As discussed above, at the federal level, the current federal tax rebate for electric vehicles will be subject to reductions for some manufacturers as they reach established program volume limits per company. This has initially impacted Tesla vehicles, reducing the maximum rebate available from $7,500 in 2018 to $3,750 by early 2019, with further reductions phasing in later in 2019. For other manufacturers, the federal government will continue to offer federal tax credits ranging from $2,500 to $7,500. The credit is equal to $2,500 for an electric vehicle with a battery of at least 5 kWh of capacity, plus an additional $417 for each kWh of battery capacity in excess of 5 kWh, up to the maximum of $7,500. The credit begins to phase out for each manufacturer when at least 200,000 of the manufacturer's qualifying vehicles have been sold for use in the United States (determined on a cumulative basis for sales after December 31, 2009). General Motors has also been subjected to a rebate reduction in 2019. [43]

Clean Vehicle Rebate Project (CVRP)

The legislative Budget Act of 2016 and SB 859 created an expenditure plan for unallocated revenues from the Cap and Trade program, and established targets for making clean vehicles more accessible to a greater number of California drivers, especially in communities that are highly impacted by air pollution. The CVRP program in turn helps to advance these goals by offering rebates of up to $7,000 for the purchase or lease of new, eligible zero-emission vehicles, including electric, plug-in hybrid electric and fuel cell vehicles. As long as funds are available, eligible California residents can follow a simple process to apply for a CVRP rebate after purchasing or leasing an eligible vehicle. Rebates are administered by the Center for Sustainable Energy under a contract with CARB (see www.CleanVehicleRebate.org). Single income tax filers making more than $150,000, head-of-household filers making more than $204,000, and joint filers making more than $300,000 are not eligible for the program. [44] However, low-to-moderate income filers making less than 300 percent of the federal poverty level (for example, $75,300 or less for a family of four) are eligible for a $2,000 rebate increase above the $2,500 baseline. [45]

Monthly rebates for California electric vehicles hit record highs by mid-2018, thanks in part to a surge of purchases by Tesla Model 3s buyers wishing to claim the full $7,500 federal tax rebate. Rebate growth has continued despite the imposition of the high-income cap on program participation.

---

[43] IRS. *Plug-in Electric Drive Vehicle Credit (IRC 30D).* Retrieved from: https://www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d

[44] Clean Vehicle Rebate. Income Caps. Retrieved from: https://cleanvehiclerebate.org/eng/income-eligibility#income-cap

[45] More information available from the ARB at: https://www.arb.ca.gov/msprog/lct/cvrp.htm

Clean Vehicle Assistance Program (CVAP)
The CVAP provides grants and affordable financing to help income qualified Californians purchase a new or used hybrid or electric vehicle. The program is funded by California Climate Investments and Cap-and-Trade dollars.[46] As of May 2019, the program has a waitlist is in effect and is pending renewed funding to restart the assistance program.

Southern California Edison Clean Fuel Rewards Program
Funds from California's LCFS Program allow SCE to offer a rebate of $1,000 through its *Clean Fuel Reward Program.* This incentive may be claimed up to three times during the life of a specific vehicle as it changes hands among different owners. All electric vehicles, new or used, including both plug-in hybrid and battery electric models, get the same rebate. Both Direct Access and Community Choice Energy agency customers are eligible for the program, as well as regular SCE customers.[47] SCE also facilitates the *Charge Ready Program* referenced above, which provides incentives for both commercial and residential electric vehicle charging installations. The Charge Ready Program is described in more detail in Chapter 3.

Air District Programs
The Ventura County APCD facilitates vehicle replacement programs that offer residents cash rebates to voluntarily retire old cars, pick-ups, vans, or SUVs. Ventura County APCD offers $1,000 to retire vehicles older than 1997 that are registered in Ventura County.[48]Ventura County and other Air Districts have also historically funded a limited number of commercial charging installations each year.

Low Carbon Fuel Standard Program
The LCFS program provides funding for low-carbon fueling, including electricity. Supported by Cap and Trade revenues, the Program helps to incentivize electric vehicle charging in the state – by enabling electric vehicle service providers to generate credits valued between $0.25 per kWh for grid charging, and $0.33 per kWh for charging with renewable energy.[49] Additional information on LCFS is provided in Chapter 3 of this report.

High Occupancy Vehicle (HOV) Lane Access
HOV Lane access via the CalTrans HOV sticker program is another significant incentive to electric vehicle adoption. Battery and plug-in hybrid electric vehicles are eligible to drive in restricted HOV lanes but are subject to differential access privileges depending on designated freeway restrictions. Use of the stickers can speed up travel time significantly and is especially useful for Ventura County residents navigating busy highway systems in the greater Los Angeles basin or commuting to Santa Barbara County.

---

[46] Clean Vehicle Assistance Program. Retrieved from: https://cleanvehiclegrants.org/
[47] More info available from Southern California Edison at: https://evrebates.sce.com/cleanfuel
[48] Ventura County Air Pollution Control District. Incentive Programs. Retrieved from: http://www.vcapcd.org/grant_programs.htm
[49] California Air Resources Board (CARB) (2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons. March

California Energy Commission Funding

Energy Commission grant opportunities for electric vehicle infrastructure are issued annually based on priorities developed for each state fiscal year (July 1 through June 30th). Specific guidelines are not typically announced in advance but are presented in each solicitation as it is published. Recent grant cycles have focused on inter-regional Fast Charge corridors, as well as workplace and destination charging sites. It is expected that charging for apartments and condominiums, also known as multi-unit developments, will be a significant focus of upcoming solicitations. Ventura County stakeholders will be most likely to succeed in these solicitations by identifying target sites in advance, partnering with previously successful project developers, and developing at least one-for-one local matching resources, where feasible. Support and participation of local utilities, Air Districts, government agencies, and relevant nongovernmental organizations can increase the likelihood of a successful project. More information on grant opportunities is presented in Chapter 11.

Electric Vehicle Adoption Trends in Ventura County

Declining costs, incentives, improved products, and increasing consumer interest have driven steadily increasing adoption of electric vehicles in Ventura County. CVRP filings indicate there are more than 6,700 electric vehicles in Ventura County as of January 1, 2018, with an approximate split of 44 percent battery electric vehicles to 56 percent plug-in hybrid electric vehicles, as shown in the Table 2 below. Historic adoption of the CVRP credits reveal that electric vehicle adoption has experienced a combined annual growth rate in Ventura County of 56.6 percent per year, as shown in Figure 6. While the annual growth rate of EVs has been impressive, the cumulative percentage of electric vehicles in the total Ventura vehicle fleet is just now reaching 1 percent. Given the approximate 12-year lifespan of new vehicles, sustained double-digit sales of electric vehicles will be needed over a 10+ year period to bring the cumulative Ventura electric vehicle count above 10 percent.

Table 2: Count of Ventura County Vehicle Fuel Types (January 1, 2018 CVRP Data) [50]

Fuel Type	Count	Percent
Battery Electric	3,015	0.42%
Diesel	28,516	3.95%
Diesel Hybrid	26	0.00%
Ethanol	42,979	5.95%
Fuel Cell	21	0.00%
Gasoline	619,401	85.74%
Hybrid Gas	24,186	3.35%
Plug in Hybrid	3,768	0.52%
Butane	1	0.00%
Compressed Natural Gas	70	0.01%
Methanol	125	0.02%
Methane	3	0.00%

[50] DMV Statistics: California Motor Vehicle Fuel Types by County. January 1, 2018. Retrieved from: https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics

Natural gas	269	0.04%
Propane	68	0.01%
Total	722,448	

Adoption of electric vehicles by city within Ventura County tracks closely with the distribution of higher income households, as illustrated below.

Table 3: Electric Vehicle Adoption by City

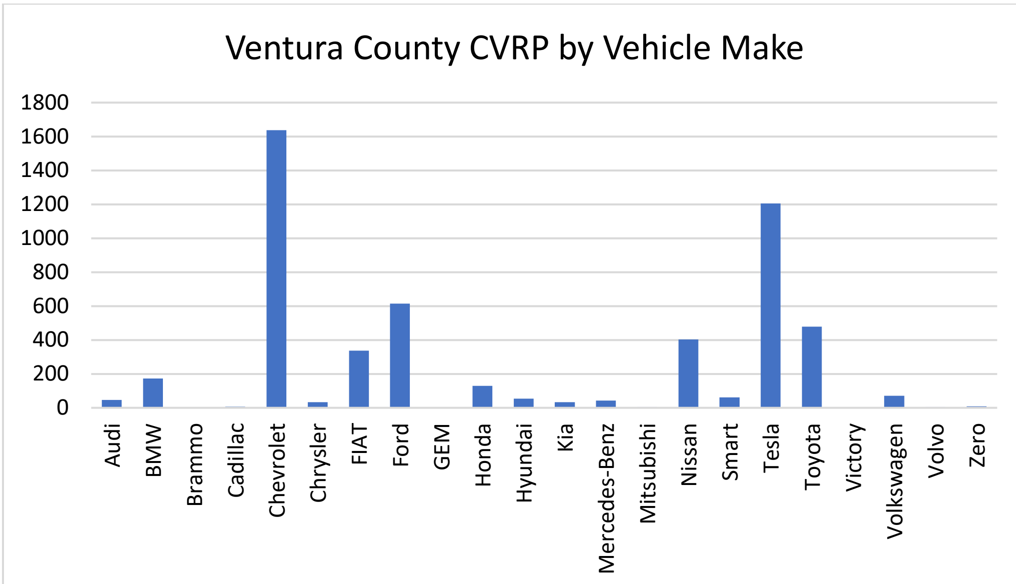
Agency	Pop. [51]	Total registered vehicles [52]	# EVs & % EVs	Percent EV
Ventura County Unincorporated	99,121	81,985	BEVs :444 PHEVs: 448 TOTAL: 892	1.088
Oxnard	210,037	129,825	BEVs: 208 PHEV: 252 TOTAL:462	.356
City of Ventura	108,511	101,411	BEVs: 400 PHEVs: 378 TOTAL: 778	.767
Thousand Oaks (includes DMV Newbury Park)	128,995	111,963	BEVs: 758 PHEVs: 969 TOTAL: 1,727	1.542
Simi Valley	126,878	115,679	BEVs: 458 PHEVs: 870 TOTAL: 1328	1.148
Camarillo	67,845	70,776	BEVs: 351 PHEVs: 377 TOTAL: 728	1.029
Fillmore	15,812	14,953	BEVs: 27 PHEV: 36 TOTAL: 63	.421
Moorpark	36,802	33,451	BEVs: 175 PHEVs: 235 TOTAL: 410	1.226
Ojai	7,582	19,665	BEVs: 132 PHEVs: 113 TOTAL: 243	1.236
Port Hueneme	22,327	16,138	BEVs: 23 PHEVs: 44 TOTAL: 67	.415
Santa Paula	30,313	26,602	BEVs: 44 PHEV: 46 TOTAL: 90	.338
TOTAL (County-wide) [53]	854,223	722,448	BEVs: 3015 PHEVs: 3768 TOTAL: 6783	.939

Vehicle purchase choices of Ventura County residents have mirrored statewide trends, with the Chevy Volt and various Tesla models dominating the first decade of electric vehicle purchases on a cumulative

[51] US Census. Retrieved from: https://www.census.gov/data.html
[52] CA Department of Motor Vehicles. DMV Statistics. Retrieved: https://www.dmv.ca.gov/portal/dmv/detail/pubs/media_center/statistics
[53] Totals don't add above based on merging of multiple data sources, the 722,448 total EV adoption is based on CVRP data.

basis. Ford, Toyota, and Nissan models are the next most popular. However, a higher proportion of Tesla owners choose not to pursue the credit – or are ineligible due to high income – and thus the CVRP data is not a perfect proxy for sales by manufacturer.

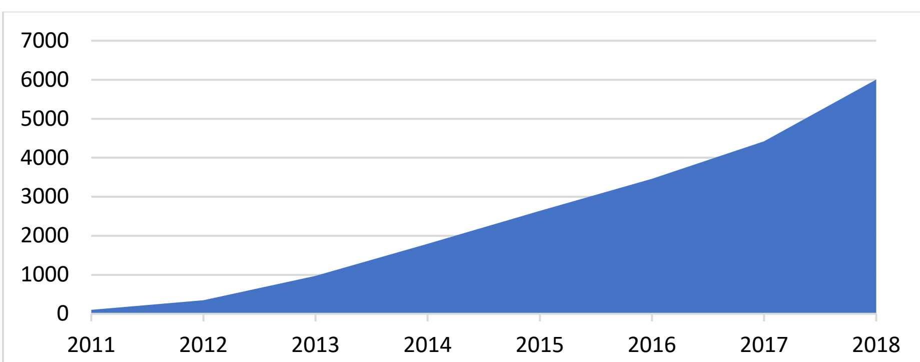
Figure 5: Ventura County CVRP Credits by Vehicle Make[27]



Electric Vehicle Adoption Growth

Analysis of CVRP registration data reveals a combined annual growth rate in Ventura County of 56.6 percent per year. Based on this adoption rate, and assuming no market saturation occurs and reduces the adoption rate the total number of electric vehicles in the county is expected to reach nearly 250,000 vehicles by 2025.

Figure 6: Ventura County Cumulative CVRP Filings, 2011-2018 [54]



[54] Center for Sustainable Energy (2019). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated 5/15/2019. Retrieved 5/19/2019 from: https://cleanvehiclerebate.org/eng/rebate-statistics

Despite the steady growth in countywide electric vehicle adoption, approximately 99 percent of vehicles in the County remain dependent on fossil fuels. To create a “tipping point” in the percentage of new vehicle sales that are electric, enhanced local programs, policies, and strategies are needed to improve consumer electric vehicle awareness, increase electric vehicle sales, promote new electric mobility solutions, accelerate charging deployment, reach under-served residents, and attract additional resources for electric vehicle ecosystem development. The following chapters of this report presents a cohesive set of recommendations designed to inform local policy and program development and accelerate accomplishment of Ventura County’s transportation electrification and climate action goals.

Chapter 2 References

Bloomberg New Energy Finance. Electric Vehicle Outlook, 2018. Retrieved from: https://about.bnef.com/electric-vehicle-outlook/

California Air Resources Board. (December, 2017). California Clean Vehicle Rebate Project. Retrieved from: https://cleanvehiclerebate.org/eng24BAQMD.

California Vehicle-Grid Integration Roadmap: Enabling Vehicle-Based Grid Services; California Independent System Operator and Partners, February 2014, https://www.caiso.com/Documents/Vehicle-GridIntegrationRoadmap.pdf, p. 1.

CARB. LCFS Basics. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/background/basics.htm

CARB. LCFS Data Management System. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/reportingtool/datamanagementsystem.htm#lrt-cbts

Center for Sustainable Energy (2018). California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. Data last updated 11/19/2018. Retrieved November, 2018. from https://cleanvehiclerebate.org/eng/rebate-statistics

Darlene Steward, Critical Elements of Vehicle-to-Grid Economics, National Renewable Energy Laboratory, September 2017, p. 4. https://www.nrel.gov/docs/fy17osti/69017.pdf

Deloitte Global Consumer Auto Survey, 2011. Retrieved:

https://www2.deloitte.com/us/en/pages/manufacturing/articles/unplugged-electric-vehicle-realities-vesrus-consumerexpectations.

Electrifying Your Business. Business Council on Climate Change and Bay Area Council. Accessed November, 2018

at http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf.

Southern California Edison. Charge Ready Program Fact Sheet. Retrieved from: https://www.sce.com/wps/wcm/connect/ff4d5544-c304-495f-9251 372a0f4b6031/4950_SCE_ChargeReadyFactSheet_20160412.pdf?MOD=AJPERES

Southern California Edison. Clean Fuel Rewards Program. Retrieved from: https://evrebates.sce.com/cleanfuel

IRS. Plug-in Electric Drive Vehicle Credit (IRC 30D). Retrieved from: https://www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d

California Air Resources Board (CARB). (March. 2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons.

Nicolaz Zart. Clean technical. Batteries Keep on Getting Cheaper. Retrieved from: https://cleantechnica.com/2017/12/11/batteries-keep-getting-cheaper/

Southern California Edison. Charge Ready Program Fact Sheet. Retrieved from: https://www.sce.com/wps/wcm/connect/ff4d5544-c304-495f-9251 372a0f4b6031/4950_SCE_ChargeReadyFactSheet_20160412.pdf?MOD=AJPERES

Steven Loveday. (January 6, 2019). Inside EVs. December U.S. plug-in EV sales will climb again, but how high? Retrieved from: https://www.greentechmedia.com/articles/read/us-electric-vehicle-sales-increase-by-81-in-2018

Inside EVs. Longest Range Electric Cars for 2019. Retrieved from: https://insideevs.com/longest-range-electric-cars-2019/

Electrans. (August, 2017). The Baojun E100 is a micro-sized offering for China's urban commuters. Retrieved from: https://www.electrans.co.uk/gms-micro-ev-makes-big-debut-china/

Inside EVs. Monthly Plug-In EV Sales Scorecard. Retrieved from: https://insideevs.com/monthly-plug-in-sales-scorecard/

IRS. Plug-in Electric Drive Vehicle Credit (IRC 30D). Retrieved from: https://www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d

Ventura County Air Pollution Control District. Incentive Programs. Retrieved from: http://www.vcapcd.org/grant_programs.html

Chapter 2 Appendix:

2018 Monthly Sales Chart

2018 U.S. EV SALES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Tesla Model 3*	1875	2485	3820	3750	6000	5902	14250	17800	22250	17750	18650	25250	139,782
Toyota Prius Prime	1496	2050	2922	2626	2924	2237	1984	2071	2213	2001	2312	2759	27,595
Tesla Model X*	700	975	2825	1025	1450	2550	1325	2750	3975	1225	3200	4100	26,100
Tesla Model S*	800	1125	3375	1250	1520	2750	1200	2625	3750	1350	2750	3250	25,745
Honda Clarity PHEV*	604	911	1131	1129	1639	1495	1542	1462	1997	2025	1897	2770	18,602
Chevrolet Volt*	713	983	1782	1325	1675	1336	1475	1825	2129	1475	2530	1058	18,306
Chevrolet Bolt EV*	1177	1424	1774	1275	1125	1083	1175	1225	1549	1975	2825	1412	18,019
Nissan LEAF	150	895	1500	1171	1576	1367	1149	1315	1563	1234	1128	1667	14,715
BMW 530e*	224	413	689	518	729	942	536	749	756	733	1012	1363	8,664
Ford Fusion Energi	640	794	782	742	740	604	522	396	480	453	1131	790	8,074
Chrysler Pacifica Hybrid**	375	450	480	425	650	710	450	654	637	623	895	713	7,062
BMW i3 (BEV + REx)	382	623	992	503	424	580	464	418	461	424	490	356	6,117
BMWX5 xDrive 40e*	261	596	627	563	499	321	431	264	225	224	213	210	4,434
Mitsubishi Outlander PHEV	300	323	373	273	297	390	350	366	378	309	376	431	4,166
Kia Niro PHEV*	155	246	227	120	218	281	225	346	313	323	619	316	3,389
BMW 330e*	101	142	202	166	150	138	106	192	195	229	373	606	2,600
Audi A3 Sportback e-tron*	145	199	214	189	267	238	220	240	230	210	180	265	2,597
Volvo XC60 PHEV*	109	155	167	141	214	226	185	210	215	180	225	240	2,267
Fiat 500e**	210	235	285	215	250	225	220	75	94	100	148	193	2,250
Porsche Panamera E-Hybrid*	1	2	49	336	275	168	195	200	210	170	200	230	2,036

2018 U.S. EV SALES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Mercedes C350e*	29	172	208	158	166	176	165	170	82	75	80	240	1,721
Hyundai IONIQ PHEV*	22	178	218	180	217	143	180	43	11	128	136	134	1,590
Mini Countryman SE PHEV*	127	100	74	106	163	211	210	128	140	117	74	114	1,564
Volvo XC90 T8 PHEV*	99	106	93	90	126	133	115	125	120	100	130	150	1,387
Volkswagen e-Golf	178	198	164	128	76	32	18	32	14	62	230	222	1,354
smart ED	84	90	103	80	110	126	103	108	98	95	100	122	1,219
Kia Soul EV*	115	163	157	152	133	57	130	33	18	61	61	54	1,134
Porsche Cayenne S-E*	113	121	197	265	59	12	15	45	60	25	35	75	1,022
Mercedes GLE 550e*	44	70	181	93	83	75	85	90	42	28	35	140	966
Kia Optima PHEV*	86	103	156	142	98	83	90	39	17	51	79	21	965
Honda Clarity BEV*	153	74	48	39	34	86	102	75	108	106	37	86	948
BMW i8	32	39	47	57	64	45	72	67	55	64	133	97	772
Ford C-Max Energi	234	142	105	57	18	6	4	4	12	0	0	0	582
Mercedes GLC 350e*		5	57	59	64	66	60	65	27	20	24	120	567
Ford Focus Electric	70	73	137	83	88	50	46	7	4	0	1	1	560
Hyundai Sonata PHEV*	52	54	78	38	67	62	60	20	15	5	5	4	460
Volvo S90 T8 PHEV*	27	29	52	29	30	35	30	40	45	35	40	45	437
Jaguar I-Pace*										5	165	223	393
Hyundai IONIQ EV*	49	3	60	7	32	47	35	21	12	21	34	24	345
BMW 740e*	18	23	31	60	17	16	40	18	25	45	18	28	339
Cadillac CT6 PHEV*	6	24	17	42	30	18	26	23	11	12	13	9	231
Mercedes B250e	40	49	33	7	3	0	0	1	0	1	0	1	135
Mercedes S550e*	13	3	11	9	7	7	8	10	8	5	4	11	96
2018 U.S. Sales Totals	12,009	16,845	26,443	19,623	24,307	25,029	29,598	36,347	44,544	34,074	42,588	49,900	361,307
2017 U.S. Sales Totals	11,004	12,375	18,542	13,367	16,596	17,046	15,540	16,514	21,242	14,315	17,178	26,107	199,826

2018 U.S. EV SALES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2018 Worldwide Sales*	82,000	81,000	141,000	128,450	159,346	160,894	144,975	175,362	206,500	214,800	237,553	286,367	2,018,247

Above – 2018 Monthly Sales Chart for The Major Plug-In Automakers – *Estimated Sales Numbers – Reconciled on Monthly or Quarterly Totals, ** Estimated (Based on State/Rebate Data and other reports). BEV models are designated with the icon. [55]

[55] Steven Loveday. (January 6, 2019). Inside EVs. December U.S. plug-in EV sales will climb again, but how high?

Ventura County Electric Vehicle Ready Blueprint

Chapter 3: Charging Infrastructure for Light-Duty Electric Vehicles and Electric Vehicle-Grid Integration

Current and Future Charging Technology

The infrastructure that delivers electricity to the vehicle is referred to by three different acronyms, often used interchangeably. These include: electric vehicle infrastructure, EVSE, or electric vehicle charging stations. The most commonly used term is EVSE, and this will be used throughout this report. To date, a wide array of EVSE exists and can supply electricity at different voltages and currents, depending on customer needs and use cases. Three predominant categories of EVSE exist, known as Level 1, Level 2, and DC Fast Charge, sometimes also called Level 3.

Level 1 Charging	Level 2 Charging	DC Fast Charging
110V	220V	440V
~1.3 kW	~3.3-6.6 kW	25-350kW

Within the DC Fast Charging standard, charging speeds very dramatically according to power output, which varies from 25 kW to 350 kW for light duty vehicles, and up to 850 kW+ for heavy duty vehicles such as transit buses. The emerging category of extremely high-speed DC Fast Charge (350 kW+) is also attracting a new informal set of designations, such as “ultra-fast” DC Fast Charging and “hyper-charging.” The voltage and common use cases of these charging types are outlined in the table below. Note that cost ranges are highly variable depending on the need for utility upgrades, cost-sharing arrangements with utilities, as well as varying equipment choices and installation contexts. Cost differences among sites may vary by 300 percent or much more for electrical capacity upgrades, equipment, and installation between the lowest and highest cost scenarios within a given equipment class.

Table 1: Categories of Electric Vehicle Supply Equipment [56]

Type	Voltage	Kilowatts	Miles Range Per Hour	Common Use Case	Cost Range Per Port (equipment + install)	Standard
Level 1	120 V AC (30 AMP)	1.9kW	2-5 miles RPH	Home Charging or long dwell time workplaces	$300+	SAE J1772
Level 2	240 V AC (with 40 – 70 AMP circuit)	3.3kW – 19.2kW	10 – 44 miles RPH	Home or Workplace Charging	$600* - $15,000**	SAE J1772
Level 3 DC Fast Charging (DCFC) 25kW	240 V Direct Current	25kW	30 - 40 miles RPH	Fleet or en-route charging	$15,000 - $25,000 [57]	SAE J1772/ Combined Charging System (CCS) CHAdeMO
DCFC 50kW	480 V Direct Current	50kW	50-60 miles RPH	Fleet or en-route charging	$25,000 - $45,000	SAE J1772/CCS CHAdeMO
DCFC 100kW – 150kW	480 V Direct Current	100 - 150kW	100 - 150 miles RPH	En route charging	$100,000 - $200,000+	SAE J1772/CCS CHAdeMO Tesla SuperCharger
DCFC 350kW	480 V Direct Current	350kW	400+ miles RPH (~180mi. in 15 min)	En route charging	$400,000+	SAE J1772/CCS CHAdeMO Tesla

Most of the Fast Chargers installed to date in California are Tesla SuperChargers rated between 72 kW-150 kW. These are installed in Tesla-only charging plazas with the proprietary Tesla connector, which is not compatible with other vehicle types. Other electric vehicles must utilize Fast Chargers from other manufacturers. Most of these chargers have been rated at the 50 kW level and are approximately evenly

[56] Alternative Fuels Data Center. *Developing Infrastructure to Charge Plug-In Electric Vehicles*. Retrieved from: http://www.afdc.energy.gov/fuels/electricity_infrastructure.html.
[57] EV Charger Solutions. Retrieved from: https://www.evchargesolutions.com/Delta-EV-DC-Quick-Charger-Wallbox-p/deltadcfcsingle.htm

split between the Japanese CHAdeMO standard, which serves Nissan and Mitsubishi models only, and the European – American Combined Charging System (CCS) standard, which serves other electric vehicle brands. While the California Energy Commission has mandated that state-funded Fast Charging stations include both CHAdeMO and CCS standards, many industry analysts predict that eventually the CCS standard will dominate in the non-Tesla market. Tesla vehicles have adapters that enable use of either CHAdeMO or CCS Fast Chargers and J1772 Level 2 stations, but not vice versa. Tesla has recently begun deploying their V3 SuperChargers, rated at 250 kW and allowing charge rates of 75 miles in 5 minutes and top charging rates of 1,000 miles per hour (though these charge rates can only be supported for near empty batteries, and past 50 percent, charge rates taper off quickly). [58]

Electrify America is installing 150 kW DC Fast Chargers at most of their inter-city Fast Charging plazas and are beginning to include 350 kW chargers as well. However, only Porsche and BMW have announced light-duty vehicles capable of charging at 350 kW as of early 2019, with more manufacturers expected to follow soon. [59] As noted in the chart above, when comparing charging types it is useful to use the metric of RPH of charging, which designates the distance an electric vehicle can travel for each hour it is charging. While RPH provides a guideline, the exact amount of range a charging station can deliver per hour depends on several factors, including the power capacity of the car's on-board charger, the state of charge of the vehicle when it begins charging, the temperature of the battery, and the efficiency of a particular vehicle in translating electricity into motive power. Because of these factors, the actual speed of Fast Charging is typically not directly proportionate to the rated power of the EVSE, as most EVSE slow down their charge rate considerably as the battery state of charge increases.

Deployment of charging infrastructure involves significant tradeoffs between cost and charging speed. DC Fast Charge equipment costs much more than the slower Level 2 systems. A key driver of differential costs is in the electrical upgrade requirements for DC Fast Chargers. Typically, most DC Fast Charge installations require upgrades in local electrical capacity to accommodate increased power needs, and the cost of these upgrades are widely variable depending both on physical needs, and the outcome of negotiations with the host utility regarding who will bear the cost of major site-specific modifications such as transformer replacements. Likewise, EVSE installation costs are highly variable depending on distance from the charging station to the power supply, need for trenching, labor costs, and other factors.

Matching Charging Technology with User Needs

The diverse travel patterns of electric vehicle drivers result in a wide range of needs that require multiple charging solutions. In the residential single-family context, many electric vehicle owners and especially plug-in hybrid electric vehicle drivers with smaller capacity batteries may find Level 1 charging to be adequate for their driving needs. By contrast, electric vehicle owners or fleet managers with multiple vehicles under management may require Level 2 equipment to facilitate more rapid home or depot charging. On-route charging for longer distance trips or for charging of commercial vehicles typically requires DC Fast Charging.

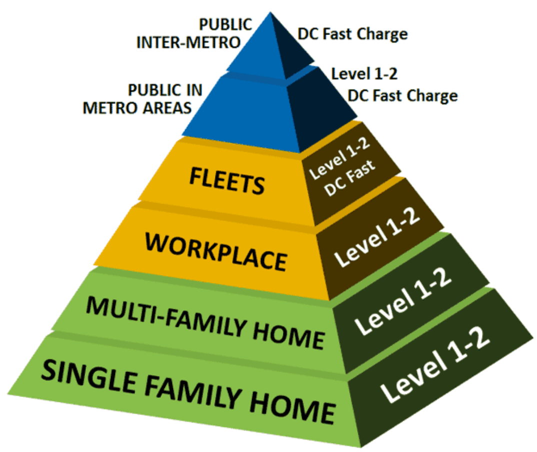
---

[58] Tesla. Supercharging. Retrieved from: https://www.tesla.com/blog/introducing-v3-supercharging

[59] Elektek. Retrieved From: https://electrek.co/2018/12/06/electrify-america-first-350kw-charger-california/

To address the diverse charging needs of electric vehicle drivers, planners have introduced the concept of the "charging pyramid." As a rule of thumb, 85 percent or more of all light-duty vehicle charging is expected to occur at home, usually overnight when electricity rates are low. DC Fast Charging is expected to provide the least amount of charging proportionately, as the price per kWh delivered through a DC Fast Charging station are likely to be the highest cost of all electric vehicle rates, given both the cost of the equipment and the potential for charging to occur closer to peak rate periods. The "convenience premium" for Fast Charging stations can bring the refueling costs for an EV at a Fast Charging station much closer to gasoline costs, with a $20 charge at EvGO stations being a typical experience for many electric vehicles making inter-city trips in California.

Figure 1: Charging Pyramid [60]



Source: New York State Energy Research and Development Authority

The charging pyramid illustrates that the great majority of all charging occurs in residential settings, while workplace, fleet, and public charging accounts for a small balance (15 percent) of electric vehicle charging needs.

Residential Charging, Incentives, and Smart Charging Management

Residential charging is the dominant form of charging for individually owned electric vehicles. In a single-family residential setting both Level 1 and Level 2 charging solutions can be readily installed in most newer homes where adequate electrical panel capacity is located near to the garage or desired charging place. However, in older homes with less capacity, or that lack garage space, costs for home charging can sometimes be prohibitive or technically infeasible.

SCE Charge Ready Program

Robust incentives are available from SCE for both single family and multi-family residential charging equipment and installation costs. SCE's Charge Ready Program also offers favorable electric vehicle rates based on time of use (TOU) structures designed to offer reduced price charging during non-peak energy use periods. To enroll in the program, SCE requires commercial customers to install a separate meter for

---

[60] NYSERDA. *Charging Station Hosts.* Retrieved from: https://www.nyserda.ny.gov/Researchers-and-Policymakers/Electric-Vehicles/Info/Charging-Station-Hosts

their electric vehicle charging needs, though residential customers can install a separate meter or remain on a meter with their house. In exchange, customers must enroll in TOU rates, gaining access to low off-peak pricing in windows outside the highest rate periods of 4 pm – 9 pm.[61]

SCE offers residential charger rebates under the Charge Ready Program, although the rebate levels and program criteria are subject to change. As of early 2019, SCE offered residential customers a rebate of up to $1,500 toward their out-of-pocket costs for the electrical upgrades and permitting fees to install Level 2 electric vehicle charging stations (but not for the EVSE hardware itself). Electrical upgrades eligible for the rebate may include a new 240-volt circuit and socket, new or upgraded panel, new meter socket, and permit fees. In order to receive the rebate, the applicant must be a customer of SCE and enroll in an eligible SCE TOU rate. TOU rates are based on the time of day and season when electricity is used and provide steep discounts for customers that charge primarily during off-peak periods.

In the commercial program, free installation is available for some types of installations, while a rebate is also available to cover some or all the costs of the charging station hardware. The program also pre-qualifies vendors and charging station models, with technical assistance provided by SCE to complete EVSE "make-ready" preparations for charger deployment. Key program requirements for commercial EVSE include:

1. Deployment of a minimum of ten charging stations per site (the minimum is lowered to five EVSE for disadvantaged communities)
2. Available selection of Level 1 (120v) or Level 2 (240v) charging stations
3. All charging stations must be installed on a new dedicated circuit deployed by the utility (with its own panel, meter, and service), separately from any existing panel, meter or service
4. Program covers all-electric infrastructure costs related to the new circuit
5. SCE offers a rebate to offset some or all the costs for the charging stations and their installation
6. All permits and inspections are obtained directly by SCE or Charge Ready vendors[62]

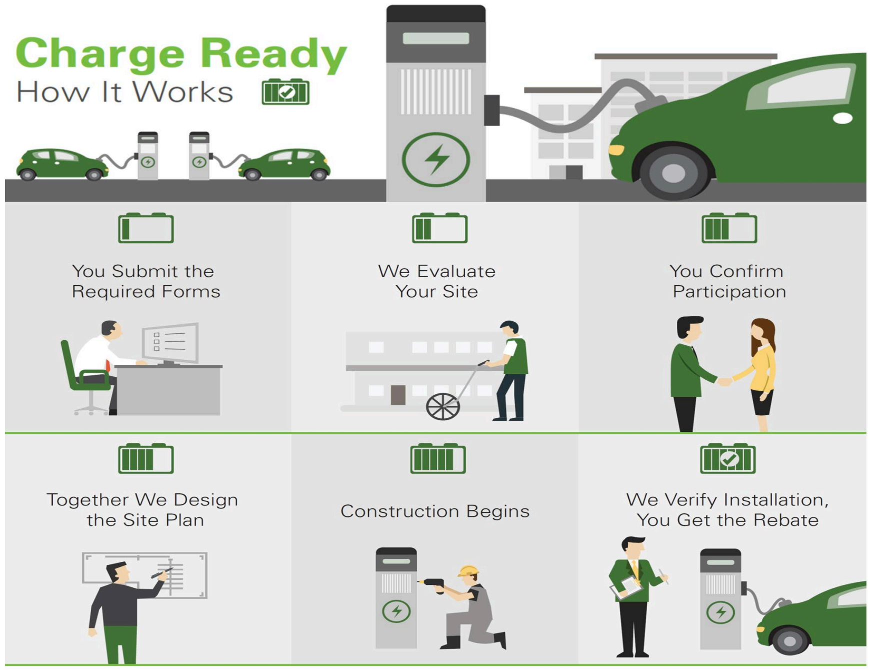
As indicated in the illustration below, the Charge Ready program requires close coordination with utility representatives, who must approve the specific site plan. Additional details on the program as applicable to MUDs are highlighted in the sections below.

---

[61] Southern California Edison. *Electric Vehicle Rates.* Retrieved from: https://www.sce.com/residential/electric-cars/residential-rates

[62] Southern California Edison. *Charge Ready Program Fact Sheet.* Retrieved from: https://www.sce.com/wps/wcm/connect/ff4d5544-c304-495f-9251 372a0f4b6031/4950_SCE_ChargeReadyFactSheet_20160412.pdf?MOD=AJPERES

Figure 2: SCE Charge Ready Program



Clean Power Alliance

In addition to Investor Owned Utility rebates, Community Choice Energy providers are beginning to offer a wide variety of electric vehicle incentives, rebates, and customer programs. In Ventura and Los Angeles counties, where the CPA recently became fully operational, similar programs can be expected to emerge in the coming months, in alignment with the trend among other Community Choice Energy providers in California. Residential and commercial customers should check the CPA website for updates on new electric vehicle program announcements.

Low Carbon Fuel Standard Program

The LCFS program supports alternative vehicle fueling sources, including electricity. Supported by Cap and Trade revenues, the program enables electric vehicle supply equipment providers to generate credits valued between $100 to $185 per $MTCO_2e$ offset by alternative fuel sources.[63] Recent credit prices are equivalent to $0.25 per kWh for grid charging, and $0.33 per kWh for 100 percent renewables charging. Given the magnitude of LCFS credits, some fleets could conceivably charge their electric vehicles for free and receive an additional subsidy for every kWh used. For individual light-duty vehicles, the LCFS credits are modest and are typically unclaimed except by some charging station network operators. However, for fleet vehicles with very large batteries, notably transit buses (which can have batteries in the 450-600+ kWh range), credits can amount to as much as $10,000 - $20,000 per vehicle per year and even more if local solar is used for electric fueling. Somewhat smaller values pertain to electric school buses (due to smaller battery size) but LCFS credit claiming will be very important to school districts as well.

[63] California Air Resources Board (CARB) (2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons. March

CARB administers credits based on fueling pathways rather than individual vehicles. As a result, public charging infrastructure installers and fleet operators are better positioned to claim the credits than individual electric vehicle owners. Credits are currently eligible for the fueling of vehicles via Level 1, Level 2, and DC Fast Charging stations.[64] CARB currently facilitates applications for LCFS credits through the web-based Program Data Management system, which comprises the following three modules:

1. Reporting Tool
2. Credit Bank and Transfer System
3. Alternative Fuel Portal [65]

Guidance documents outlining the Program's process are available on the CARB website at: https://www.arb.ca.gov/fuels/lcfs/guidance/guidance.htm#guidance. For DC Fast Charging, an application template for fast charging infrastructure was made available on February 11, 2019 and will be available for download on the CARB website.[66] Additional information on the Program can be found in Chapter 4 of this report.

Multi-unit Residential Charging Needs and Strategies

Multi-unit Dwelling Charging Challenges

Residential charging installations are relatively straightforward where electric vehicle owners have access to garages or in mobile home parks. However, electric vehicle drivers who are renting, lack garages, or who live in apartments or condominiums face a unique set of charging challenges. In rental or MUD living situations, even Level 1 outlets can prove difficult to access due to safety risks from long charging cords or cables, theft concerns, and challenges with charging cost attribution between the driver and the building owner. Finally, property owners are often reluctant to set aside dedicated EVSE-equipped spaces when electric vehicles make up just a small part of the total driving population. Because of these challenges, most electric vehicle owners require significant assistance in overcoming MUD parking challenges, or they must utilize public or workplace charging stations as their primary refueling options.

According to the University of California, Los Angeles (UCLA) Luskin Center for Innovation, throughout California 93 – 97 percent of electric vehicles are owned or leased by single family homeowners, even though nearly half of all Californians are renters or apartment dwellers. This gap is due to the fact that: 1) MUDs have not received nearly the same level of attention and investment by policy makers as workplace and inter-regional charging; and 2) because MUD charging solutions can be extremely difficult and costly to implement. Without substantial incentives, MUD owners are reluctant to invest in chargers due to: 1) lack of financial incentives; 2) limited tenant demand; 3) tenant turnover and potential risk of stranded charging infrastructure, 4) uncertainty regarding tracking of charging costs and other potential liabilities, and 5) prohibitive EVSE installation cost and complexity. The table below further highlights challenges facing EVSE installation in MUDs.[67]

---

[64] CARB. LCFS Basics. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/background/basics.htm

[65] CARB. LCFS Data Management System. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/reportingtool/datamanagementsystem.htm#lrt-cbts

[18] Available for download: https://www.arb.ca.gov/fuels/lcfs/guidance/fci_apptemplate.xlsx

[67] Luskin Center for Innovation. 2017. Overcoming Barriers to Electric Vehicle Charging in Multi-unit Dwellings.

Table 2: Challenges to EVSE Installation in MUDs

Physical Challenges	▪ Availability of capacity in the electrical panel ▪ Availability of space for additional meters in the meter room ▪ Distances between utility meters, parking spaces, and unit electrical panels ▪ Building vintage and age of electric infrastructure ▪ Parking capacity and parking space requirements and variability across apartment type and design
Cost of Installation and Operation	▪ Restrictive facility configurations (master meter, remote parking, etc.) ▪ Cost allocation to residents (e.g., based on usage, equipment, parking, shared service areas, etc.) ▪ Inability to take advantage of off-peak charging rates ▪ Homeowner association fee structures ▪ Reluctance from building owners to spend on planning, load studies, and electrical upgrades
Business Model Barriers	▪ Demand or MUD charging is low and not requested by a majority of tenants; therefore, building owners and managers see little incentive to install charging stations ▪ Residents demand faster, and more expensive charging, making cost recovery difficult ▪ Software and network fees can further diminish financial viability of cost recovery ▪ Setting fees and reimbursements for charging
Codes Covenants, and Legal Restrictions	▪ Differences in ownership ▪ Differences between actors who make the investment (owners) versus those that reap benefits (renter/ EV driver) ▪ Legacy agreements between property owners and residents/tenants ▪ Deeded parking spaces and individual parking assignments ▪ ADA and access requirements ▪ Difficult determining EV readiness Requirements

American With Disabilities Concerns: Deploying shared or publicly available charging on existing properties triggers adherence to 2017 ADA California State Architect Electric Vehicle Charging Guidelines. Alternatively, if a charger is deployed in an assigned tenant parking spot, then ADA guidelines are not triggered. This may lead many property owners to attempt to offer charging exclusively to tenants in assigned parking.

The 2017 California State Architect's ADA guidelines recommend that the first publicly available or shared charging space be designated as "van-accessible ADA," which requires a bigger space than a standard size parking place. Additionally, a path of travel from a parking location to a building entrance is required for ADA spaces. Unfortunately, the configurations of many existing parking environments do not easily support retrofit to meet this requirement, which may result in the loss of one or two regular spaces to accommodate the ADA-compliant EVSE equipped space.

MUD Charging Costs: The Luskin report also highlights the wide range of costs to run wires and conduit to charge points, to provide electrical panel upgrades, and for service upgrades to connect the building to the distribution system. Significant costs for labor, consulting, and permit fees can further discourage charging installation in MUDs. The chart below illustrates the wide range of potential costs.

Figure 3: Potential Costs of EVSE Installation at MUD Locations [68]

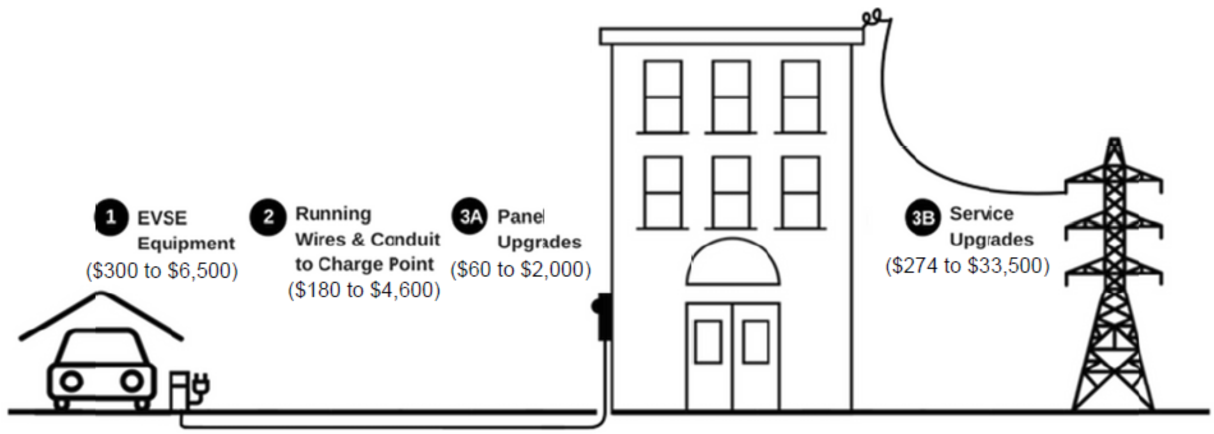


Image Source: Noun Project; car by Tracy Tam; electric equipment by Prosymbols; building by Nicholas Menghini; pylon by Arthur Shlain.

MUD Charging Installation Design Issues: In addition to the physical challenges and high costs encountered in many MUDs, would-be site hosts and Electric Vehicle Service Providers must determine the answers to a complex set of questions that may require considerable research. These include:

- **Shared vs. dedicated charging:** Does the Homeowners Association or building management want to offer charging services to residents on a shared use basis or should each resident be responsible for their own installation with a separately metered service?
- **Ownership model:** Who will own the chargers—the resident, the property management company, the owner, or the Electric Vehicle Service Provider?
- **Electrical capacity:** Is there sufficient electrical capacity either on the unit electrical panel or common area panel to install EVSE? (Note that a 240V, 40-amp circuit is usually required for Level 2 charging. Level 1 charging is possible on a 120V outlet, with a 30-amp circuit required (most 120V circuits for household use are only 15 amps and these should be upgraded for ongoing use). Note that new managed power charging solutions can dramatically increase charging capability for instances of limited power availability.
- **Cost allocation for upgrades:** Who pays for any increase in electrical capacity needed i.e., transformers, new panels, engineering, construction, etc.? (In some circumstances, the utility may pay for some of the utility-side expenses, but this must be individually negotiated.)
- **Cost allocation for EVSE:** Who pays for the individual EVSE installations?

---

[68] UCLA Luskin Center, 2017

- **Energy costs:** Who pays for the monthly incremental electricity usage?
- **Membership or subscription costs:** Who pays any membership, subscription or software license fees needed for shared use or individually designated spaces?
- **Maintenance costs:** Who pays for maintenance, repair, and replacement?
- **What happens when EV owner moves out?** What happens to the EVSE equipment if the electric vehicle driver moves out and the apartment is taken over by a non-electric vehicle driver?

There are no "one size fits all" solutions to the charging challenges for renters and residents of MUDs. However, there is an emerging consensus among utilities, Electric Vehicle Service Providers, and policy makers that new MUD-focused business models – and increased investment – will be required to boost electric vehicle and EVSE access. A new level of innovation and investment is needed is in part due to the classic "chicken verses egg" dilemma in which MUD residents will not purchase electric vehicles absent a viable charging solution, and property owners and many Electric Vehicle Service Providers are reluctant to invest on the uncertain premise that "if you build the charging, electric vehicle owners will come." For the Electric Vehicle Service Provider, there are large up-front costs to address the MUD market, and these include:

- Site host identification
- Site host qualification and negotiation
- Engineering design
- Approval of the relevant electric vehicle charging solution by property owners and local permitting authorities
- Capital financing of the up-front equipment and installation
- Financing of potential operating losses during the first months or years of deployment before the property's electric vehicle charging stations are fully utilized

The CPUC explicitly acknowledged the fact that there has been a MUD "market failure" when they authorized the state's Investor Owned Utilities to create programs that pay for much of the charging infrastructure in MUDs. This was an important step forward. Unfortunately, the provision of free installation and equipment alone has in many cases not been a sufficient incentive to motivate EVSE adoption. Many property owners view charging as outside the scope of their business, carrying risks – such as malfunctions, stranded assets, safety, or vandalism – that must be compensated by reliable and robust opportunities for new revenue, not just free equipment. Further, the issues to be addressed at an apartment or condo complex may require considerable site-specific problem solving and "time on task" by both the Electric Vehicle Service Provider and the property owner. To respond effectively to these challenges to MUD deployment, it is recommended that Ventura County's electric vehicle stakeholders pursue future grant funding specifically allocated to MUDs and seek out project development partnerships with Electric Vehicle Service Providers and consultants with experience in the MUD market.

Potential Strategies to Address MUD Charging Deployment Challenges

There are new resources emerging to help overcome some of the key barriers to electric vehicle charging deployment in MUDs. Two helpful programs recently introduced include: 1) The SCE Charge Ready program and SCE-provided technical assistance; and, 2) emerging car sharing and third-party e-mobility programs targeting the MUD segment.

SCE Charge Ready Program

SCE is currently facilitating its Charge Ready Pilot program and providing incentive and advisory support in key market areas including MUDs. Through the Charge Ready program, SCE is currently installing, owning, maintaining, and paying for all related costs for make-ready stubs serving EVSE, including:

- Electric distribution infrastructure, such as transformers, service lines, and meters dedicated to electric vehicle charging equipment deployed under the program.
- Customer-side infrastructure, such as panels, step-down transformers, wiring and conduits, and stub outs, to allow for EVSE installations.

Participating customers are in turn responsible for procuring, installing, and maintaining qualified EVSE, including energy and networking costs. However, rebates are available to pay for some or all of the EVSE and installation costs.[69] SCE owned and operated infrastructure addresses several of the barriers experienced in the MUD segment and removes planning, management, and cost burdens from building managers and owners. However, the Charge Ready program is administered on a first-come, first-served basis and is currently still considered to be a pilot program. It is SCE's intention to replenish the available funding upon approval by the CPUC, and to provide additional resources and program flexibility over time. Ventura stakeholders should be sure to sign up for program updates on the SCE website and to prepare applications for funding early in the SCE funding cycles.

Identification of the 100 Largest MUDs in Ventura County

Larger MUDs are typically more cost-efficient to serve on a per-unit basis, and therefore are a special focus of attention for the Ventura Electric Vehicle Ready Blueprint. To determine the size of the addressable MUD market, as well as top 100 largest MUDs in the County, data was collected for residential apartments, condominium developments, and mobile home parks in Ventura County, including incorporated municipalities and unincorporated areas. Additional data for smaller multi-family properties, such as duplexes, was obtained but is not summarized in this report. Data for large and medium MUDs was obtained from the Dyer-Sheehan Group (DSG), a commercial data provider. DSG collected the multi-family residential apartment data as part of Ventura County Apartment Market Survey, which is used for the University of California Santa Barbara - Economic Forecast Project. Staff from GRID Alternatives provided additional data on multi-family housing properties that had received Low-Income Housing Tax Credits for solar projects. GRID Alternatives obtained this data from the California Tax Credit Allocation Committee.

Data on mobile home and recreation vehicle parks was obtained from the California Department of Housing and Community Development using their Codes and Standards Automated System.[70] Additional data was obtained from SCE to help identify mobile home and RV parks that have received electrical

[69] SCE. Charge Ready Program Pilot Quarterly Report. 4th Quarter, 2018. March 1, 2019. Retrieved from: https://www.sce.com/sites/default/files/inline-files/SCE%20Quarterly%20Charge%20Ready%20Pilot%20Program%20Report%202018Q4_0.pdf https://www.sce.com/sites/default/files/inline-files/SCE%20Quarterly%20Charge%20Ready%20Pilot%20Program%20Report%202018Q4_0.pdf

[70] Codes and Standards Automated System (CASA). California Department of Housing & Community Development. Accessed November 5, 2018. https://casas2prodwlext2.hcd.ca.gov/casas/

infrastructure upgrades through the Mobile Home Park Utility Upgrade Program.[71] [72] The County of Ventura's Geographic Information Systems (GIS) staff provided additional data for MUDs in Disadvantaged Communities. Condo complexes included in the list were found using online realty listings from Condo House.[73]

The project team also incorporated Disadvantaged and Low-income Communities designations, as defined for California Climate Investments under Senate Bill 535 (De León, Chapter 830, Statutes of 2012) and Assembly Bill 1550 (Gomez, Chapter 369, Statutes of 2016). Two principal criteria have been used to rank order the 100 largest MUDs: (1) Low-income and Disadvantaged Community adjacent designations and (2) the size of a multi-family housing development, as measured by the number of housing units.

MUDs located within Disadvantaged Communities that have a score of 75 percent or higher in CalEnviroScreen 3.0 were given special attention and are provided in a separate list of the 50 largest MUDs in Disadvantaged Communities (see the appendix at the back of this chapter).[74] The remaining dataset for MUDs located outside of Disadvantaged Communities was used to create the 100 largest MUD list. The project team thus created two tiers of rankings for the 100 largest multi-family development list. The 100 largest MUDs located in an AB 1550 Low-Income Communities or adjacent to a SB 535 Disadvantaged Community were included in the first tier (Tier 1). The large multi-family properties that fall outside Low-income Community boundaries and are not adjacent to a Disadvantaged Community were included in the second tier (Tier 2). Since there is a need and mandate to expand access to electric vehicle charging for Low Income and Disadvantaged Communities, all Tier 1 properties are ranked higher than Tier 2 properties in the list of 100 largest MUDs for purposes of highlighting near-term, high-priority project development opportunities in the County.

It is also important to note the methodological limitations of map-based Disadvantaged Community and Low-income Community designations. The State uses existing census tracts boundaries to identify Disadvantaged and Low-income Communities. However, the true extent of local environmental impacts and poverty is not limited to these census tracts boundaries. In many cases, census tract boundaries cut through our region's Disadvantaged and Low-income Communities. For this reason, MUDs located adjacent to a Disadvantaged Community but outside of a Low-income Community are also prioritized for electric vehicle infrastructure development in the higher Tier 1.

Integration of Electric Vehicle Charging and Electric Vehicle Car Sharing in Workplaces and MUDs

An emerging trend in urban mobility is the increasing desire for many city dwellers to transition from personal car ownership to shared mobility as their preferred mode of transportation. Electric vehicles could be a mainstay of this trend. Specifically, the electrification of multi-unit residential parking provides a dual opportunity to substitute electric vehicles for internal combustion engine vehicles, and to replace

[71] Southern California Edison. Mobile Home Park Utility Upgrade Program. https://www.sce.com/business/tools/for-landlords.

[72] Condo House Index. CondoHouse: Ventura County Homes for Sale. http://www.condohouse.com/sitemap.html

[73] Ventura County Multi-Unit Dwelling Parcels. Ventura County GIS Division.

[74] As designated by the California Office of Environmental Health Hazard Assessment (OEHHA), on behalf of CalEPA.

a portion of individually owned vehicles with shared mobility solutions. Electric vehicles available for short-term rental in car share "pods" enjoy lower utilization cost per mile compared to individually owned vehicles. Equally important, sharing frees up more urban space for non-parking uses.

Car sharing provider Envoy, a LACI portfolio company, currently integrates electric vehicle car sharing into MUDs throughout California, including several Southern California sites. Envoy places at least two electric vehicles in either market rate multi-family properties or – with grant subsidies – in below-market-rate housing. The Envoy model provides these vehicles on an as needed basis via a time-and-distance rental agreement. Vehicles are most often used for errands and are priced to discourage daily commuter use. Thus, Envoy is not a complete solution for MUD residents with long daily commute needs.

Additional car sharing providers include Maven, Turo, and Getaround, among others. The full range of these and other shared mobility offerings are described in Chapter 7 of this report. It is recommended that Ventura electric vehicle stakeholders work closely with electric car share service providers to introduce shared mobility solutions into apartment complexes, and to access grant funds. Site hosts and Electric Vehicle Service Providers should work to identify electric car share service models and pricing structures that best accommodate the financial realities and the diverse transportation needs of Disadvantaged and Low-income Communities in Ventura County.

Recommendations for Expanding E-Mobility Access to Residents of MUD

- **Recommendation #1 - Educate tenants on the "electric experience" to create demand for MUD charging:** Develop informational materials that highlight the broad range of electric vehicle adoption. By cultivating tenant demand for electric vehicle charging, building owners and managers will begin to see value in deploying electric vehicle charging as an amenity. It is important to note that state law requires that building owners accommodate reasonable requests for charging (although the electric vehicle driver may be required to pay for charging installation costs.)
- **Recommendation #2 - Focus programs on new MUD construction and geographies with public charging gaps:** As part of the Ventura County EVSE location study, MUDs with the largest number of residents and the largest existing and projected utilization of electric vehicles are being designated as "priority sites" for deployment of e-mobility solutions. The list of the 100 largest MUDs in Ventura County and of MUDs in Disadvantaged or Low-income areas should inform follow-on project development activities. To bridge the mobility access gap, EVSE planning and development should place special emphasis on MUDs in the region's Disadvantaged and Low-income Communities. To drive successful funding applications, it is also recommended that project developers conduct an electric vehicle survey at proposed locations, identify a resident electric vehicle champion where feasible, and map existing charging as part of their application for funding (e.g., from the SCE Charge Ready program). The development of a comprehensive MUD plan that promotes clean mobility equity has the greatest potential to attract additional resources and investment to accelerate the County's electric vehicle transition.

Recommendation #3 - Deploy public charging at or near larger clusters of apartments and condos: The deployment of charging near apartments and condos can provide a charging solution to those with major barriers to at home charging. Visible siting of electric vehicle charging infrastructure can also spur adoption by creating community awareness.

- **Recommendation #4 - Convene utility, industry, and funding partners to coordinate MUD electric vehicle charging deployment:** The California Energy Commission will likely be releasing Grant Funding Opportunities totaling $30 million dollars or more in 2019, some of which will be targeted for MUD charging. In addition, SCE has updated its Charge Ready program guidelines for the MUD marketplace, including reducing the required number of installed charging ports from ten to five ports for MUD Charge Ready station installations. These developments will create a unique opportunity for County stakeholders to design a comprehensive strategy to deliver e-mobility options to MUD residents. This strategy could include (but not be limited to) EVSE deployment, electric vehicle car share strategies, and potential co-location of local solar and energy storage where appropriate to enhance the return on investment for property owners and to ensure green electrons for drivers. Alternatively, planning could include assessment of street-side and plaza-based charging options to serve MUD residents that cannot be served with onsite charging options.
- **Recommendation #5 - Educate to engage and inspire property managers to implement step-by-step guides for MUD charging installation:** Develop informational materials that highlight the broad range of innovative MUD business models and service types available to property owners and residents in Ventura County, with attractive next steps identified that will enable owners to familiarize themselves with the full range of electric vehicle readiness resources and strategies.
- **Recommendation #6 – Focus investment on electric vehicle infrastructure that will serve MUD residents in Ventura County's Disadvantage Communities.**
- **Recommendation #7 - Target MUDs with 17 or more units that were subject to the 2013 California Building Code for electric vehicle charging infrastructure development.** As of January 2, 2014, the California Building Code requires 3 percent of the total number of parking spaces, but no less than one parking space, to be electric vehicle charging station capable (e.g. have stubouts and sufficient electric panel capacity to accommodate electric vehicle charging) at all MUDs with 17 or more units.

Meeting the Charging Needs of Disadvantaged Community Residents

As discussed above, barriers such as high upfront costs, finding workable business models, and technical challenges can all slow or prevent charging adoption in MUDs. These barriers are especially challenging for properties located in disadvantaged and low-income neighborhoods. According to the state of California, formally designated Disadvantaged Communities are those "most affected by many sources of pollution, and where people are often especially vulnerable to pollution's effects." [75] In Ventura County, 36,915 people live in Disadvantaged Communities as identified by the state of California's CalEnviroScreen 3.0 website, developed by the Office of Environmental Health Hazard Assessment. These areas are represented in the Figure 4 below. To qualify for many state grant programs, at least 25 percent of all

[75] Disadvantaged Community definition found at the California EPA CalEnviroScreen website at https://oehha.ca.gov/calenviroscreen/about-calenviroscreen.

funds expended must be in state-designated Disadvantaged Communities. Within Ventura County, formally qualified DACs are shown as the darkest regions highlighted in the CalEnviroScreen image below, Disadvantaged Community neighborhoods include portions of the cities of Ventura, Oxnard, and Port Hueneme, and coastal areas near South Victoria Avenue.

In addition to the Disadvantaged Communities identified below, the Ventura County region has large areas of Low-income Communities, as defined by AB 1550. Low-income Census tracts are located in Oxnard, Port Hueneme, West Ventura, and the Santa Clara River Valley, which stretches from East Ventura and Santa Paula to Fillmore and Piru. Parts of the Ojai Valley, and smaller census tracts within the cities of Simi Valley, Moorpark, Thousand Oaks, and Camarillo are also considered low-income. Within the low-income areas of Oxnard and West Ventura, there are eight census tracts that are dual-designated as SB 535 Disadvantaged Communities under CalEnviroScreen 3.0.

The City of Oxnard has a long legacy of environmental justice challenges, with some of the state's heaviest agricultural pesticide use in the strawberry fields that surround the city's schools and neighborhoods. Oxnard also has an industrialized coastline, and a concentration of Ventura County's most polluting sites, including three power plants, Halaco's Ormond Beach Superfund site, a manufacturing and port industry, as well as old landfills beneath the city. Oxnard is comprised of 85 percent people of color, including 75 percent Latino, with one in five residents lacking health insurance and many neighborhoods ranked above the 90th percentile in asthma rates. The Westide of Ventura was built around the city's oilfields, as well as heavy industry such as steel manufacturing that is connected to the oil industry. Ventura's Westside is now home to the largest Latino neighborhood in a narrow valley of largely low-income immigrant families running along Highway 33 and the Ventura River on the western side and bounded by the 101 Freeway on the southern end.

The Santa Clara River Valley is home to predominantly Hispanic, low-income families living along the path of the Santa Clara River and Highway 126. Several of the communities along Highway 126 were designated as Disadvantaged Communities in CalEnviroScreen 2.0 results and score just below the 25 percent designation threshold in CalEnviroScreen 3.0. The rural communities in these census tracts are disproportionately affected by agricultural pesticide use, impaired water quality, ozone air pollution, and oil and gas development. There is a largely immigrant population of farmworkers in Santa Paula, Fillmore, and Piru. Climate change will increase impacts and environmental hazards for this inland region that is already affected by extreme heat, drought, and threats to groundwater quality. Approximately 80 percent of the population in these cities identify as Latino and have some of the lowest median incomes in Ventura County.

According to 2013 - 2017 data from the United States Census, more than one third (38.6 percent) of Ventura County's population speaks a language other than English at home. The number of households that speak a language other than English is much higher in some County communities. For example, 2013 -2017 Census data for the City of Oxnard estimates that well over half (67.9 percent) of the city's households speak a language other than English.[76] Ventura County also has a large population of

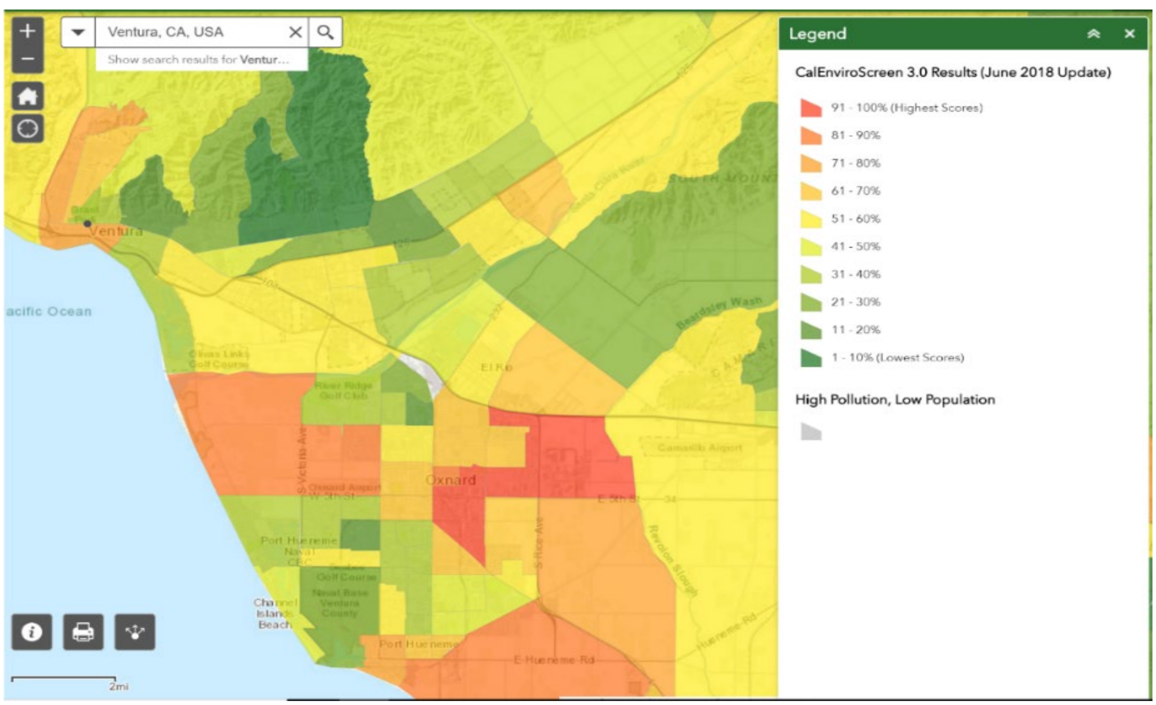
[76] United State Census Bureau's QuickFacts for Oxnard city, California. Available at: https://www.census.gov/quickfacts/oxnardcitycalifornia

indigenous people from Mexico. A large percentage of the indigenous immigrants from Mexico speak Mixtec, an indigenous language. According to the Mixteco/Indígena Community Organizing Project (MICOP), there are more than 20,000 indigenous people from Mexico that are living and working primarily in Ventura County.[77] Mixtecs make up the largest proportion of the region's indigenous population but there are also Zapotecs, Purepecha, and others indigenous peoples from Mexico that live in Ventura County. Of the 20,000 indigenous people from Mexico in Ventura County, an estimated 17,000 work in agriculture.

A review of CVRP data for Ventura County suggests that there is low awareness of the increased availability of electric vehicle rebates targeted to low-to-moderate income households. The state of California began issuing increased low-to-moderate rebates through the CVRP as of March 29, 2016. Out of the 3,086 total CVRP rebates issued in Ventura County since the enhanced rebates were offered, only 200 (less than 6.5 percent) were low-to-moderate income rebates.

Transportation costs account for a large percentage of household expenses in the Ventura County region, second only to housing costs. According to data from the Center for Neighborhood Technology, the average household in Ventura County devotes 33 percent of their total income to housing and another 22 percent of their income to transportation costs, leaving only 45 percent of their income to meet other essential needs, including education, food, and healthcare services.[78]

Figure 4: Ventura County CalEnviroScreen Results, June 2018[79]



[77] Mixteco/Indígena Community Organizing Project (MICOP). *Mixtecs in Ventura County.* Available at: http://mixteco.org/mixtecs/

[78] Center for Neighborhood Technology. Maps available at: https://htaindex.cnt.org/map/

[79] CalEnviroScreen. *June 2018, Map Data*. Retrieved From: https://oehha.ca.gov/calenviroscreen/maps-data

Nearly one-third of Ventura County's 100 largest employers (see the appendix at the end of this chapter) are located inside of or immediately adjacent to the region's Disadvantaged and Low-income Communities. Increasing workplace charging within or near Disadvantaged and Low-income Community employment centers will help expand access to electric vehicle charging in these areas of need – especially if workplace charging is available for public use. Table 3 below shows the 35 workplaces from Ventura County's 100 largest workplaces list that are located inside of or immediately adjacent to Disadvantaged and Low-income Communities. Reducing transportation emissions in Disadvantaged Communities by transitioning local fleets and other vehicles to electric drive is a critical step to improving environmental quality and health outcomes, especially for the elderly and young children disproportionately affected by air pollution.

Table 3: Largest Workplaces Located Within or Adjacent to Disadvantaged and Low-income Communities

Employer	Industry	Street Address	City	Zip Code	# Employees	Existing EVSE Ports*/ interest in EVSE	Top Public Desti-nation	DAC	In LIC or DAC adj-acent
Haas Automation	Mfg.	2800 Sturgis Rd.	Oxnard	93030	1,235	Yes		Yes	Yes
Patagonia Inc	Retail	259 W Santa Clara St	Ventura	93001	525	4	Yes	Yes	Yes
Waterway Plastics Inc	Mfg	2200 Sturgis Rd	Oxnard	93030	500			Yes	Yes
Raypak Inc	Mfg	2151 Eastman	Oxnard	93030	404			Yes	Yes
County of Ventura Behavioral Health	Gov't	1911 Williams Rd	Oxnard	93036	330	2		Yes	Yes
County of Ventura Human Serv. Agency	Food and Produce	1400 Vanguard Ave	Oxnard	93033	321	2		Yes	Yes
Gill's Onions LLC	Gov't	1051 S Pacific Ave	Oxnard	93030	321			Yes	Yes
Procter & Gamble Paper Products	Mfg	800 N Rice Ave	Oxnard	93030	310			Yes	Yes

Spatz Laboratories & ColourPop	Healthcare	1600 Westar Dr	Oxnard	93033	288			Yes	Yes
PTI Technologies Inc	Mfg	501 Del Norte Blvd	Oxnard	93030	245			Yes	Yes
Monsanto Seminis Vegetable Seeds	Mfg	2700 Camino del Sol	Oxnard	93030	202			Yes	Yes
PinnPack	Mfg	1151 Pacific Ave	Oxnard	93033	200			Yes	Yes
Drum Workshop Inc	Mfg	3450 Lunar Ct	Oxnard	93030	166			Yes	Yes
Ventura Unified School District Office	Gov't	255 W Stanley Ave	Ventura	93001	162			Yes	Yes
County of Ventura Public Health	Gov't	2240 Gonzalez Rd	Oxnard	93030	230			Yes	
Clinicas Del Camino Real	Healthcare	200 S Wells Rd, St 200	Ventura	93003	800				Yes
Pentair Aquatic Systems	Retail	10951 W. Los Angeles Ave.	Moorpark	93021	490	Yes			Yes
City of Oxnard City Hall	Gov't	300 W Third St	Oxnard	93030	381				Yes
Walmart #2032	Retail	2001 N Rose Ave	Oxnard	93036	371	Yes			Yes
City of Ventura	Gov't	501 Poli St	Ventura	93010	318	4			Yes
Costco Wholesale #420	Retail	2001 Ventura Blvd	Oxnard	93030	304				Yes
Southern California Edison	Utilities	10060 Telegraph Rd	Ventura	93004	303				Yes

County of Ventura Probation	Gov't	4333 E Vineyard Ave	Oxnard	93030	252				Yes
CoorsTek	Mfg	4544 McGrath St	Ventura	93003	246				Yes
Walmart #3650	Retail	1739 South Victoria	Ventura	93003	238	Yes			Yes
Shoreline Care Center	Healthc are	5225 S J St	Oxnard	93033	235				Yes
Home Depot #1040	Retail	401 W Esplanade Dr	Oxnard	93030	230				Yes
Pacifica High School	Automo tive	600 E Gonzalez Rd	Oxnard	93030	220				Yes
Rio Mesa High School	Educati on	545 Central Ave	Oxnard	93030	218				Yes
Walmart #3087	Retail	2701 Saviers Rd	Oxnard	93033	198				Yes
Ventura Police Department	Gov't	1425 Dowell Dr	Ventura	93003	196				Yes
County of Ventura - Area Agency on Aging & Probation	Gov't	646 & 669 County Square Dr	Ventura	93003	180	3			Yes
Channel Island High School	Gov't	1400 E Raiders Way	Oxnard	93030	180				Yes
Todd Road Jail	Gov't	600 S Todd Rd	Santa Paula	93060	177	2			Yes
BendPak Inc	Automo tive	1645 Lemonwoo d Dr	Santa Paula	93060	169				Yes

Many low-to-moderate income households in Ventura's Disadvantaged and Low-income Communities are concentrated in multi-unit developments. Accordingly, developing electric vehicle infrastructure at MUD locations and neighboring public destinations is a crucial step to enable increased rates of electric vehicle ownership in lower-income communities. The list of the top 50 largest MUDs in Disadvantaged Communities (see Appendix at the back of this chapter) will enable the prioritization of electric vehicle infrastructure investment and related outreach activities. In addition, a list of the 100 largest MUDs is provided to identify MUDs located outside of Disadvantaged Community boundaries, as well as those of the top 100 that are located in Low-income Communities or are adjacent to Disadvantaged Communities (these are indicated in the Tier 1 rankings).

Recommendations for inclusive engagement

- **Recommendation #1 - enhance incentive access for disadvantaged community members through education and outreach through community-based organizations and the Ventura county Electric Vehicle Ready Communities Coalition**: local service providers and community-based organizations that already engage disadvantaged community residents in accessing services will provide the most effective means of delivering electric vehicle-related information and services. Examples of prospective partners include CAUSE and MICOP, who helped inform recommendations for this electric vehicle ready blueprint.
- **Recommendation #2 - engage electric vehicle car sharing providers to serve low-income communities:** for mud residents unable to afford their own electric vehicles, new electric vehicle car share services such as envoy provide an alternative avenue to electric mobility. Envoy utilizes public as well as private funding to place at least two electric vehicles at a multi-unit residential building. These electric vehicles are available to residents for errands on an affordable time-and-mileage based short-term rental charge. Envoy and equivalent service providers can be pro-actively engaged along with mud property owners to develop effective car share programs, and to integrate disadvantaged community focused car share into upcoming grant and investment proposals.
- **Recommendation #3 - promote used electric vehicle options and promote the state's clean vehicle assistance grant program**, with provides a $5,000 down payment grant for the purchase of used electric vehicles: many disadvantaged community residents and consumers generally are unaware of the more affordable electric vehicle options increasingly available on the used market. Both plug-in hybrids and battery electric vehicles are available at price points below $10,000 (https://cleanvehilcegrants.org) with financing available for people with lower credit scores. An appropriate public agency or non-governmental organization could create a *pre-owned electric vehicle access project* to ensure that vehicle and charger incentives are made available to disadvantaged community and low-income residents seeking used electric vehicles, and that guidance is provided in selecting reliable and well-priced used electric vehicle options.
- **Recommendation #4 - promote electric paratransit options and seek to identify pilot program opportunities with regional partners**: Ventura transportation planners and policy makers should consider prioritization of multiple electric mobility options serving disadvantaged community and low-income residents. These could include electric paratransit, dial-a-ride, jitney, and vanpool services.
- **Recommendation #5 - work with GCT, VCTC, and other transit service providers to understand how e-bus deployments could enable enhanced clean mobility access for disadvantaged and low-income communities**: with many of Ventura county's residents reliant on public transportation as their primary means of transport, the electrification of transit fleets provides an important opportunity to reduce GHG emissions and provide benefits to community stakeholders. Further, electrification can result in operational and maintenance cost savings for local transit agencies. Ventura Electric Vehicle Coalition stakeholders could create or extend an "e-fleet accelerator" service that pro-actively provides fleet electrification planning and implementation assistance, including transit agencies.

- **Recommendation #6 – provide education and incentives for old vehicle retirements at smog check locations:** California certified smog check locations are well-situated to share information about electric vehicle rebates and incentives. Electric vehicle incentives can be stacked with the bureau of automotive repair's consumer assistance program rebate for the voluntary retirement of a high polluting vehicle (based on its most recent smog check). Retiring old and heavily polluting vehicles has been a practice backed by investment money from California's cap and trade proceeds. Coordinating with these programs to offer educational materials on electrification as well as rebates for vehicle retirement can act as a staging ground for new electric vehicle adoption
- **Recommendation #7 - track implementation of and promote carb's forthcoming zero-emission assurance project battery replacement**, which will provide a rebate of up to $1,800 for the replacement of an electric vehicle battery.

Enhancing Workplace Charging

As part of the creation of the Ventura County Electric Vehicle Readiness Blueprint the project team identified a list of existing charging from the largest Ventura County workplaces, identifying a total of six Level 1 chargers, 165 Level 2 chargers, and 51 DC Fast Chargers across 38 workplaces (see the workplace list above). The project team has also identified a list of the top 100 workplaces in Ventura County with high potential for new electric vehicle charging infrastructure. Both lists are presented in appendix of this Chapter. Resources for implementing workplace electric vehicle charging programs in California are abundant. Therefore, the following discussion of workplace charging will be focused on providing: 1) basic foundational information to orient local employers who wish to initiate or expand a workplace charging program in Ventura County; and 2) access to additional resources for more in-depth technical information on workplace and fleet charging.

Benefits of Workplace Charging

Workplace charging is especially important for drivers who do not have access to reliable home charging options – and for drivers who own an electric vehicle with all-electric range that is less than their daily driving distance. The provision of workplace charging also offers significant benefits for both employers and their current and future employees, visitors, and customers. Providing charging can differentiate a workplace as environmentally friendly, socially responsible, and technologically cutting-edge. Local companies, including Patagonia, Takeda, and Amgen, have installed charging stations at their workplaces, and help to amplify their brand images of innovation and sustainability.

The following list of benefits outlines the compelling case for expanding workplace charging throughout Ventura County.

Benefits to Employees

- **Increased ability and incentive to purchase an electric vehicle**: The availability of workplace charging helps make the electric vehicle purchase decision easier – especially for would-be battery electric vehicle owners with longer commutes who may not feel comfortable making their commute in an all-electric vehicle without a workplace charging option to use for their return trip home.

- **Commute cost reduction:** Employees utilizing electric vehicles typically enjoy substantial (70+ percent) fuel cost savings verses gas-powered vehicles. Savings can be even greater for employees that make long commutes and are currently driving vehicles with lower fuel economy ratings (e.g. less than 30 miles per gallon).
- **Range security and range extension**: The opportunity to charge at work can help many electric vehicle owners feel most confident about commuting in an all-electric vehicle. Plugging in at work provides "driving range security", so a driver will have plenty of charge for the return trip home – and for unexpected errands.
- **Preheating/cooling**: Workplace chargers can enable electric vehicle owners to preheat or pre-cool the car without draining the battery.

Benefits to Employers

- **Employee attraction and retention**: An increasing number of employees will be driving electric vehicles to work, motivated by a commitment to environmental sustainability, cost savings, a fun ride – or all three! By installing chargers, employers can help retain current employees and attract new hires – putting their commitment to sustainability and innovation into practice. Integration of electric vehicles with existing or new carpooling programs can further extend the benefits of on-site charging and vehicle electrification.
- **Positive publicity and green credentialing:** Showing leadership in supporting cutting-edge, clean transportation can raise the environmental profile and positive public perception of a business. U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) points are also available for the installation of electric vehicle charging equipment. By deploying chargers in visible locations, a workplace also creates immediate awareness and "green curb appeal" for the organization and property. This awareness can be extended through promotional and marketing materials. In combination with solar installations, businesses can go even further in showcasing the coming era of clean transportation and 100 percent renewable energy.
- **Fleet cost savings**: Going beyond electric vehicle charging for employees and visitors, a business can realize cost savings by electrifying its own fleet of company vehicles and charging them at the workplace. Significant financial savings from both reduced fuel and maintenance costs can lead to a substantial reduction in the total cost of ownership for electric vehicle-adopting companies.
- **Access to incentives**: Businesses that make an early decision to adopt EVSE are optimally positioned to access state and utility programs, as many utility and state incentive programs for both electric vehicles and infrastructure will sunset over time. If charging is installed and used on a large enough scale, workplaces may be able to receive significant subsidy from the LCFS credit market.
- **Carbon reporting and Corporate Social Responsibility**: Metrics reflecting Corporate Social Responsibility and Triple Bottom Line impacts (people, planet, and profit) are being used to communicate the broader success factors of a business, government, or nonprofit organization. Multiple initiatives require that organizations use standardized carbon reporting protocols – particularly those of the World Resources Institute and ICLEI -- to report GHG emissions. These protocols go beyond the reporting of emissions directly tied to business operations and encompass what are known as "Scope 3" emissions. Scope 3 emissions specifically include

emissions caused by employee commuting. For many service sector organizations, the GHG impact of employee commuting can be the dominant form of business-related emissions, larger than that from energy use in office buildings, for example. Electric vehicle charging facilities will encourage more "carbon-free commuting" and EVSE software can quickly and simply report the results in tons of GHG reduction, supporting annual voluntary Corporate Social Responsibility filings.

Case study: workplace charging at the Port of Hueneme

Dona works at the Port of Hueneme. She had been interested in buying an electric vehicle for a couple of years but wasn't quite ready to make the switch. She was motivated by the potential fuel savings and minimal maintenance of an electric vehicle, as well as by her desire to live more sustainably. When her employer at the Port of Hueneme installed electric vehicle charging stations in their parking lot, Dona decided to make the leap. She spent about a month researching various models and prices and watching and reading reviews by electric vehicle drivers. Ultimately, Dona decided that a used electric vehicle with a dependable urban driving range would work best for her budget and needs. In April of 2018, she found a pre-owned 2015 Volkswagen e-Golf with an 80-mile battery range for sale at a local dealer for $14,500. Dona went for a test drive and bought it that day.

Dona travels approximately 40-50 miles per day in her electric vehicle for work, school pick-ups, and errands. She can charge her vehicle with a 110-volt outlet in her garage at home but does most of her charging at the Level 2 stations at work. This allows her to make extra trips outside of her work commute with confidence. Dona's family of three still has one gas powered vehicle that they use for longer trips. Even so, in the year since she traded her car in for an electric vehicle, Dona has seen a 57 percent reduction in gas purchases and a 60 percent reduction in service and maintenance costs for the household's cars.

One of the only inconveniences Dona has experienced with charging her electric vehicle is the need to purchase different charge cards and download various apps in order to charge her car. She feels the initial time it takes to figure out electric vehicle charging is outweighed by the financial benefit of fueling with electricity. It costs Dona around $7.00 to completely charge her battery at work. Her charging costs at home are even less. She was not initially aware of the SCE clean fuel rebate but was still able to claim the $450* incentive nearly a year after purchasing her car. The SCE rebate will cover the cost of driving for well over 5,000 miles for Dona.

Dona charges her e-Golf at the Port of Hueneme during the workday and in her garage at night with a 110-volt outlet.

Despite her initial hesitation to buy an electric vehicle with limited range, after just over a year of ownership, Dona is very happy with her choice. Her Volkswagen e-Golf is quiet, quick to accelerate, easy to maintain, affordable to fuel, and has never left her stranded. Once she learned how to plan for her range and drive the car efficiently, she loved the new technology even more. Dona says it feels great to be environmentally friendly while enjoying a quick, sporty, and reliable car. Dona wants to use her experience to share with others that the choice to drive differently doesn't have to be scary. She imagines that she will trade her e-Golf model for a newer electric vehicle within a couple of years as the range and size of electric vehicles is steadily improving.

Since the charging stations were installed at the Port of Hueneme, some of Dona's co-workers who were considering purchasing a new car have decided on a plug-in hybrid or all-electric vehicle. She knows that for herself, and many others, workplace charging was the key catalyst that made electric vehicle driving possible.

**For plug-in electric vehicles purchased on or after January 1, 2019, the SCE rebate is $1,000.*

Planning and Executing a Workplace Electric Vehicle Charging Program

Implementing electric vehicle workplace charging is easiest when the employer is in full control of the entire facility, including the parking lot. Unified control of the parking area, building, and electrical service streamlines decision-making and cost allocation. However, many employers confront more complex ownership and management scenarios that may involve a building that is owned by one entity, maintained by another entity, with yet another entity operating the parking facility. For these more complex scenarios, the guidelines below will have to be modified to fit the specific ownership situation.

Regardless of the facility ownership scenario, successful workplace charging programs will depend on both employer and employee engagement. For more complex programs, a task force comprised of all the affected parties – including future EVSE users – will help to streamline planning, deployment, and operation of the EVSE. Human Resource staff may also need to be involved to help determine whether free or discounted electric vehicle charging will be considered a (taxable) employee benefit, and risk managers may need to advise on insurance and liability issues. Most charging stations offer charge management software, including an app for drivers, that allow employees and the station operators to know when vehicles are charged and when they can be swapped out. Using these technology solutions for charging station management can increase efficiency and help to maximize daily utilization. Charging station management technologies can also be used to align charging prices with time-of-use electricity rates and facilitate dual use by employer fleet vehicles and employees' personal vehicles.

Pricing for Charging: As in the case of public charging generally, employers must be careful to limit inappropriate use of scarce charging resources. While some employers may wish to initially offer charging for free as an amenity, the danger of this approach is that spaces will be used all day by drivers that may not actually need the additional range but are seeking to save money on charging. This could lead to scenarios where employees or visitors who actually need the range will be unable to access the EVSE. To guard against this scenario, most EVSE can be programmed with graduated charging rates that provide for a free or lower-cost charging period for the first hour or two of charging, after which the cost is ratcheted up to motivate the owner to move to a non-EVSE equipped space once their immediate need for additional range is met.

Recommendations for Increased Adoption of Workplace Charging

- **Recommendation #1 - Connect workplaces with an EV Coach that can facilitate access to electric vehicle infrastructure incentive programs and grant funding – with an emphasis on dual use opportunities for electric vehicle fleets, employees, and the public**
- **Recommendation #2 - Create an Electric Vehicle Champion recognition program to increase EV awareness among employers and acknowledge leadership in the field**
- **Recommendation #3 - Promote innovative "charging as a service" financing models that reduce upfront costs and operational risks for site hosts**
- **Recommendation #4 - Encourage use of incentives for smart networked chargers capable of modulating charger load in response to grid signals**
- **Recommendation #5 - Encourage deployment of lower-cost Level 1 charging where feasible and appropriate for longer-dwell scenarios**
- **Recommendation #6 - Prioritize outreach, education, and support for workplaces charging infrastructure development that will meet the electric vehicle charging needs of multiple users, including employees, fleet vehicle, and the public**

Enhancing Public Charging

Public Charging Challenges:
Deploying new publicly accessible charging faces a number of barriers as outlined in the table below:

Siting and Physical Challenges	▪ Identifying sites near target populations that will receive sufficient utilization ▪ Electrical capacity upgrade costs ▪ Long distances between utility meters, parking spaces, and electrical panels ▪ Parking capacity and ADA requirements

Cost of Installation and Operation	▪ Variance in installation costs across new construction and major retrofits ▪ Maintenance and service costs to keep public sites up and running
Business Model Barriers	▪ Finding public sites or private site hosts willing to collaborate with planners and Electric Vehicle Service Providers ▪ Selecting appropriate technology for deployment and making decisions on number of ports, and level of charging capability ▪ Ensuring sites are accessible, easy to find, and secure
Legal Issues	▪ Protecting from liability concerns and contracting with Electric Vehicle Service Providers and site hosts to define the burdens of risk associated with public use

Potential Strategies to Address Public Charging Deployment Challenges

Abundant public charging is vital to accelerating electric vehicle adoption and providing equal charging access for drivers that may confront barriers to the installation of residential charging. Robust inter-city corridor charging can also resolve range anxiety and support broader use of electric vehicles as a realistic "one-car solution" for all driving needs. Strategies to advance public charging access include:

- **Appropriate Signage:** While most electric vehicle drivers use mobile apps to find chargers, physical signage at the charging site and along transportation corridors remains important for electric vehicle messaging to the broader community. Highly visible signage can provide a substantial boost to electric vehicle awareness - reminding community members that the region is electric vehicle ready.
- **Streetlight Charging:** Integrating charging stations with LED streetlights can increase street side charging access. Currently streetlights across the state are being actively upgraded to LED bulbs, reducing the electrical load in the pole and leaving surplus capacity that can be tapped for electric vehicle charging without installing new conduit. SCE owns the streetlights in Ventura County. Accordingly, specific streetlight tariffs may have to be instituted to support charging, requiring CPUC approval. In addition, innovative metering and payment solutions will likely be needed to navigate public access and billing issues. Some successful models of streetlight-integrated charging have been developed in Europe, where electric vehicle owners often provide their own charging cables to facilitate charging.
- **Charger Configuration for Dual Fleet and Employee or Public Use:** Some workplaces may be able to enable dual use of fleet chargers by private employer fleets and employee or publicly owned vehicles. This can be as simple as charging fleet vehicles at night and employee or public vehicles during the day. Or chargers can be enabled with technologies such as electronic reservations queuing and text-based driver notification which can notify drivers of available chargers and enable fleet managers to reserve chargers at times essential for fleet operations.
- **Smart Charging Management:** As noted above, some EVSE are equipped with the capacity to respond dynamically to utility price signals. It is recommended that EVSE be specified that can respond to these events, as this capability can reduce charging costs, especially for longer-duration parking contexts at workplaces or at multi-unit residential properties. Further, some utilities – including San Diego Gas & Electric – have already reduced real-time electric vehicle

rates, with the expectation that chargers will be able to respond in real time to enable lower cost and lower-emissions charging.

- **Accessing Public Funding:** Sponsors of workplace and public charging should work closely with SCE to ensure maximum utilization of utility incentives, and with VCREA to ensure participation in relevant state grants, incentive programs, and policy development.
- **Interpreting Charger Utilization Data:** Drivers report that their utilization of public charging often declines as station density increases -- because drivers feel more confident that they can make it back to their home-based charging station without topping off. With more options to recharge, drivers feel less compelled to top off as frequently. Given this phenomenon, planners should be cautious not to read a utilization plateau or decline in charging sessions per charging port as a sign that additional infrastructure is not needed. For example, charger placement in destination locations that may be relatively remote is still important to ensure that all electric vehicles can travel freely throughout the region. Also, providing adequate DC Fast Charging to serve both local and through traffic is extremely important to build confidence that electric vehicle drivers will not be subjected to a long wait when charging is urgently needed.

Recommendations for Increasing Public Charging

- **Recommendation #1 - Install electric vehicle charging stations at key local government parking lots**: The installation of electric vehicle charging at high-utilization public parking lots, community centers, and employee lots will help to promote electric vehicle visibility and adoption.
- **Recommendation #2 - Encourage use of incentives for smart networked chargers:** As noted above, some EVSE are equipped with the capacity to respond dynamically to utility price signals. It is recommended that EVSE be specified that can respond to dynamic pricing and grid signals, as this capability can reduce charging costs.
- **Recommendation #3 - Develop competitive funding proposals to support public electric vehicle charging infrastructure:** Local EVSE investments can be leveraged with significant state funding by effective partnership building and grant development with site hosts, Electric Vehicle Service Providers, local public agencies, and utilities (including both SCE and CPA.) Work with VCREA to designate a collaborative subgroup that will help track and pursue funding opportunities.
- **Recommendation #4 - Enhance public signage for electric vehicle charging stations**: Require high-visibility public signage for electric vehicle charging stations both at the parking space and along transportation corridors; and adopt policies in local ordinances defining signage requirements.
- **Recommendation #5 - Track available funding and pursue a regional CALeVIP incentive project** serving Ventura County which offers incentives for the purchase and installation of electric vehicle charging infrastructure at publicly accessible sites. Approximately $29.1 million in funding would be needed for a larger CALeVIP project that includes the three counties of Ventura, Santa Barbara and San Luis Obispo. The Center for Sustainable Energy administers the CALeVIP program on behalf of the California Energy Commission, so local governments in the region would not be responsible for dispersing funds or managing electric vehicle infrastructure

development. The California Energy Commission seeks local government partnerships for marketing and outreach to promote CALeVIP projects and participation.

- **Recommendation # 6 - Create an online application and streamlined approval process for the Ventura County APCD's Electric Vehicle Charging Station Infrastructure Program** which will facilitate quick dispersal of grant funding that can be stacked with other electric vehicle infrastructure development incentives to reduce upfront cost barriers, including the CALeVIP program.

Existing and Future Public Charging in Ventura County

Public charging stations have been steadily deployed throughout Ventura County, with public EVSE being a primary charging location for many local electric vehicle owners. Information on the location of existing public charging is provided by multiple agencies. A survey of datasets from the federal Alternative Fuels Data Center (AFDC) and PlugShare indicates the following charging port counts by municipality. As of February 2019, 54 Level 1 Chargers, 306 Level 2 Chargers, and 92 DC Fast chargers are registered in the AFDC and PlugShare, as shown in the table below.

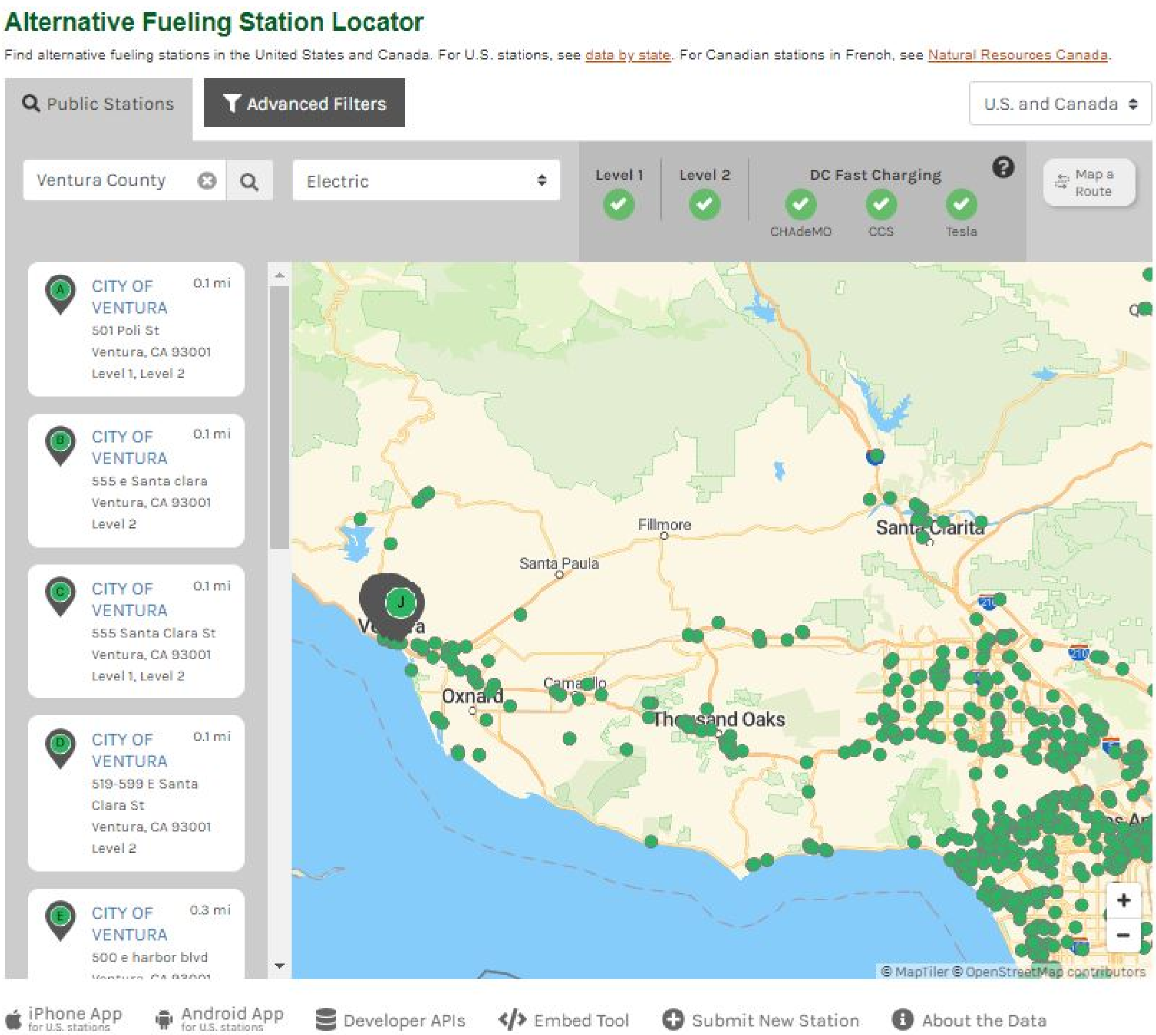
Table 4: Public EV Charging Ports as Listed on AFDC and PlugShare Data Sets as of February 2019

City	Level 1	Level 2	DC Fast Charging
Camarillo		53	4
Moorpark		16	
Newbury Park	4	5	
Not in Ventura		3	
Oak Park	1	9	
Ojai		12	
Oxnard		51	22
Point Mugu		1	
Port Hueneme		4	
Santa Paula		2	
Fillmore		0	
Simi Valley		14	5
Thousand Oaks		57	52
Ventura	9	74	3
Grand Total	**14**	**301**	**86**

New chargers are being installed frequently throughout the county, and databases should be revisited regularly to provide the most up to date inventories of EVSE for planning and public use. Both PlugShare and AFDC provide maps of publicly available charging on their websites and on iPhone and Android apps, providing data and directions for available charging infrastructure.

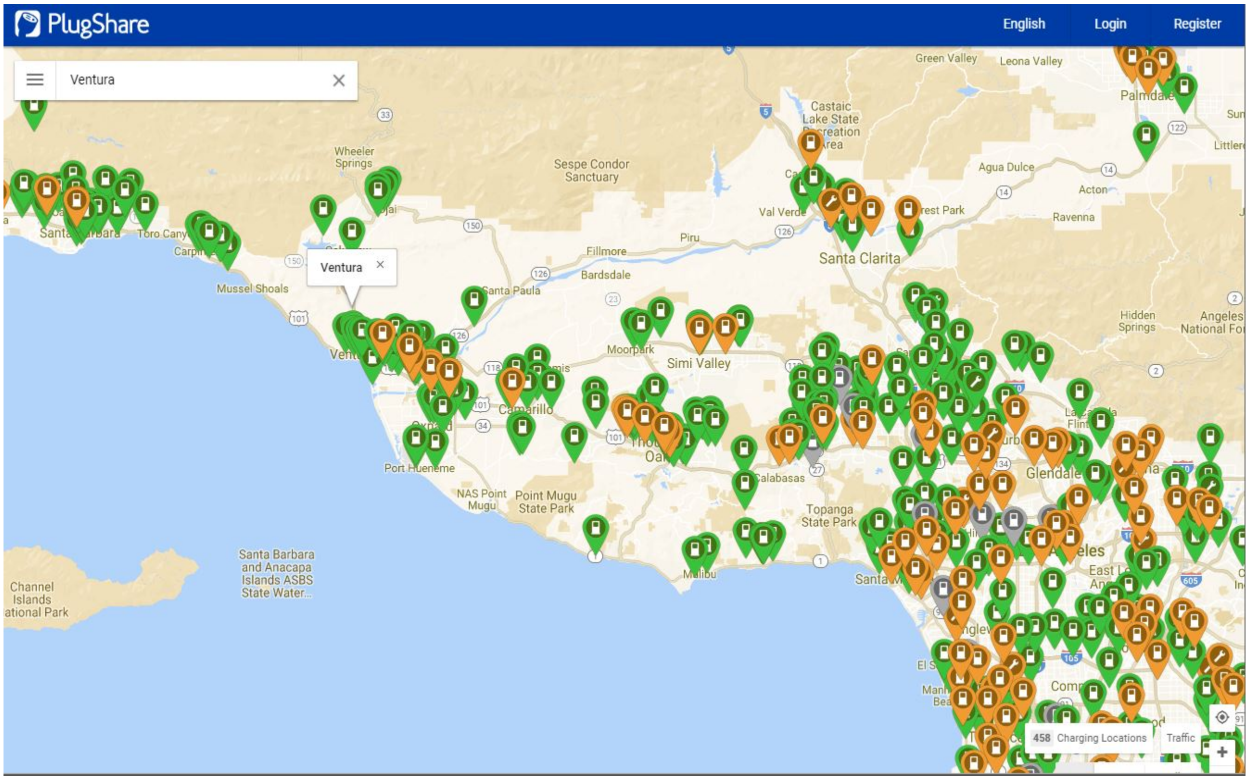
The County is also developing an interactive map-based tool that will show all charging stations in the region, using an API from the AFDC. The County's map-based tool will automatically show new charging stations in the region when they are added to the AFDC's national map. Submitting new charging stations to the AFDC will help ensure that the County's regional map-based has the most up-to-date charging information.

Figure 5: Alternative Fuel Data Center Public Charging Map[80]



[80] Available at: https://afdc.energy.gov/stations/#/find/nearest?location=Ventura%20County&fuel=ELEC&ev_levels=2&ev_levels=dc_fast&ev_levels=1

Figure 6: PlugShare Ventura County Public Charging Map[81]



Future Charging Initiatives in Ventura County

The expansion of charging infrastructure in the County can be facilitated by increasing the availability of chargers on public property, by expanding workplace charging, and by increasing the installation of charging at MUDs. However, to ensure that new charging is well-utilized, smart siting is critical. In the context of this report, VCREA identified a list of the 100 largest and best-fit workplaces for new EVSE installation. In addition, approximately 60 high-priority destinations were identified for future EVSE deployment. These two lists can act as a foundation for future charging infrastructure installation and are presented in the Appendix of this chapter.

Forecasted EVSE Needs Through 2025: The California Energy Commission currently assesses the need for electric vehicle charging infrastructure in California in collaboration with NREL using the EVI-Pro EVSE planning model. The EVI-Pro tool takes into consideration the statewide projections of the number and type of ZEVs that will be on California roads by 2025. The tool estimates that by 2025, Ventura County will have 28,096 plug-in electric vehicles. These are projected to required 1073 charging ports at multi-family residential developments, 800 Level 2 workplace ports, 1167 Public Level 2 ports, and 201 DC Fast Chargers. This represents a rapid growth rate in charging deployment, as indicated in the Table 5 below.

[81] Available at https://www.plugshare.com/

Table 5: EVI-Pro Charging Forecast through 2025

Charging Level	2019 Deployment	EVI Pro 2025 estimated deployment requirement	Annualized Growth Requirement
Multi-Family EVSE	Unknown	1,073	Unknown
Workplace Level 2	323	800	96 chargers / year
Public Level 2	464	1167	141 chargers / year
DC Fast Charger	89	201	23 chargers / year

The table below provides localization of charging growth needs by integrating census data with Alternative Fuels Data Center EVSE deployment data. The table provides a per capita ratio of EVSE deployment to population based on current EVSE baselines, highlighting opportunities for improved EVSE deployment within Ventura County.

Table 6: Ratio of EV Charging Deployment to Population in Ventura County Municipalities [82]

City	Population [83]	Level 2 Chargers	Level 2 per capita	DC Fast Chargers	Population per DC Fast Chargers
Camarillo	67,845	53	1280	4	16,961
Moorpark	36,802	16	2300	0	N/A
Newbury Park	37,775	5	7555	0	N/A
Ojai	7,607	12	644	0	N/A
Oxnard	210,037	52	4039	22	9547
Point Mugu	82	1	82	0	N/A
Port Hueneme	22,327	4	5582	0	N/A
Santa Paula	30,313	2	15157	0	N/A
Simi Valley	126,878	14	9063	5	25,375
Thousand Oaks	138,160	57	2424	52	2657
Ventura	110,790	90	1231	9	12,310
Fillmore	15,298	0	0	0	N/A
County Total	849,738	306 [84]	2,777	92	9,236

As represented above, cities with the lowest electric vehicle deployment per capita are Santa Paula and Simi Valley. There are currently no DC Fast Chargers deployed in Santa Paula, Newbury Park, Moorpark, and Ojai, while Fillmore lacks any public Level 2 or DC Fast Charge charging stations.

---

[82] Per capita based siting is not necessarily the best indicator of electric vehicle charging needs. A more accurate representation of EVSE needs should be based on a combination of data inputs including traffic flow, current EVSE deployment, electric vehicle registration data, grid capacity data, and other factors material to EVSE siting.

[83] US Census. Population. Retrieved from: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk

[84] Difference in sum result of unincorporated towns within Ventura County

DC Fast Charging Corridor

According to the AFDC, as of February 2019, Ventura County is home to 86 DC Fast Chargers. The highest-density deployment of chargers is in Thousand Oaks and along the US 101 corridor. There is a significant gap in DC Fats Charge infrastructure in low-income communities along Highway 126. With the exception of DC Fast Charge stations located adjacent to the US 101, there are currently no DC Fast Charge stations in Oxnard. As a result, Oxnard's downtown workforce and residents that living South of the US 101 – including several Disadvantaged Communities - have little to no access to DC Fast Chargers. Currently, Tesla's 62 proprietary DC Fast Chargers represent the majority of Ventura County's fast charging capability. Tesla's network in Ventura County may approximately double by the end of 2019, as Tesla's website lists planned superchargers opening in Ojai, Simi Valley, and the City of Ventura. However, these chargers will only be accessible to Tesla drivers and will not promote broad access to DC Fast Charge stations in the region for the many non-Tesla electric vehicle drivers.

Integration of Solar, Storage, and Electric Vehicle Charging

To develop greener fueling options for electric vehicles and to improve energy resilience, property owners may wish to co-locate electric vehicle charging with solar photovoltaic and stationary battery storage. These resources can also provide new revenues for the asset owners as well as benefits for the grid. For commercial customers, solar and energy storage can also mitigate demand charges, which are an additional fee paid on the monthly bill based on peak power usage measured in kilowatts within a single 15-minute period (rather than a so-called volumetric charge based on cumulative energy use, which is measured in kilowatt hours.) The demand charge is calculated based on the peak power consumed over the highest 15-minutes of monthly utilization. Within SCE territory, the utility announced in March 2019 an new Time of Use rate specifically for electric vehicles, known as the TOU-EV rate plan, which will temporarily waive demand charges for a five-year period (2019-2023) with gradual phase in of demand charges after that time. [85] However, many commercial users will want to begin preparing now to mitigate the potentially significant impact of demand charges upon their re-imposition in 2024 and beyond.

For most large commercial and industrial customers, the total monthly charge for electricity is based on multiplying energy consumption by the energy rate (i.e. $ per kWh), with an additional demand charge per peak kilowatt of power usage. By understanding the potential impact of utility demand charges, site hosts will be better equipped to evaluate the business case for co-locating battery storage to help meet their electric vehicle charging needs most efficiently. Facility managers must weigh the higher capital costs associated with battery purchases versus the avoided costs of future demand charges to identify the potential return on investment. While demand charges waivers are in effect between 2019-2023, relatively little incentive exists to integrate solar, storage, and electric vehicle charging. However, as demand charges are phased back in and battery prices drop over the next five years, new economic incentives and penalties will exist that make integrated solutions financially viable, and in some cases, crucial to ensure that electric vehicle charging remains economically competitive with fossil fuels.

Integrated Solutions at MUDs: Given barriers to charger adoption by property owners, particularly in the MUD residential space, some entrepreneurs are deploying integrated charging, solar, and storage

[85]SCE. Rate Schedules for Business Customers Charging Electric Vehicles. Retrieved from: https://www.sce.com/sites/default/files/inline-files/TOU-EV-7_8_9%20Rate%20Fact%20Sheet_WCAG_0.pdf

solutions that can provide enhanced revenue and functionality to drive increased adoption. One such example is Powertree, a San Francisco based company that offers three revenue streams to apartment owners: 1) parking space rental fees for the provision of shared electric vehicle charging; 2) a share of the solar installation revenue; and, 3) a share of the electric vehicle charging revenue. Further, the building owner gains a valuable capital improvement for the building in the form of the combined value of electric vehicle chargers, solar panels, and energy storage (if applicable based on revenue and resilience benefits). These distributed energy resources can create a bankable revenue stream that in turn will increase the building's property valuation. With this approach to integrated electric vehicle, solar, and storage, the multi-family property owner benefits can include:

- New rental income and lowered costs from previously non-monetizable value streams in tenant energy and gasoline spending
- Attractive new amenities for the property including, solar energy benefits, electric vehicle charging on site, and increased building resilience from solar plus storage
- Compliance with the California Green Building Standards Code, Title 24, Part 11 (CALGreen), which requires allocation of a portion of parking to electric vehicle charging
- Avoidance of stranded charging assets that would otherwise be caused by tenant churn, as the EVSE are provided on a shared use basis, rather than being dedicated 24/7 to just one tenant.

To date, the appeal of adding a "green amenity" – even at no cost to the building owner - has not been sufficient to catalyze EVSE adoption for most building owners, except in demographics where electric vehicle adoption is already very strong. While the EVSE plus solar plus storage model has yet to be proven at scale, it is clear that EVSE adoption will be increased as complementary revenue opportunities are developed and deployed. Given the urgent need to accelerate the MUD market, it is recommended that Ventura County stakeholders partner with a broad range of Electric Vehicle Service Providers to pilot innovative new charging business models for the multi-family market. Those models that prove viable can in turn be scaled up through public-private partnerships, potentially including state grant funds. To support the planning and development of integrated electric vehicle charging, solar, and energy storage projects, Ventura County project sites with solar capacity are highlighted in the appendix to this chapter.

Locational Priorities for Public Charging

The installation of new public charging stations is a high priority for further development of the Ventura County EV ecosystem. Ubiquitous and convenient public charging will reduce range anxiety, increase electric vehicle miles traveled (e-VMT), and help provide consumers the confidence they need to purchase electric vehicles. Siting priorities identified by Electric Vehicle Service Providers and local electric vehicle stakeholders include:

- Locations with high utilization -- including grocery stores and shopping centers
- Locations with longer vehicle dwell time such as multi-unit apartments, workplaces, airports, and transit hubs
- Proximity to disadvantaged communities and low-income communities, as identified by CalEnviroScreen 3.0 mapping and CARB's AB 1550 mapping.
- Proximity to major transportation corridors
- Locations that address gaps in existing charging station deployment.

In the development of this report, a list of the 69 top destinations for new chargers was identified by Ventura EV Blueprint coalition members and the project team. This list is included along with a list of the top 100 largest workplaces in the Appendix of this chapter. These two lists can act as a foundation for future charging infrastructure installation.

Smart Charging and Vehicle-Grid Integration

The integration of electric vehicles with the electricity grid can provide important economic and environmental benefits for electric vehicle drivers, utility ratepayers, and the state as a whole. Accordingly, the CPUC, the CAISO, and the California Energy Commission collaboratively produced the first statewide *Vehicle Grid Integration Roadmap* in 2014. The purpose of this report was to ensure that electric vehicle charging is optimized to support grid resilience, minimize peak charging, and provide cost savings for electric vehicle drivers. This Roadmap is being updated in 2019 and will likely result in more funded programs to advance vehicle grid integration projects across the state. In the preface to the *Vehicle Grid Integration Roadmap*, policy makers indicate that:

> Vehicle electrification and smart grid technology implementation present an opportunity for electric vehicles, through charging strategies and aggregation, to support and provide valuable services to contribute to reliable management of the electricity grid. At a minimum, managed or smart charging strategies are needed to ensure that electric vehicles do not increase peak load, requiring additional generation or capacity expansions. Ideally, charging is coordinated with grid conditions and the ability for aggregation of electric vehicles to respond to grid operator signals.[86]

Studies by the Lawrence Berkeley National Labs, the National Renewable Energy Laboratory, and the Electric Power Research Institute, indicate that the value of grid services provided by grid-enabled vehicles will be in the billions of dollars per year as electric vehicles approach 20 percent to 30 percent or more of all on-road vehicles in California. Smart charging services enable vehicles to start, stop, and modulate charging to ensure that vehicles are charging when solar and wind generation is greatest (and prices and carbon intensity per kilowatt hour are lowest.) These smart charging strategies require that the charger be responsive to grid signals.

Some load-serving entities in California – such as Sonoma Clean Power – already provide significant incentives for electric vehicle owners to install smart residential chargers, and to participate in programs that modulate charging within customer-defined parameters to earn rebates on their charging. Currently, the CPUC, CAISO, and Energy Commission are working with utilities and industry organizations on standards to ensure that smart charging capabilities are built into the next generation of EVSE. In the next few years, nearly all chargers will be mandated to be responsive to grid signals that optimize charging to coincide with time periods when electricity is most abundant, cheapest, and cleanest.

---

[86] California Independent System Operator. February, 2014. *California Vehicle-Grid integration (VGi) Roadmap: Enabling vehicle-based grid services. Retrieved from:*
http://www.caiso.com/documents/vehicle-gridintegrationroadmap.pdf

Two-way energy flow through V2G operations are distinct from the general category of VGI, which includes smart one-way charging management. In VGI configurations, an electric vehicle sends energy back to the grid from the vehicle (or to another external load, such as a building or an appliance.) Currently, an expanding number of trucks and buses are being equipped at the factory with two-way V2G capabilities. Some Asian manufacturers, including Nissan, have also equipped light-duty vehicles, such as the Nissan Leaf, for V2G operation in certain markets (e.g., Japan and England, in the case of the Nissan Leaf.) However, V2G enablement for a much larger array of light-duty manufacturers is still a few years away and will require the resolution of V2G related standards issues among utilities, automakers, and charging manufacturers.

The benefits of V2G are numerous. V2G capability can be used to power buildings or appliances in the case of a grid outage. An electric vehicle battery can power a typical household load for one to three days - depending on the size of the vehicle battery and the electrical needs of the house. In addition, V2G operation can enable electric vehicle owners to reduce their charging bill by purchasing energy at low-cost times of the day and selling back a portion of that energy at high-cost times. Much of the past decade's work on V2G pilot programs has determined that electric vehicle owners need only provide a relatively small amount of electricity to the grid (within customer-defined parameters) to enable an economically useful *aggregation* of vehicles to respond to grid signals. Further, it has been demonstrated that the incremental degradation of the battery's useful life – caused by the additional cycling of batteries in V2G configurations -- is typically outweighed by the economic advantages of V2G participation. Finally, from the grid operator's perspective, having a large aggregation of electric vehicles available to reduce system peaks could eventually enable the retirement of significant gas powered peaker plant capacity, saving substantial sums in total grid infrastructure costs and providing significant ratepayer benefits, as well as air quality and climate benefits. [87] In light of the potential benefits of VGI initiatives, the following recommendations have been developed to encourage local Smart Charging and V2G pilot projects.

Recommendations for Smart charging and Vehicle to Grid Integration

- **Recommendation #1 - Identify potential Vehicle Grid Integration and Vehicle-to-Grid pilot projects:** The Energy Commission and CARB have invested over $30 million in Vehicle-to-Grid demonstration projects in recent years, with more funding opportunities expected in future years. To compete effectively in these grant solicitations, it is recommended that the VCREA and Ventura County electric vehicle stakeholders explore a collaborative effort with fleet operators and industry partners to develop VGI and Vehicle-to-Grid projects that are technically and economically feasible in the near-term and provide multiple value streams. Specific project types could include:
    - Integrating electric School Buses with the grid, to provide lower Total Cost of Ownership for the school districts, clean transportation, and solar-charged backup power for the bus fleet
    - Consumer or fleet-level Smart Charging and Demand Response programs integrated with SCE and CPA

[87] Darlene Steward, *Critical Elements of Vehicle-to-Grid Economics,* National Renewable Energy Laboratory, September 2017, p. 4. https://www.nrel.gov/docs/fy17osti/69017.pdf

- A renewable microgrid that includes fleet vehicles equipped for two-way energy flow (V2G) as well as stationary energy storage and solar photovoltaics. The microgrid and V2G equipped vehicles could in turn help meet community emergency and disaster resilience needs through Vehicle-to-Building connectivity.

- **Recommendation #2 - Link EVSE incentives to networked electric vehicle charging stations** that can respond to utility price signals and participate in virtual power plants and demand response programs. Smart charging programs can provide benefits in the range of a few hundred dollars per charger per year based on optimizing charging to take advantage of the lowest energy prices and cleanest power available on the grid. These benefits can in turn be shared among rate payers, the utility, and Electric Vehicle Service Providers
- **Recommendation #3 - Link EVSE incentives to networked electric vehicle charging infrastructure able to respond to utility price signals**, and participate in virtual power plants and demand response programs
- **Recommendation #4 - Develop electric vehicle charging station projects that are paired with solar carports at workplaces**, MUD properties, and public destinations to enable mid-day charging from solar energy and reduce on-going costs associated with electricity demand

Chapter 3 References

Alternative Fuels Data Center. Developing Infrastructure to Charge Plug-In Electric Vehicles. Retrieved from: http://www.afdc.energy.gov/fuels/electricity_infrastructure.html.

Bay Area Climate Collaborative. Metropolitan Transportation Commission Alameda, and

the County General Services Agency Ready Set Charge Fleets.

CalEnviroScreen. June 2018, Map Data. Retrieved From: https://oehha.ca.gov/calenviroscreen/maps-data

California Independent System Operator. February, 2014. California Vehicle-Grid integration (VGi) Roadmap: Enabling vehicle-based grid services. Retrieved from: http://www.caiso.com/documents/vehicle-gridintegrationroadmap.pdf

Elektek. VW's Electrify America opens California's first 350kW ultra-fast charger, before cars can actually use it. Retrieved From: https://electrek.co/2018/12/06/electrify-america-first-350kw-charger-california

EVGo. Retail Fast Charging Stations. Retrieved from: https://www.evgo.com/ev-charging-business/retail/

LA Department of Building and Safety. Online permit System. Retrieved from: http://ladbs.org/LADBSWeb/LADBS_Forms/InformationBulletins/IB-P-GI2011-003ExpressPermits.pdf

Luskin Center for Innovation. May, 2016. Overcoming Barriers to Electric Vehicle Charging in Multi-unit Dwellings. Retrieved from: http://innovation.luskin.ucla.edu/sites/default/files/Overcoming%20Barriers%20to%20EV%20Charging%20in%20Multi-unit%20Dwellings.pdf

NYSERDA. Charging Station Hosts. Retrieved from: https://www.nyserda.ny.gov/Researchers-and-Policymakers/Electric-Vehicles/Info/Charging-Station-Hosts

Plug-in Electric Vehicle Infrastructure Guidelines for Multi-unit Dwellings [88] by the California PEV Collaborative

Ready, Set, Charge California! jointly published by EV Communities Alliance, ABAG, and the Bay Area Climate Collaborative (http://www.baclimate.org/impact/evguidelines.html)

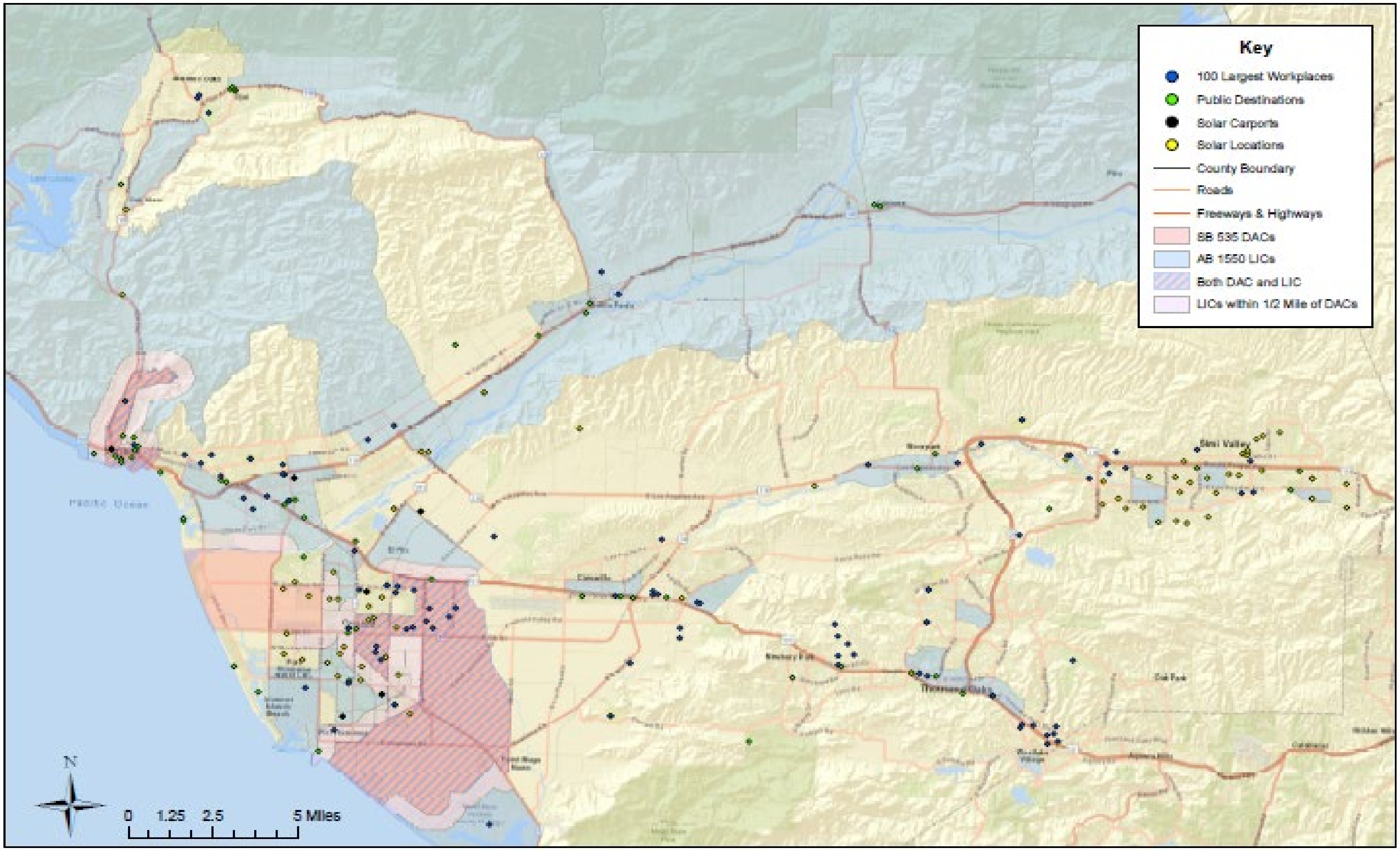
Residential Charging Station Installation Handbook for Single and Multi-family Homeowners and Renters [89] by Advanced Energy.

San Diego Gas and Electric information about their programs to install EVSE in MUDs [90]

Southern California Edison. Electric Vehicle Rates. Retrieved from: https://www.sce.com/residential/electric-cars/residential-rates

[88] http://www.pevcollaborative.org/sites/all/themes/pev/files/docs/MUD_Guidelines4web.pdf
[89] http://www.advancedenergy.org/portal/ncpev/resources/MUD%20Handbook.pdf
[90] http://www1.eere.energy.gov/cleancities/toolbox/pdfs/driving_san_diego.pdf

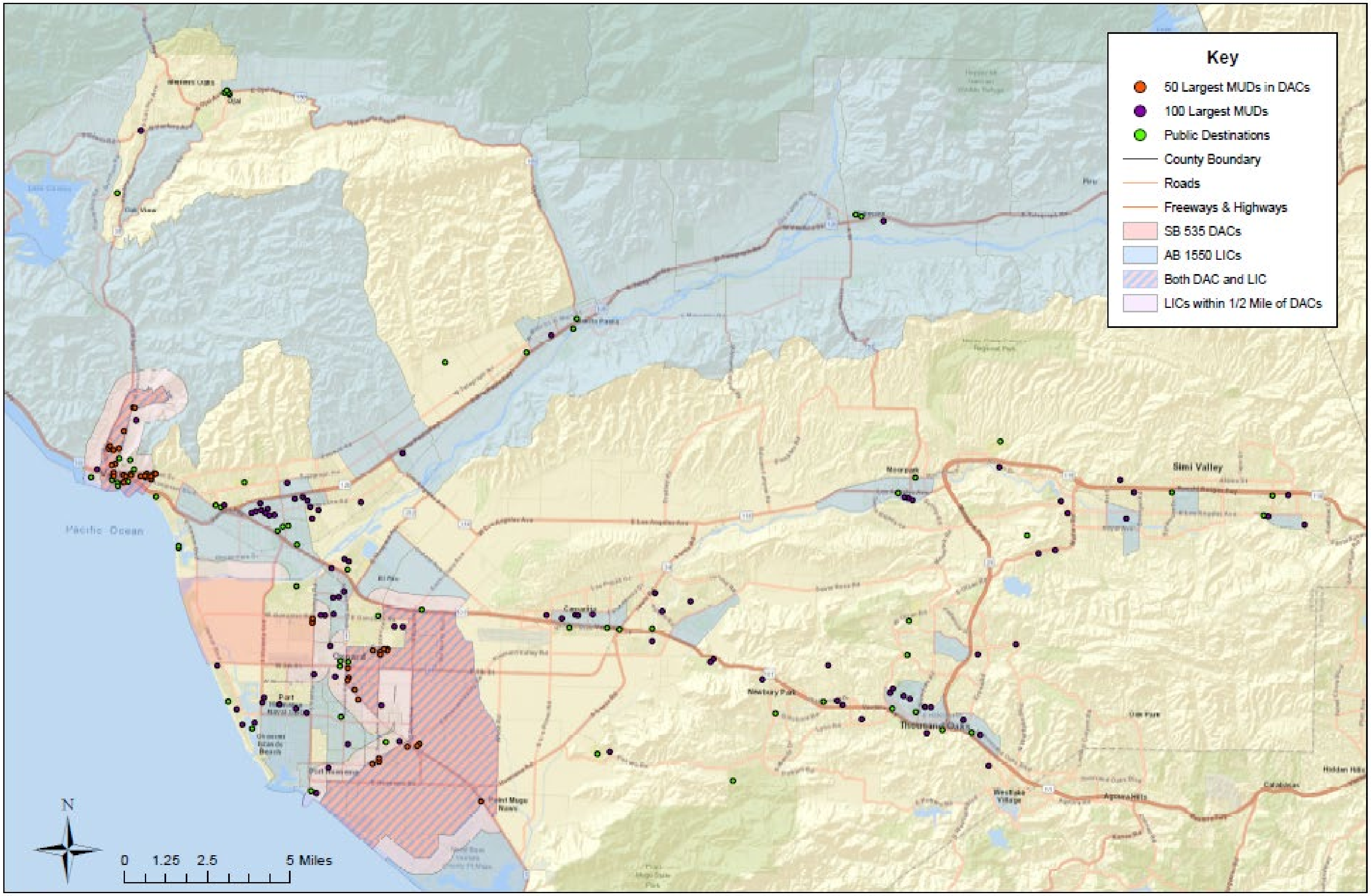
Chapter 3 Appendix



Community Environmental Council

Workplaces, Public Destinations and Solar Locations in Ventura County

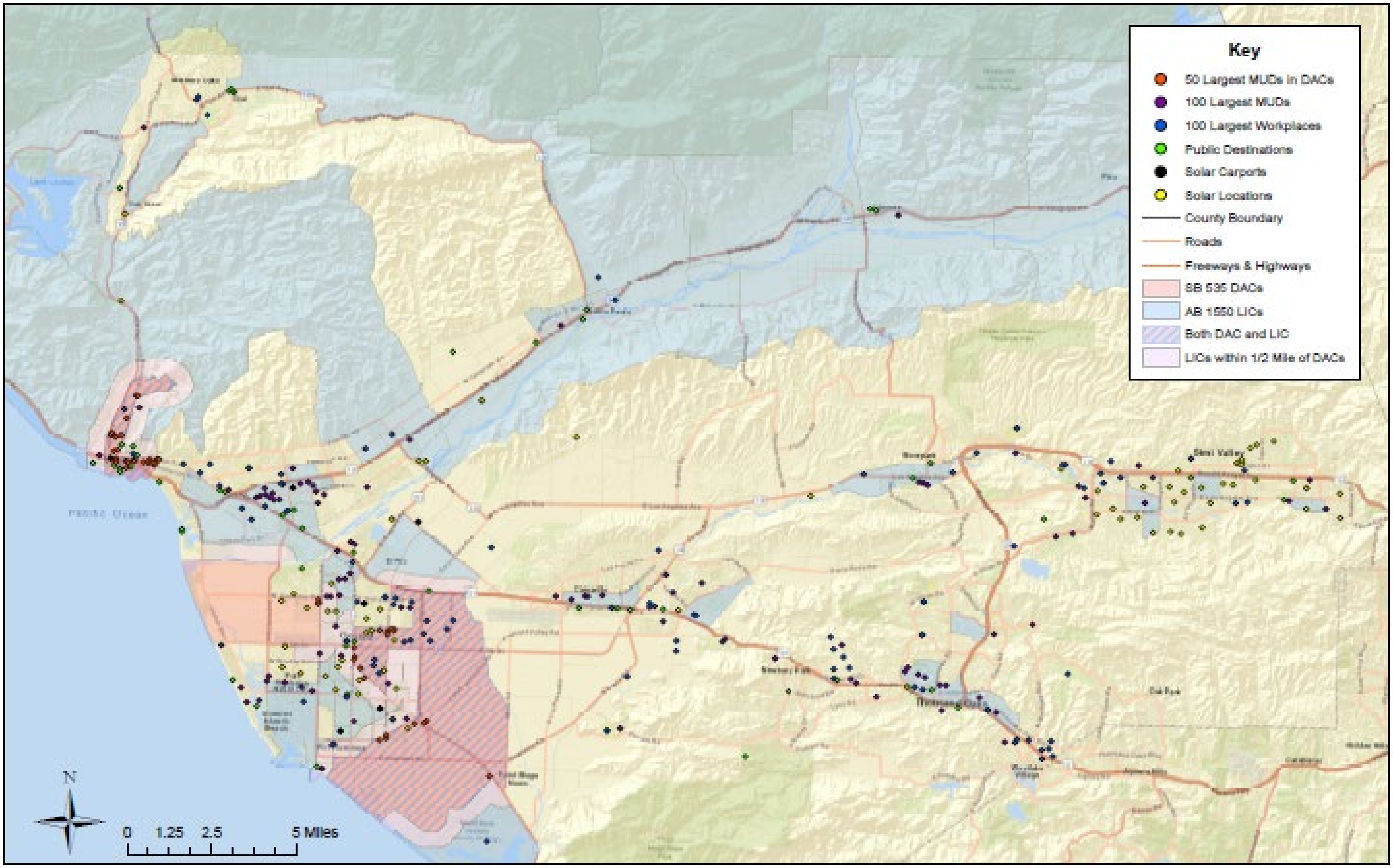
Ventura County REGIONAL ENERGY ALLIANCE www.vcenergy.org



Community Environmental Council

Multi-Unit Dwellings and Public Destinations in Ventura County

Ventura County REGIONAL ENERGY ALLIANCE www.vcenergy.org



Community Environmental Council

Multi-Unit Dwellings, Public Destinations, Workplaces and Solar Locations in Ventura County

Ventura County REGIONAL ENERGY ALLIANCE
www.vcenergy.org

Appendix. **Top 50 Largest MUDs in Disadvantaged Communities**

Property Name	Street Address	City	Zip Code	Type of Home	Units	Vintage	Potential Charging Site
Oxnard Pacific Mobile Estates	4130 Maulhardt Rd	Oxnard	93033	Mobile Home	266	1972	
Holiday Manor Apartments	1924 Camino Del Sol	Oxnard	93030	Apartment	252	1963	
Parkwood Gardens	1741 N Ventura Rd	Oxnard	93030	Apartment	157	1970	
Royal Palms Mobile Home Community	205 E Driffill Blvd	Oxnard	93030	Mobile Home	154	1963	
The Colony Mobile Home Community	2400 E Pleasant Valley Rd	Oxnard	93033	Mobile Home	150	1964	
Vista Del Mar Commons (Site A)	137 S Palm St	Ventura	93001	Apartment	142	1963	
Oxnard Mh Lodge	1301 Commercial Ave	Oxnard	93030	Mobile Home	140	1949	
Villa Capri Mobile Estates	1300 E Pleasant Valley Rd	Oxnard	93033	Mobile Home	134	1975	
Camino del Sol Senior Apartments	1900 Camino Del Sol	Oxnard	93030	Apartment	120	2005	
Gateway Plaza Apartments	1719 South Oxnard Boulevard	Oxnard	93030	Apartment	107	2000	
Westerley Shores	4840 S Rose Ave	Oxnard	93033	Apartment	90	1972	
Avenue Trailer Town	251 N Ventura Ave	Ventura	93001	Mobile Home	68	2005	Yes
Santa Clara Apartments	1381 E Santa Clara St	Ventura	93001	Apartment	66	1972	
Terraza de las Cortes	201 Carmelita Ct	Oxnard	93030	Apartment	64	2015	
Silver Wheel Ranch	4100 Maulhardt Rd	Oxnard	93033	Mobile Home	63	1957	
Oxnard Village Apartments	1500 Anna Way	Oxnard	93030	Apartment	56	1977	
San Gorgonio Apartments	1915 San Gorgonio Ave	Oxnard	93030	Apartment	52	1962	
Garden Estates	32 S Garden St	Ventura	93001	Apartment	48	1989	
No property name	35 W Thompson Blvd	Ventura	93001	Apartment	46	Not listed	
Ramona Mobile Home Park	375 W Ramona St	Ventura	93001	Mobile Home	45	Not listed	
No property name	1805 San Gorgonio Ave	Oxnard	93030	Apartment	44	1968	
No property name	100 N Rose Ave	Oxnard	93030	Apartment	44	1968	
Navalair Mobile Home Ct	4456 4484 Navalair Rd	Oxnard	93030	Mobile Home	43	Not listed	
Somerset Apartments	540 E Santa Clara St	Ventura	93001	Apartment	40	1926	

Property Name	Street Address	City	Zip Code	Type of Home	Units	Vintage	Potential Charging Site
Encanto del Mar	375 E Thompson Blvd	Ventura	93001	Apartment	37	2007-2008	
Beachfronter Townhome Apartments	369 Paseo De Playa Unit 602	Ventura	93001	Apartment	36	1971	
Tuscania Apartments	248 S Hemlock St	Ventura	93001	Apartment	35	1965	
Ivywood Apartments	1501 W Ivywood Dr	Oxnard	93030	Apartment	34	1977	
Villa Solimar Family Apartments	902 Donlon Ave	Oxnard	93030	Apartment	32	Not listed	
Downtown Ventura	156 S Laurel St	Ventura	93001	Apartment	30	1965	
Meta Street Farmworker Family Apartments	501 Meta St	Oxnard	93030	Apartment	24	2004	
Walnut Tree Trailer Park	1707 N Ventura Ave	Ventura	93001	Mobile Home	24	Not listed	
Santa Clara Courts	72 W Santa Clara St	Ventura	93001	Apartment	24	2016	
Kalorama Apartments	167 S Kalorama St	Ventura	93001	Apartment	24	1965	
No property name	50 Dakota Dr	Ventura	93001	Apartment	24	Not listed	
The Aloha	1280 E Santa Clara St	Ventura	93001	Apartment	21	1963	
Ocean Park Apartments	1344 E Main St	Ventura	93001	Apartment	20	1990	
No property name	95 S Ann St	Ventura	93001	Apartment	20	Not listed	
No property name	382 W Ramona St	Ventura	93001	Apartment	20	Not listed	
No property name	154 N Olive St	Ventura	93001	Apartment	19	Not listed	
No property name	236 W Ramona St	Ventura	93001	Apartment	19	1988	
No property name	6 Dakota Dr	Ventura	93001	Apartment	18	1987	
No property name	401 W Ramona St	Ventura	93001	Apartment	17	Not listed	
No property name	154 S Hemlock St	Ventura	93001	Apartment	16	1974	
No property name	1045 E Meta St	Ventura	93001	Apartment	16	1973	
No property name	320 N Rose Ave	Oxnard	93030	Apartment	16	1968	
No property name	155 S Ann St	Ventura	93001	Apartment	15	1962	
No property name	781 N Ventura Ave	Ventura	93001	Apartment	13	1989	

Property Name	Street Address	City	Zip Code	Type of Home	Units	Vintage	Potential Charging Site
No property name	72 W Ramona St	Ventura	93001	Apartment	12	Not listed	
No property name	558 E Thompson Blvd	Ventura	93001	Apartment	12	Not listed	

Appendix 2. Top 100 list of MUDs in Ventura County

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
TIER 1 RANKINGS: LOCATED IN A LOW-INCOME COMMUNITY OR WITHIN ½ MILE OF DISADVANTAGED COMMUNITY							
Surfside I-IV	685 Ocean View Dr	Port Hueneme	93041	Tier 1	781	Condo	1973-85
Hueneme Bay	87 W Delta Green St	Port Hueneme	93041	Tier 1	773	Condo	1963-71
Camarillo Oaks	921 Paseo Camarillo	Camarillo	93010	Tier 1	564	Apartment	1985
Oaknoll Villas	290 Sequoia Ct	Thousand Oaks	91360	Tier 1	419	Condo	1974-82
Tierra Vista	1750 Monte Vina Circle	Oxnard	93030	Tier 1	404	Apartment	2000
Capes at Ventura	760 S. Hill Road	Ventura	93003	Tier 1	400	Apartment	1984
River Ranch	1518 Patricia Avenue	Simi Valley	93065	Tier 1	397	Apartment	1985
The Ranch at Moorpark	51 Majestic Court	Moorpark	93021	Tier 1	370	Apartment	1987
The Timbers + Woodcrest Apartments	301 W. Vineyard	Oxnard	93036	Tier 1	367	Apartment	1973

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Villa Camarillo	645 Lantana Street	Camarillo	93010	Tier 1	352	Apartment	1979
Pepertree Condos	1300 Saratoga Ave	Ventura	93003	Tier 1	343	Condo	1974
Shadow Ridge Apartments	1987 Ridgegate Lane	Simi Valley	93065	Tier 1	332	Apartment	1989
Hidden Valley Apartment Homes	5065 Hidden Park Court	Simi Valley	93063	Tier 1	324	Apartment	2004
Waterstone at Moorpark	4767 Moorpark Avenue	Moorpark	93021	Tier 1	312	Apartment	2002
Mira Vista Senior Apartments	2700 East Ponderosa Drive	Camarillo	93010	Tier 1	305	Apartment	1990
Orchard Lane I-III	640 Holly Ave	Oxnard	93036	Tier 1	290	Condo	1973-76
Colony Park	1024 Britten Lane	Ventura	93003	Tier 1	272	Apartment	1988
Cypress Point	1241 Cypress Point Lane	Ventura	93003	Tier 1	268	Apartment	1990
California Lighthouse Townhomes	1336 Lost Point Ln	Oxnard	93030	Tier 1	265	Condo	1992
Ventura Del Sol	6250 Telegraph Road	Ventura	93003	Tier 1	254	Apartment	1977
Charter Oaks	887 St. Charles Drive	Thousand Oaks	91360	Tier 1	242	Apartment	1974
Paseo del Mar	221 E Shoshone St	Ventura	93001	Tier 1	231	Condo	1986

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Lemon Wood Mh Community	7001 Telephone Rd	Ventura	93003	Tier 1	231	Mobile Home	1973
Sycamore Senior Village	333 N F Street	Oxnard	93030	Tier 1	228	Apartment	2009
Mosaic Apartments	500 Forest Park Blvd	Oxnard	93036	Tier 1	224	Apartment	2014
Pacific Point	1001 W. Gonzales Road	Oxnard	93036	Tier 1	216	Apartment	1969
Lakeside Villas	630 Chapala Dr	Camarillo	93010	Tier 1	200	Condo	1977
Marlborough Seaside Village	2646 Hurricane Cove	Port Hueneme	93041	Tier 1	200	Condo	1986
La Ventana Greens	6785 Sargent Ln	Ventura	93003-4	Tier 1	200	Condo	1984-85
Wilbur Oaks	450 E. Wilbur Road	Thousand Oaks	91360	Tier 1	198	Apartment	1974
Cedar Glen	701 Aster Street	Oxnard	93036	Tier 1	196	Apartment	1976
Heritage Park Apartments	820 South E Street	Oxnard	93030	Tier 1	195	Apartment	1979
Los Arbolitos Apartments	201 W. Vineyard Avenue	Oxnard	93036	Tier 1	192	Apartment	1973
Via Ventura Apartments	930 Pacific Strand Court	Ventura	93003	Tier 1	192	Apartment	2002
IMT Thousand Oaks	491 W. Gainsboro Road	Thousand Oaks	91360	Tier 1	191	Apartment	1973

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Meadowlake Mobile Home Park	2475 Apple Ln	Oxnard	93030	Tier 1	191	Mobile Home	1980
Vintage Crest Senior Apartments	4722 Park Lane	Moorpark	93021	Tier 1	190	Apartment	2004
Imperial Ventura (North)	5067 Thille St	Ventura	93003	Tier 1	190	Mobile Home	1971
Casa de Oaks	74 Maegan Pl	Thousand Oaks	91362	Tier 1	189	Condo	1985-87
Imperial Oxnard Mobile Estates	4010 S Saviers Rd	Oxnard	93033	Tier 1	186	Mobile Home	1972
Oxnard Shores Mhp	5540 W Fifth St	Oxnard	93035	Tier 1	183	Mobile Home	1973
Imperial Ventura Mh Estates (South)	5065 Telephone Rd	Ventura	93003	Tier 1	182	Mobile Home	1971
Ocean Aire Mobile Estates	2250 E Butler Rd	Oxnard	93033	Tier 1	181	Mobile Home	1962
Vintage Paseo Senior Apartments	2970 Tapo Canyon Road	Simi Valley	93063	Tier 1	176	Apartment	2004
Weston Cape Regatta	1001 Gilbert Lane	Ventura	93003	Tier 1	174	Condo	1987
Club Pacifica	5200 South J Street	Oxnard	93033	Tier 1	170	Apartment	1987
Racquet Club Villas	963 Dunbar Ln	Thousand Oaks	91360	Tier 1	170	Condo	1967-78
Del Prado Townhomes	645 Lantana St	Camarillo	93010	Tier 1	169	Condo	1975-77

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Kona Kai Mh Estates	1853 Ives Ave	Oxnard	93033	Tier 1	169	Mobile Home	1964
Wagon Wheel Trailer Lodge\Apts	2851 Wagon Wheel Rd	Oxnard	93030	Tier 1	169	Mobile Home	1948
Park Madera	2410, 2561 Madera Circle	Port Hueneme	93041	Tier 1	168	Apartment	1974
Ventura Beach Rv Resort	800 W Main St	Ventura	93001	Tier 1	168	Mobile Home	
Porta Rossa Apartments	1201 W. Gonzales Road	Oxnard	93036	Tier 1	166	Apartment	1969
Biltmore Apartments	555 Laurie Lane	Thousand Oaks	91360	Tier 1	166	Apartment	1965
Allure at Camarillo	390 Paseo Camarillo	Camarillo	93010	Tier 1	165	Apartment	2003
The 400 Mobile Estates	400 Craig Dr	Santa Paula	93060	Tier 1	165	Mobile Home	1965
TIER 2 RANKINGS: LOCATED OUTSIDE OF LOW-INCOME COMMUNITIES AND MORE THAN 1/2 MILE FROM DISADVANTAGED COMMUNITIES							
Leisure Village	5301 Mission Oaks Blvd	Camarillo	93012	Tier 2	2136	Condo	1984
Marina Village	2694 N Victoria Ave	Port Hueneme	93041	Tier 2	732	Condo	1971-2007
Hillcrest Park Apartments	1800 W. Hillcrest Drive	Newbury Park	91320	Tier 2	608	Apartment	1972
The Knolls Apartments	2751 Avenida de los Arboles	Thousand Oaks	91362	Tier 2	544	Apartment	1990

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Conejo Creek	1707 Calle Diamonte	Newbury Park	91320	Tier 2	524	Condo	1971
The Villas at Wood Ranch	241 Country Club Drive	Simi Valley	93065	Tier 2	504	Apartment	1986
Avalon Simi Valley	1579 E. Jefferson Way	Simi Valley	93065	Tier 2	450	Apartment	2007
The Colony at Mandalay Beach	2202 Vina Del Mar	Oxnard	93035	Tier 2	440	Condo	1984-87
Todd Ranch	1343 Iguana Cir	Ventura	93003	Tier 2	434	Condo	1974-76
Serenade at River Park	700 Forest Park Blvd	Oxnard	93036	Tier 2	400	Apartment	2008
Paz Mar Reserve	3100 Peninsula Road	Oxnard	93035	Tier 2	395	Apartment	1969
The Meadows at Westlake Village	603 Hampshire Road	Newbury Park	91361	Tier 2	395	Apartment	1971
AMLI Spanish Hills	668 Spring Oak Road	Camarillo	93010	Tier 2	384	Apartment	2014
Arbors Parc Rose	1500 Tulipan Circle	Oxnard	93030	Tier 2	373	Apartment	2001
Arroyo Villa	1600 Rancho Conejo Blvd.	Newbury Park	91320	Tier 2	354	Apartment	1995
Villa Ventura	1107 Carlsbad Pl	Ventura	93003	Tier 2	332	Condo	1971
Mission Hills Apartment Homes	45 Rincon Drive	Camarillo	93012	Tier 2	328	Apartment	2002

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Meadowood Apartments	1733 Cochran Street	Simi Valley	93065	Tier 2	320	Apartment	1987
Vanoni Ranch	10676 Veronica Lane	Ventura	93004	Tier 2	316	Apartment	2005
Ventura Marina Mhp	1215 Anchors Way	Ventura	93001	Tier 2	310	Mobile Home	1969
Pacific Gardens	1241 South Petit Avenue	Ventura	93004	Tier 2	309	Apartment	1971
Vallecito Mh Community	1251 Old Conejo Rd	Newbury Park	91320	Tier 2	303	Mobile Home	1984
El Dorado Mh Estates	250 E Telegraph Rd	Fillmore	93015	Tier 2	302	Mobile Home	1971
Buenaventura Gardens	3700 Dean Dr	Ventura	93003	Tier 2	282	Condo	1982
Simi Country	1550 Rory Ln	Simi Valley	93063	Tier 2	274	Mobile Home	1969
Camarillo Springs Country Club Village	803 Paseo Tosamar	Camarillo	93012	Tier 2	261	Mobile Home	1969-2007
Indian Oaks Apartments	5555 Cochran Street	Simi Valley	93063	Tier 2	254	Apartment	1986
Rancho Adolfo Mobilehome Estates	172 Rancho Adolfo Ct	Camarillo	93012	Tier 2	250	Mobile Home	1977-81
Los Robles Apartments	300 Rolling Oaks Drive	Westlake Village	91361	Tier 2	248	Apartment	1972
Harborwalk	3225 S Harbor Blvd	Oxnard	93035	Tier 2	244	Condo	1974-76

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Villa Del Arroyo	15750 E Los Angeles Ave	Moorpark	93021	Tier 2	240	Mobile Home	1978
Rancho Corrales	643 Country Club Drive	Simi Valley	93065	Tier 2	229	Apartment	1987
Lamplighter Camarillo Mobile Home Park	3905 Via Rosal	Camarillo	93012	Tier 2	227	Mobile Home	1972
Buenaventura Mh Estates	11405 Darling Rd	Ventura	93004	Tier 2	224	Mobile Home	1969
Oakbrook Townhomes	1824 Orinda Ct	Thousand Oaks	91362	Tier 2	223	Condo	1972-90
Friendly Village Simi Mh Community	195 Tierra Rejada Rd	Simi Valley	93065	Tier 2	222	Mobile Home	1971
Miramonte Townhomes	6024 Via Montanez	Camarillo	93012	Tier 2	218	Condo	1989-92
Channel Islands Village	3650 Ketch Avenue	Oxnard	93035	Tier 2	216	Apartment	1972
Woodbridge Townhomes	7131 Owl Ct	Ventura	93003	Tier 2	198	Condo	1978
Ojai Villa Mh Estates	70 Baldwin Rd	Ojai	93023	Tier 2	179	Mobile Home	1970
Avalon Camarillo	1571 Flynn Road	Camarillo	93012	Tier 2	176	Apartment	2005
Camelot	2486 Pleasant Way	Thousand Oaks	91362	Tier 2	176	Condo	1985
Ventu Park Villa	26 S Ventu Park Rd	Newbury Park	91320	Tier 2	172	Mobile Home	1965

Property Name	Street Address	City	Zip Code	DAC Tier Tier 1: LIC or within ½ mile of DAC Tier 2: All other multi-family housing	Number of Units	Ownership Type	Building Vintage
Rancho Ventura Senior Homes	1220 Johnson Dr	Ventura	93004	Tier 2	164	Condo	1982

Appendix 3. Top Destinations in Ventura County

Name	Type	Street Address	City	Zip Code	Level 1	Level 2	DC Fast Chargers	Tesla Super
Ventura County Community Foundation	Non-profit organization	4001 Mission Oaks Blvd	Camarillo	93012				
Metrolink Station	Parking lot	30 N. Lewis Rd	Camarillo	93010	2*			
Camarillo Premium Outlets	Shopping Center	740 Ventura Blvd.	Camarillo	93010		7		
Old Town Camarillo	City Center	2221 Ventura Blvd	Camarillo	93010				
Fillmore Post Office	Postal service	333 Central Ave	Fillmore	93015				
City Hall	Government Office	250 Central Ave	Fillmore	93015				
Vons	Grocery store	636 Ventura St	Fillmore	93015				
Super A	Grocery store	725 Ventura St	Fillmore	93015				
Moorpark College	Education	7075 Campus Rd	Moorpark	93021				
Moorpark Station	Metrolink	300 E High St	Moorpark	93021		2		
Moorpark Plaza	Shopping Center	530 Los Angeles Ave	Moorpark	93021				
Borchard Park	Recreation	190 N Reino Rd	Newbury Park	91320				
Oak View Community Center	Public Park	18 Valley Rd	Oak View	93022				
West Ridge Midtown Market	Grocery store	131 W Ojai Ave	Ojai	93023				
Libby Park	Recreation	210 S. Signal Ave.	Ojai	93023				
Ojai Skate Park	Recreation	E Ojai Ave	Ojai	93023				

Downtown Ojai	City Center	Ojai Ave.	Ojai	93023	2			
The Collection	Shopping Center	2751 Park View Ct.	Oxnard	93036		6		18
Walmart	Retail Co	2001 N Rose Ave	Oxnard	93036				
River Ridge Golf Course	Golf Club	2401 W. Vineyard Ave.	Oxnard	93036				
Metrolink Station	Train, parking	201 East 4th St.	Oxnard	93030	1*			
City Hall	Government Office	300 W. 3rd St.	Oxnard	93030	1			
Plaza Park	Tourist Attraction	519 S. C. St.	Oxnard	93030				
Marine Emporium Landing	Tourist Attraction	3600 Harbor Blvd.	Oxnard	93035				
Oxnard College	Community College	4000 S Rose Rd	Oxnard	93033				
Oxnard Beach Park	Tourist Attraction	1601 S. Harbor Blvd.	Oxnard	93035				
Oxnard Park & Ride	Parking	2621 Ventura Blvd	Oxnard	93036				
CenterPoint Mall	Shopping Center	2655 Saviers Rd	Oxnard	93033				
Hueneme Beach Park	Public beach	E Surfside Dr	Port Hueneme	93041				
K-Mart	Store	895 Faulkner Rd	Santa Paula	93060				
Limoneira Ranch	Ranch/event space	1141 Cumming Rd	Santa Paula	93060				
Santa Paula Airport	Airport	28 Wright Taxi Way	Santa Paula	93060				
Downtown Santa Paula	City Center	970 E Ventura St	Santa Paula	93060				
Reagan Presidential Library	Library/museum	40 Presidential Dr	Simi Valley	93065				
Swank's Chevron	Gas Station/parking	2449 Stearns St.	Simi Valley	93063				
Simi Valley P & R	Park & Ride	2501 Stearns St	Simi Valley	93063				
Simi Valley P & R	Parking	2599 Sycamore Dr	Simi Valley	93065				
Metrolink Station	train station/parking	5050 E Los Angeles Ave	Simi Valley	93063				
Cal Lutheran	Education	60 W Olsen Rd	Thousand Oaks	91360				
Los Robles Hospital	Health Care	215 W Janss Rd	Thousand Oaks	91360	3			
Oaks Mall	Shopping Center	350 W Hillcrest Dr	Thousand Oaks	91360		5	4	20

TO Civic Center	Performing Arts Theater	2100 Thousand Oaks Blvd	Thousand Oaks	91362		3		
Park & Ride	Transportation center	265 S. Rancho Rd	Thousand Oaks	91361		3	2	
Janss Marketplace	Shopping Center	275 N Moorpark Rd	Thousand Oaks	91360		2		
Park & Ride	Parking lot	475 Rancho Conejo Blvd	Thousand Oaks	91320				
Sycamore Canyon	Parking lot/trail	Via Goleta	Thousand Oaks	91320				
Montalvo Square	Shopping Center	1746 S Victoria	Ventura	93003			2*	
Emma Wood State Beach	Tourist Attraction	Pacific Coast Hwy	Ventura	93001				
Ventura Botanical Gardens	Botanical Gardens	567 S Poli St	Ventura	93001	2	2		
Bell Arts Factory	Art Center	432 N Ventura Ave	Ventura	93001				
Downtown Ventura Parking Structure	Parking Garage	74 S California St	Ventura	93001		4		
Downtown Ventura	Parking	100-700 E Main Street	Ventura	93001				
Surfer's Point at Seaside Park	Tourist Attraction	Shoreline Drive	Ventura	93001				
Ventura County Fair Grounds	Fairground	10 W Harbor Blvd	Ventura	93001				
Ventura Amtrak	Train Station	Harbor Blvd and Figueroa St	Ventura	93001				
Crown Plaza	Hotel	450 E Harbor Blvd	Ventura	93001	4	4		
San Buenaventura State Beach	Tourist Attraction	901 San Pedro St.	Ventura	93001				
Pacific View Mall	Shopping Center	3001 E. Main St.	Ventura	93003	2			
Ventura College	Community College	4667 Telegraph Rd	Ventura	93003		4		
Lowes Center	Home improvement + shopping center	500 S Mills Rd	Ventura	93003				

Channel Island National Park Visitor Center	Visitor Center	1901 Spinnaker Dr.	Ventura	93001				
Ventura Harbor Village	Dining & recreation	1583 Spinnaker Dr.	Ventura	93001		2		
East Ventura Metrolink	Parking lot/train station	6175 Ventura Blvd	Ventura	93003		2		
Walmart & Trader Joe's	Retail Co	1739 S Victoria	Ventura	93003				
Golf N' Stuff	Amusement Center	5555 Walker St	Ventura	93003				
Silver Star Automotive Group	Auto Sales/services	3601 Auto Mall Dr	Thousand Oaks	91362				

Appendix 4. Largest workplaces with Existing Charging in Ventura County

Employer	Street Address	City	Level 1	Level 2	DC Fast Chargers	Network	Access	Source
Meissner Filtraton Products	1001 Flynn Rd	Camarillo		19		EV Connect	Public	AFDC
St John's Pleasant Valley Hospital	2309 Antonio Rd	Camarillo		6		ChargePint	Public	PlugShare
CSU Channel Islands	1 University Dr	Camarillo		9		Clipper Creek	Public	AFDC, PlugShare, facilities
Frontier Communications	201 Flynn Rd	Camarillo		3			Restricted	Facilities
Camarillo Premium Outlets	740 Ventura Blvd	Camarillo		3	4	EVGo	Public -requires card key	PlugShare
Metrolink Station	30 N. Lewis Rd	Camarillo		2			Public	PlugShare
Moorpark College	7075 Campus Rd	Moorpark		12		Charge Point	Public	AFDC, PlugShare
Moorpark Station	300 E High St	Moorpark		2		Blink	Public	AFDC, PlugShare
Ojai Valley Inn and Spa	905 Country Club Rd.	Ojai		6		Tesla	Public	AFDC, PlugShare, facilities
The Collection	2751 Park View Ct	Oxnard		4	18	Tesla, Volta	Public	AFDC, PlugShare

Oxnard Transit Center	255 East 5th St	Oxnard		1		ParkMobile	Public	PlugShare
St John's Regional Medical Center	1600 N Rose Ave	Oxnard		3		ChargePoint	Public	PlugShare
Ventura County Probation	4333 E Vineyard Ave	Oxnard		2		ChargePoint	Public	AFDC, PlugShare
Ventura County Human Services Agency	1400 Vanguard Ave	Oxnard		2		ChargePoint	Public	AFDC, PlugShare
County of Ventura Behavioral Health	1911 Williams Rd	Oxnard		2		ChargePoint	Public	AFDC, PlugShare
Todd Road Jail	600 S Todd Rd	Santa Paula		2		ChargePoint	Public	AFDC, PlugShare
Simi Valley Police Department	3901 Alamo St	Simi Valley		2		ChargePoint	Public	AFDC, PlugShare
Takeda	1700 Rancho Conejo Blvd	Thousand Oaks		16		EV Connect	Public	PlugShare, facilities
California Lutheran University	60 W Olsen Rd	Thousand Oaks		4			Public - requires key card	Facilities
Oaks Mall	350 W Hillcrest Dr	Thousand Oaks		5	24	EVGo, Tesla (20), Volta	Public	AFDC, PlugShare
Thousand Oaks Civic Arts Plaza (City Hall)	2100 Thousand Oaks Boulevard	Thousand Oaks		4		Blink	Public	AFDC, PlugShare
Thousand Oaks Transportation Center	265 S. Rancho Rd	Thousand Oaks		2	2	Blink	Public	AFDC, PlugShare
Janss Marketplace	275 N. Moorpark Rd.	Thousand Oaks		2		Blink	Public	AFDC, PlugShare
PennyMac	3043 Townsgate Rd	Thousand Oaks		2		ChargePoint	Public	AFDC
Silver Star AG	3905 Auto Mall Drive	Thousand Oaks		1			Restricted	AFDC

Community Memorial Hospital	75, 85 N Brent	Ventura		4		Charge Point	Public	AFDC, PlugShare
Ventura City Hall	501 Poli St	Ventura	2	2		ChargePoint	Public	AFDC, PlugShare
Ventura Promenade Parking	460 E. Harbor Blvd	Ventura	4	4		ChargePoint	Public	AFDC, PlugShare
Crown Plaza Parking	450 E Harbor Blvd	Ventura		2		ChargePoint	Public	AFDC
Pacific View Mall	3295 E Main St	Ventura		4	3	EVGo	Public	AFDC, PlugShare
Ventura College	4667 Telegraph Rd	Ventura		8		ChargePoint	Public	AFDC, PlugShare
Ventura Harbor Village	1691 Spinnaker Dr.	Ventura		2		Blink	Public	AFDC, PlugShare
Patagonia Inc	259 W. Santa Clara St.	Ventura		4		Blink	Public	AFDC, PlugShare
Ventura County Air Pollution Control District	669 County Square Dr	Ventura		3			Public	AFDC, PlugShare
Ventura County Government Center	800 S Victoria Ave	Ventura		8		ChargePoint	Public	AFDC, PlugShare
East Ventura Metrolink	6298 Inez St	Ventura		4		ChargePoint	Public	AFDC, Plugshare
Ventura County Human Services Agency	4651 Telephone Rd	Ventura		2		ChargePoint	Public	AFDC, PlugShare
Montalvo Square	1746 S Victoria	Ventura		2		ChargePoint	Public	AFDC, Plugshare

Appendix 5. Top 100 Workplaces in Ventura County

Employer	Industry	Street Address	City	Zip Code	Source	# of Employees	Existing Charging Ports*	Interest in new charging	Also on Top Public Destinations List	DAC	LIC/DAC Adjacent (Low Income Community or within a 1/2 mile of a DAC)
Naval Base Port Hueneme	Military	Patterson Ave & 23rd Ave	Port Hueneme	93042	APCD	7,205					

Amgen Inc	Manufacturing	1 Amgen Center Dr.	Newbury Park	91320	APCD	5,578					
Naval Base Point Mugu	Military	12th St & Laguna Rd	Point Mugu	93042	APCD	3,756					
County of Ventura Government Center	Government	800 S Victoria Ave	Ventura	93009	APCD	2,387	8	Yes			
Los Robles Hospital & Med Ctr	Healthcare	215 W. Janss Rd.	Thousand Oaks	91360	APCD	1,650					
Community Memorial Hospital	Healthcare	147 N. Brent St.	Ventura	93003	APCD	1,551					
CSU Channel Islands	Education	1 University Dr	Camarillo	93012	APCD	1,528	9	Yes	Yes		
St. John's Regional Medical Ctr	Healthcare	1600 N. Rose Ave.	Oxnard	93030	APCD	1,379	3				
County of Ventura Medical Center	Healthcare	3291 Loma Vista Rd	Ventura	93003	APCD	1,240					
Haas Automation Inc	Manufacturing	2800 Sturgis Rd.	Oxnard	93030	APCD	1,235		Yes		Yes	Yes
California Lutheran University	Education	60 W Olsen Rd	Thousand Oaks	91360	APCD	1,150	4	Yes	Yes		
PennyMac	Banking and Finance	6101 Condor Dr	Moorpark	93021	APCD	911					

Adventist Health Simi Valley	Healthcare	2975 N Sycamore Dr	Simi Valley	93065	APCD	900					
Bank of America Home Loans	Banking and Finance	450 American St	Simi Valley	93065	APCD	844					
Clinicas Del Camino Real	Healthcare	200 S Wells Rd, St 200	Ventura	93003	Pacific Coast	800					Yes
Ojai Valley Inn and Spa	Hospitality	905 Country Club Rd.	Ojai	93023	APCD	768	6				
Anthem Blue Cross	Healthcare	4553 La Tienda Dr	Thousand Oaks	91362	APCD	671					
Ventura College	Education	4667 Telegraph Rd	Ventura	93003	APCD	664	8		Yes		
Skyworks Solutions Inc	Manufacturing	2421 W Hillcrest Dr	Newbury Park	91320	APCD	658					
Moorpark College	Education	7075 Campus Rd	Moorpark	93021	APCD	649	12		Yes		
Bank of America Home Loans	Banking and Finance	225 W Hillcrest	Thousand Oaks	91360	APCD	606					
St. John's Pleasant Valley Hospital	Healthcare	2309 Antonio Rd	Camarillo	93010	APCD	597					
Bank of America Home Loans	Banking and Finance	1800 Tapo Canyon	Simi Valley	93065	APCD	595					
Milgard Windows & Doors	Manufacturing	355 E Easy St	Simi Valley	93065	APCD	549					

Hi-temp Insulation	Manufacturing	4700 Calle Alto	Camarillo	93012	APCD	526					
Patagonia Inc	Retail	259 W Santa Clara St	Ventura	93001	APCD	525	4		Yes	Yes	Yes
Anthem Blue Cross	Healthcare	2000 Corporate Center Dr	Newbury Park	91320	APCD	520					
Waterway Plastics Inc	Manufacturing	2200 Sturgis Rd	Oxnard	93030	APCD	500				Yes	Yes
Meggitt Safety Systems	Manufacturing	1785 Voyager Ave	Simi Valley	93063	APCD	497					
Pentair Aquatic Systems	Retail	10951 W. Los Angeles Ave.	Moorpark	93021	APCD	490		Yes			Yes
Takeda (formerly Shire)	Manufacturing	1700 Rancho Conejo Blvd	Thousand Oaks	91320	APCD	481	16	Yes			
Sage Publishing	Manufacturing	2455 Teller Rd	Thousand Oaks	91320	APCD	481					
County of Ventura Human Services Agency	Government	4651 Telephone Rd	Ventura	93003	APCD	426					
Raypak Inc	Manufacturing	2151 Eastman	Oxnard	93030	APCD	404				Yes	Yes
Ventura Youth Correctional Facility	Law enforcement	3100 Wright Rd	Camarillo	93010	APCD	400					
City of Oxnard City Hall	Government	300 W Third St	Oxnard	93030	APCD	381					Yes

PennyMac	Banking and Finance	112 S Lakeview Canyon Rd	Westlake Village	91362	APCD	373					
Walmart #2032	Retail	2001 N Rose Ave	Oxnard	93036	APCD	371			Yes		Yes
Takeda (formerly Shire)	Manufac turing	1 Baxter Way	Westlake Village	91362	APCD	338					
Silver Star AG Limited	Automoti ve	3905 Auto Mall Dr	Thousand Oaks	91362	APCD	337	1**				
County of Ventura Behavioral Health	Governm ent	1911 Williams Rd	Oxnard	93036	APCD	330	2			Yes	Yes
PennyMac	Banking and Finance	3043 Townsgate Rd	Westlake Village	91361	APCD	322	2				
County of Ventura Human Services Agency	Food and Produce	1400 Vanguard Ave	Oxnard	93033	APCD	321	2			Yes	Yes
Gill's Onions LLC	Governm ent	1051 S Pacific Ave	Oxnard	93030	APCD	321				Yes	Yes
City of Ventura	Governm ent	501 Poli St	Ventura	93010	APCD	318	4				Yes
City of Thousand Oaks City Hall	Governm ent	2100 E Thousand Oaks Bl	Thousand Oaks	91362	APCD	311					

Procter & Gamble Paper Products	Manufacturing	800 N Rice Ave	Oxnard	93030	APCD	310				Yes	Yes
Costco Wholesale #420	Retail	2001 Ventura Blvd	Oxnard	93030	APCD	304					Yes
Southern California Edison	Utilities	10060 Telegraph Rd	Ventura	93004	APCD	303					Yes
Sensata Technologies	Manufacturing	1461 Lawrence Drive	Thousand Oaks	91320	APCD	293					
Spatz Laboratories & ColourPop	Healthcare	1600 Westar Dr	Oxnard	93033	APCD	288				Yes	Yes
Wilwood Engineering	Manufacturing	4700 Calle Bolero	Camarillo	93012	APCD	260					
Benchmark Electronics	Manufacturing	200 Science Dr	Moorpark	93021	APCD	254					
County of Ventura Probation	Government	4333 E Vineyard Ave	Oxnard	93030	APCD	252					Yes
CoorsTek	Manufacturing	4544 McGrath St	Ventura	93003	APCD	246					Yes
PTI Technologies Inc	Manufacturing	501 Del Norte Blvd	Oxnard	93030	APCD	245				Yes	Yes
Ojai Valley Community Hospital	Military	1306 Maricopa Highway	Ojai	93023	APCD	245					

Channel Islands Air National Guard	Healthcare	100 Mulcahey Drive	Port Hueneme	93041	APCD	245					
Walmart #2621	Retail	255 Cochran St	Simi Valley	93065	APCD	245					
Walmart #3650	Retail	1739 South Victoria	Ventura	93003	APCD	238			Yes		Yes
Frontier Communications	Education	201 Flynn Rd	Camarillo	93012	APCD	237					
Ventura County Office of Education	Telecommunications	5189 Verdugo Way #A	Camarillo	93012	APCD	237					
Shoreline Care Center	Healthcare	5225 S J St	Oxnard	93033	APCD	235					Yes
County of Ventura Public Health	Government	2240 Gonzalez Rd	Oxnard	93030	APCD	230				Yes	
Home Depot #1040	Retail	401 W Esplanade Dr	Oxnard	93030	APCD	230					Yes
Pacifica High School	Automotive	600 E Gonzalez Rd	Oxnard	93030	APCD	220					Yes
Rusnak Autograph Westlake	Education	3822 Thousand Oaks Blvd	Thousand Oaks	91362	APCD	220					
Rio Mesa High School	Education	545 Central Ave	Oxnard	93030	APCD	218					Yes
Casa Pacifica Centers for Children & Families	Healthcare	1722 S Lewis Rd	Camarillo	93012	APCD	215					

Poly-Tainer Inc	Manufacturing	450 W Los Angeles Ave	Simi Valley	93065	APCD	212	3**				
Macy's Inc	Retail	220 W Hillcrest Dr	Thousand Oaks	91360	APCD	210					
Oxnard College	Education	4000 S. Rose Ave.	Oxnard	93033	APCD	204					
County of Ventura - Santa Paula Hospital	Government	825 N 10th St	Santa Paula	93060	APCD	204					
Monsanto Seminis Vegetable Seeds	Manufacturing	2700 Camino del Sol	Oxnard	93030	APCD	202				Yes	Yes
Simi Valley High School	Education	5400 Cochran St	Simi Valley	93065	APCD	202					
PinnPack	Manufacturing	1151 Pacific Ave	Oxnard	93033	APCD	200				Yes	Yes
Pleasant Holidays	Travel	2404 Townsgate Rd	Westlake Village	91361	APCD	200					
Walmart #3087	Retail	2701 Saviers Rd	Oxnard	93033	APCD	198					Yes
Ventura Police Department	Law enforcement	1425 Dowell Dr	Ventura	93003	APCD	196					Yes
Buena High School	Education	5670 Telegraph Rd	Ventura	93003	APCD	193					
Ventura High School	Education	2155 E Main St	Ventura	93003	APCD	193					
County of Ventura	Government	5171 Verdugo Way	Camarillo	93012	APCD	191					

JC Penny Company	Retail	377 S Mills Rd	Ventura	93003	APCD	190	4				
Rexnord Industries PSI Bearings	Manufacturing	2175 Union Place	Simi Valley	93065	APCD	183					
County of Ventura - Area Agency on Aging & Probation	Government	646 & 669 County Square Dr	Ventura	93003	APCD	180	3				Yes
Channel Island High School	Government	1400 E Raiders Way	Oxnard	93030	APCD	180					Yes
City of Simi Valley	Government	500 W Los Angeles Ave	Simi Valley	93063	APCD	180					
Todd Road Jail	Law enforcement	600 S Todd Rd	Santa Paula	93060	APCD	177	2				Yes
City of Simi Valley	Law enforcement	3901 Alamo St	Simi Valley	93063	APCD	175	2				
Simi Valley USD	Education	875 E Cochran St	Simi Valley	93065	APCD	173					
Westlake High School	Education	100 N Lakeview Canyon Rd	Westlake Village	91362	APCD	172					
Jafra Cosmetic International	Manufacturing	2451 Townsgate Rd	Westlake Village	91361	APCD	170					
BendPak Inc	Automotive	1645 Lemonwood Dr	Santa Paula	93060	APCD	169					Yes

Semtech Corp	Manufac turing	200 Flynn Rd	Camarillo	93012	APCD	167					
Drum Workshop Inc	Manufac turing	3450 Lunar Ct	Oxnard	93030	APCD	166				Yes	Yes
Harbor Freight Tools USA Inc.	Manufac turing	3491 Mission Oaks Blvd	Camarillo	93012	APCD	165					
North Ranch Country Club	Recreatio n	4761 Valley Spring Dr	Westlake Village	91362	APCD	164					
Ventura Unified School District Office	Governm ent	255 W Stanley Ave	Ventura	93001	APCD	162				Yes	Yes
City of Simi Valley Civic Center	Educatio n	2929 Tapo Canyon Rd	Simi Valley	93063	APCD	162					
County of Ventura - East County Sheriff's Dept	Law enforce ment	2101 East Olsen Rd	Thousand Oaks	91320	APCD	161					

*Provides all charging levels. See Existing Charging Station lists for more detailed information on charging levels.
**Charging ports may be restricted to staff use only.

Appendix 6. Ventura County Sites with Solar Generation

Solar Location Name	Street Address	City	Zip Code	Are there solar carports in the parking lot?	kW Capacity
Adolfo Camarillo High School	4660 Mission Oaks Blvd.	Camarillo	93012		453 kW
Ventura County Fire Station (#27)	133 C ST	Fillmore	93030	Yes	
Neptunes Net Restaurant	42505 Pacific Coast Highway	Malibu	90265		

Moorpark Wastewater Treatment Plant	9550 E. Los Angeles Avenue	Moorpark	93021		1.1 MW
No Location Name	100 Portal St	Oak View	93022		
Ocean View Junior High School	4300 Olds Road	Oxnard	93033		
Ventura County Juvenile Detention	4333 E. Vineyard Avenue	Oxnard	93036		1 MW
Human Services Agency	1400 Vanguard Drive	Oxnard	93033		157 kW
Bernice Curren School	1101 North F Street	Oxnard	93030		
Cesar Chavez School	301 North Marquita Street	Oxnard	93030		
Christa McAuliffe School	3300 W Via Marina Ave	Oxnard	93035		
Dennis McKinna School	1611 S J St	Oxnard	93033		
Driffill School	910 S E St	Oxnard	93030		
Elm Street School	450 E Elm St	Oxnard	93033		
Emile Ritchen School	2200 Cabrillo Way	Oxnard	93030		
Frank Academy of Marine Science & Engineering	701 N Juanita Ave	Oxnard	93030		
Fremont Academy of Environmental Science & Innovative Design	1130 N M St	Oxnard	93030		
Haydock Academy of Arts and Sciences	647 W Hill St	Oxnard	93033		
Juan Lagunas Soria	3101 Dunkirk Dr	Oxnard	93035		
Kamala School	634 W Kamala St	Oxnard	93033		
Lemonwood School	2001 San Mateo Pl	Oxnard	93033		
Marina West School	2501 Carob St	Oxnard	93035		
Norma Harrington School	451 E Olive St	Oxnard	93033		
Norman R. Brekke School	1400 Martin Luther King Jr Dr	Oxnard	93030		
Ramona School	804 Cooper Rd	Oxnard	93030		
Rose Avenue School	220 S Driskill St	Oxnard	93030		
San Miguel School	2400 S J St	Oxnard	93030		

Sierra Linda School	2201 Jasmine Ave	Oxnard	93036		
Thurgood Marshall School	2900 Thurgood Marshall Dr	Oxnard	93036		
Oxnard High School	3400 West Gonzales Road	Oxnard	93036		1,021 kW
Channel Islands High School	1400 Raiders Way	Oxnard	93033	Yes	403 kW
Hueneme High School	500 Bard Road	Oxnard	93041	Yes	553 kW
Pacifica High School	600 East Gonzales Road	Oxnard	93036	Yes	794 kW
Rio Mesa High School	545 Central Avenue	Oxnard	93036	Yes	695 kW
Todd Road Jail	600 Todd Road	Santa Paula	93060		1 MW
Limoneira Ranch	1141 Cummings Rd	Santa Paula	93060		
Ventura County Parks Department	11201 River Bank Drive	Saticoy	93004		154 kW
Ventura County Watershed Protection District	11251 River Bank Drive	Saticoy	93004		180 kW
Arroyo Elementary School	225 Ulysses St.	Simi Valley	93065		
Atherwood Elementary School	2350 E. Greensward	Simi Valley	93065		
Simi Valley Police Station	3901 Alamo St	Simi Valley	93063		
Simi Valley Library	2969 Tapo Canyon Rd	Simi Valley	93063		
Simi Valley Senior Center	3900 Avenida Simi	Simi Valley	93063		
Simi Valley Water Quality Control Plant	600 W Los Angeles Ave	Simi Valley	93065		
Simi Valley City Hall	2929 Tapo Canyon Rd	Simi Valley	93063		
Royal High	1402 Royal Ave.	Simi Valley	93065		
Santa Susana High	3570 E. Cochran St.	Simi Valley	93063		
Simi Valley High	5400 Cochran St.	Simi Valley	93063		
Apollo (Continuation)	3150 School St.	Simi Valley	93065		
Simi Institute (Adult Ed)	1880 Blackstock Ave.	Simi Valley	93065		
Monte Vista School	1220 Fourth St.	Simi Valley	93065		
Justin Early Learners Academy	2245 N. Justin Ave.	Simi Valley	93065		
Hillside Middle School	2222 Fitzgerald Rd.	Simi Valley	93065		
Sinaloa Middle School	601 Royal Ave.	Simi Valley	93065		

Valley View Middle School	3347 Tapo St.	Simi Valley	93063		
Arroyo Elementary School	225 Ulysses St.	Simi Valley	93065		
Atherwood Elementary School	2350 E. Greensward	Simi Valley	93065		
Berylwood Elementary School	2300 Heywood St.	Simi Valley	93065		
Big Springs Elementary School	3401 Big Springs Ave.	Simi Valley	93063		
Crestview Elementary School	900 Crosby Ave.	Simi Valley	93065		
Garden Grove Elementary School	2250 N. Tracy Ave.	Simi Valley	93063		
Hollow Hills Elementary School	828 Gibson Ave.	Simi Valley	93065		
Katherine Elementary School	5455 Katherine St.	Simi Valley	93063		
Knolls Elementary School	6334 Katherine Rd.	Simi Valley	93063		
Madera Elementary School	250 Royal Ave.	Simi Valley	93065		
Mountain View Elementary School	2925 Fletcher Ave.	Simi Valley	93065		
Park View Elementary School	1500 Alexander St.	Simi Valley	93065		
Santa Susana Elementary School	4300 Apricot Rd.	Simi Valley	93063		
Sycamore Elementary School	2100 Ravenna St.	Simi Valley	93065		
Township Elementary School	4101 Township Ave.	Simi Valley	93063		
Vista Elementary School	2175 Wisteria St.	Simi Valley	93065		
White Oak Elementary School	2201 Alscot Ave.	Simi Valley	93063		
No Location Name	501 La Loma	Somis	93066		
Oaks Mall	350 W Hillcrest Dr	Thousand Oaks	91360		
County of Ventura Government Center	800 S Victoria Ave	Ventura	93009	Yes	
No Location Name	6790 Ventura Ave	Ventura	93001		
Patagonia Inc	235 W Santa Clara St	Ventura	93001	Yes	

Ventura County Electric Vehicle Ready Blueprint

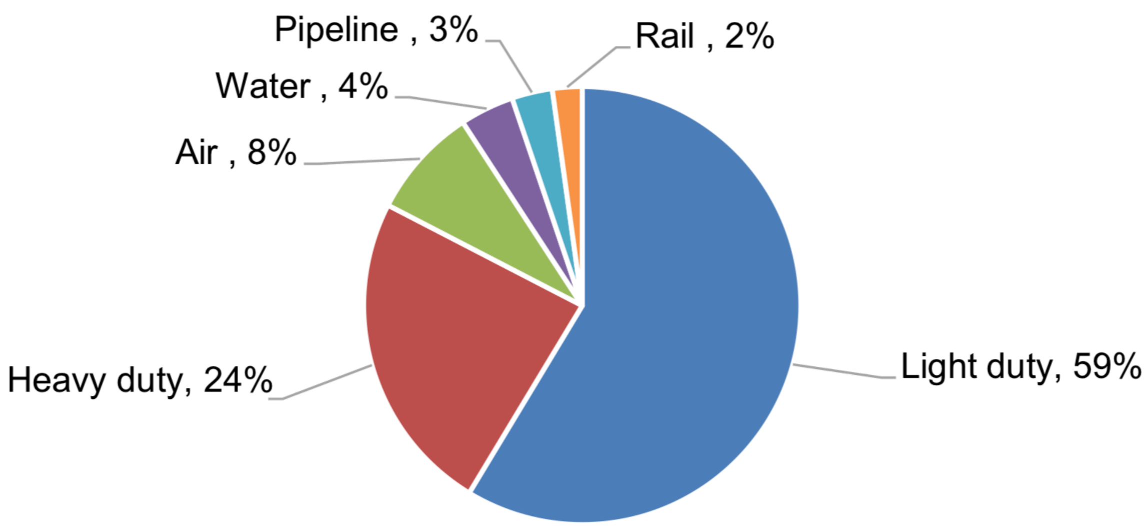
Chapter 4: Technology and Market Context for Medium and Heavy-Duty Electric Vehicles

Introduction and Summary of Benefits of Medium and Heavy-Duty Vehicle Electrification:

E-Bus and E-Truck technology represents a large opportunity for emission reductions and cost savings in the transportation sector. The shift to all-electric medium and heavy-duty fleet vehicles can have a positive impact on both the electric utility and transportation systems of Ventura County while driving local economic and job growth and reduced emissions.

According to 2016 data from the National Transit Database, 24 percent of all California transportation emissions are associated with the heavy-duty segment, and thus the electrification of E-Buses and E-Trucks is a critical part of the state's overall transportation emission reduction strategy. [91]

Figure 1: Transportation Energy Share of GHGs in California

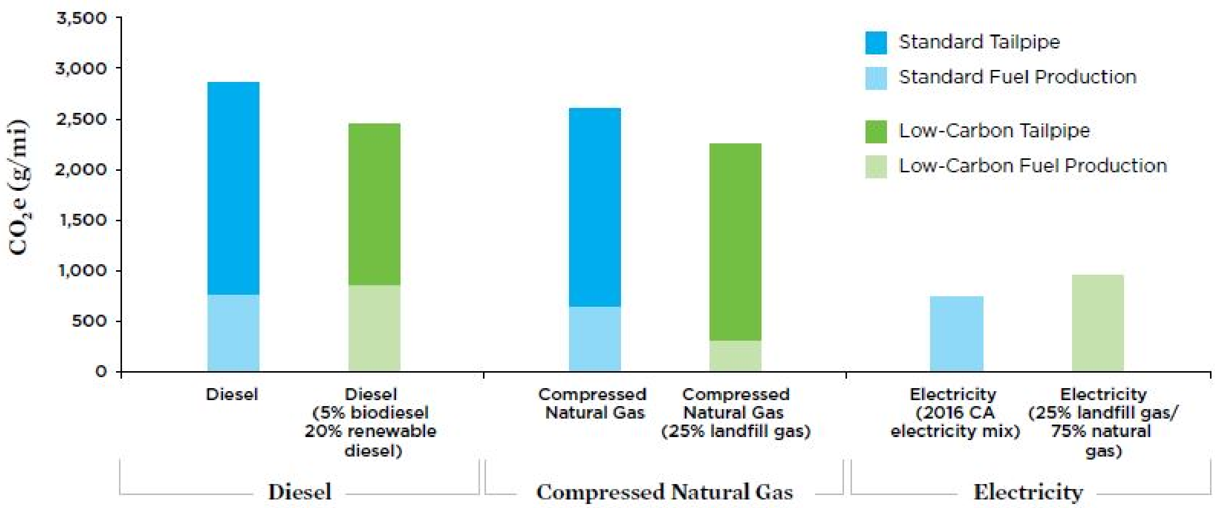


The environmental and air quality benefits from E-Bus adoption in particular are very substantial. A 2017 report from the Union of Concerned Scientist states that "battery electric buses can have more than 80 percent reductions in NOx and PM compared with diesel buses, depending on the electricity mix used." The chart below illustrates the magnitude of the emissions reduction opportunity relative to both diesel and other alternative fuels.

---

[91] National Transit Database (NTD) (2016). 2016 Annual Database Revenue Vehicle Inventory. Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/Revenue%20Vehicle%20Inventory_0.xlsx

Figure 1: Buses Powered by Low-Carbon Fuel Blends Produce Fewer Global Warming Emissions, Union of Concerned Scientist, May 2017 [92]



Global warming emissions from transit buses powered by low-carbon fuel blends are lower than those from vehicles powered by conventional fossil fuel–based diesel and natural gas.

Note: CO_2e stands for carbon dioxide equivalent.

In addition to air quality benefits, public and private fleet managers can realize fuel savings and ongoing operational cost reductions when they transition to the E-Buses or E-Trucks. These cost savings are further enhanced by the availability of state and federal incentives that can reduce upfront costs and enable electric options to financially outperform conventional fueling pathways on a TCO basis.

The economic benefits of E-Bus and E-Truck adoption can also extend to Ventura County's local utilities and grid operators, as the technology represents one of the first opportunities for the integration of electric vehicles with the electric distribution system. In the near term, as EVSE in the medium and heavy-duty segment will provide viable mechanisms for shaping and shifting load within the service area as smart charging, real-time rate designs, and demand response programs are integrated with vehicle charging. In the longer term, two-way energy flow (through V2G operation) of E-Buses and E-Trucks may enable fleet operators to generate additional revenue from the smart management of their charging. For SCE and CPA, these services can provide enhanced grid stability and reduce peak usage. The grid-integrated operation of E-Buses and E-Trucks may also provide additional revenue to fleet operators as vehicles can earn revenue for providing grid services such as Frequency Regulation, when not otherwise being used for fleet operations. (See Chapter 3 for more information on VGI concepts.)

The benefits of E-Bus and E-Truck adoption for both fleet managers and utilities are summarized below.

E-Bus and E-Truck Adoption Benefits to Fleet Managers

- Reduced fueling costs
- Operational and maintenance savings

[92] Union of Concerned Scientist. May 2017. Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California.

- Access to public funding for electric vehicle and EVSE procurement
- Aging asset replacement and modernization
- Emission reductions
- Positive public attention and brand enhancement
- Increased driver satisfaction

E-Bus Adoption Benefits to Load Serving Entities (Utilities) and Ratepayers

- Increased revenue from electricity sales and utility services
- Enablement of "smart" electric vehicle assets that can respond to price signals and offer demand response, load shaping, load shifting, and other grid services
- Progress towards state targets for vehicle electrification, GHG reduction, and social equity (SB 350)

E-Bus Adoption Benefits to the Community

- Emissions reductions for GHGs and criteria pollutants
- Improved air quality and progress towards state climate goals
- Reduced asthma burden and improved health outcomes
- Economic development and increased job creation through EVSE and electric vehicle investments

E-Bus Technology and Market Outlook

Accelerated E-Bus adoption is being led by declining product cost and improved performance, and by state regulation through the CARB Innovative Clean Transit (ICT) mandate. The ICT effectively mandates a transition of public bus fleets to zero emissions by 2040. Additionally, regional transit fleets have proactively adopted E-Bus goals, such as the 100 percent E-Bus goals by 2030 of Santa Barbara Metropolitan Transit District and Los Angeles Metro. Several transit agencies in the Monterey Bay region and San Luis Obispo County have also announced a collaboration to chart the best path forward for achieving ICT mandates. Ventura County's transit providers, including VCTC and GCT, could likely benefit from a similar engagement with peer agencies in the region, to craft their own response to the ICT and to achieve the emissions reductions and service improvements enabled via accelerated E-Bus adoption. (See Chapter 5 of this report for more detailed discussion of E-Bus and other fleet initiatives specific to Ventura County.)

Key elements of the Innovative Clean Transit rulemaking include:

- Transit agencies are required to develop individual Rollout Plans to transition to a Zero Emission Bus (ZEB) fleet by 2040
- Transit agencies must acquire a minimum number of ZEBs at the time of new bus purchases, based on the required percentage of the total new bus purchases
- ZEB purchase requirements for calendar years 2023 and 2024 are waived, if transit agencies collectively are purchasing a minimum number of ZEBs
- Agencies have an option to implement zero-emission mobility programs in lieu of ZEB purchases as well as other flexibility options

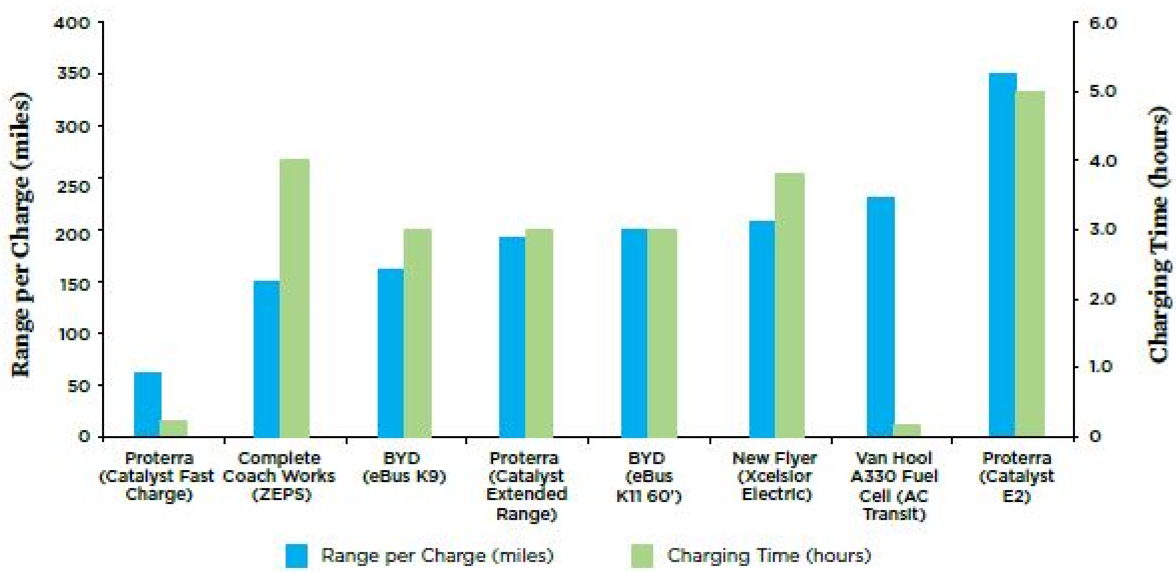
- Transit agencies must purchase low-NOx engines if available for conventional internal combustion engine bus purchases
- Transit agencies must purchase renewable fuels when diesel or natural gas contracts are renewed
- All transit agencies are required to report their fleet information annually starting in 2021. [93]

Leading E-Bus Transit Vehicles

California currently hosts several E-Bus manufacturing facilities, including those of BYD, GILLIG, GreenPower, and Proterra. Of these manufacturers, BYD and Proterra boast the largest E-Bus sales in California. BYD hosts a manufacturing center in Lancaster, California and Proterra has its corporate headquarters in Burlingame and a manufacturing facility located in the San Gabriel Valley.

E-Bus performance is differentiated in part by charging and range characteristics, as shown in the figure below. In recent year, both battery capacity and range have been increasing rapidly, such that all-electric ranges above 300 miles are now feasible, and battery capacity above 600 kWh is being delivered.

Figure 2: E-Bus Ranges Are Increasing While Charging and Refueling Times are Decreasing, Union of Concerned Scientists, 2017



Electric transit buses travel from 60 miles to 350 miles on a single charge, and charging times vary from 10 minutes to five hours. All buses listed are 40 feet long except for BYD Motors' 60-foot K11 bus.

Bus Characteristics by Major Manufacturer

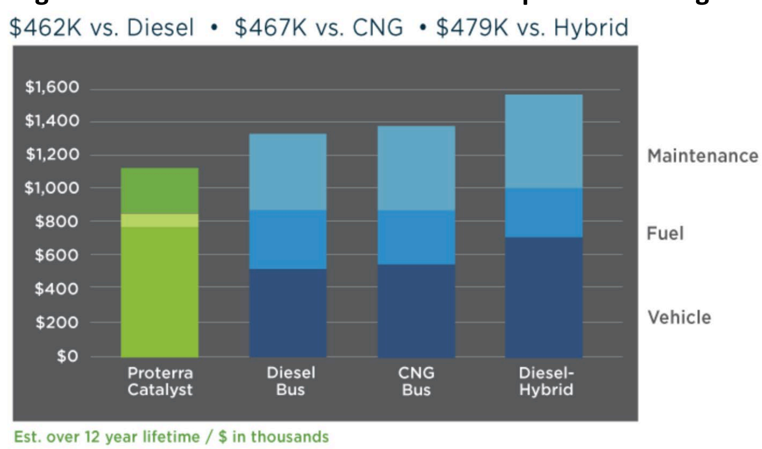
BYD: BYD currently supplies buses to Los Angeles Metro, Antelope Valley Transit Authority, Foothill Transit, and other California Agencies. Available BYD models range from 35-foot commuter coaches to double-deckers and 60-foot articulated models. BYDs range capabilities vary by model but can operate up to 190 miles without range extension.

[93] State of California Air Resource Board. Public hearing to consider the Proposed Innovative Clean Transit Regulation A replacement of the Fleet Rule for Transit Agencies. Staff Report: Initial Statement of Reasons. August 7, 2018.

BYD 60 Foot Articulated E-Bus

Proterra: Proterra has also achieved substantial sales success in California, with buses deployed at the Santa Clara Valley Transportation Agency, San Francisco Municipal Transportation Agency, San Jose Airport, and numerous other agencies. Proterra boasts lower lifetime operational costs for its flagship vehicle, the 40-foot Catalyst, vs. ICE buses, as shown the figure below.

Figure 3: Proterra 40-foot e-bus lifetime operation savings [94]



The Catalyst has an operating range of up to 390 miles with a 660 kWh battery pack and range extension capability through an overhead ultra-fast charging connector. Currently, the Catalyst is the best-selling E-Bus in the United States.

The Proterra Catalyst boasts a range of up to 390 miles and battery capacity of 660kWH

Additional information on electric bus options can be found in the appendix at the end of this chapter.

---

[94] **Proterra. December 2018. Retrieved from:** https://www.proterra.com/products/40-foot-catalyst/

Barriers to E-Bus Adoption

While E-Buses are able to provide many benefits, there are still several barriers preventing wide-spread technology adoption including:

- High upfront vehicle costs relative to internal combustion engine options
- Very high initial charging infrastructure costs
- Ensuring range and vehicle reliability across varying terrains, duty cycles, temperatures, and passenger loading
- Training drivers to meet efficiency requirements
- Training maintenance and operations personnel to effectively maintain, charge, and service E-uses

E-Bus Total Cost of Ownership: Of these barriers, cost factors are the most prohibitive to agency procurement. However, when lifetime fixed and variable costs of E-Bus ownership are considered, E-Buses can become competitive on a TCO basis, assuming that funds are available to address the initial charging infrastructure installations. TCO evaluations are typically favorable when including upfront vehicle purchase costs, maintenance costs, fueling costs, and the availability of state E-Bus purchase incentives.

Capital Cost of E-Buses: In the 2018 CARB staff report for the *Innovative Clean Transit Regulation* it was estimated that the *incremental* additional cost for a 40-foot battery electric bus (with a battery size of 324 kWh) was (in 2018) approximately $335,000 over that of a diesel bus and approximately $285,000 over that of a CNG bus. However, E-bus prices are declining each year, in tandem with battery price reductions of more than 7 percent per year.[95] In light of these declining costs, CARB estimates that by 2026 "the incremental cost for a battery E-Bus with a larger battery (440 kWh) would be less than $205,000 when compared to a diesel bus, and $155,000 when compared to a CNG bus."[96] (CARB, VIII-5 and 6).

Variable Bus Maintenance and Operational Costs: Bus maintenance and fueling costs are variable based on local routing, topography, operator efficiency, ambient temperature, and passenger loading, among other factors. Thus, average cost data must be considered just a starting point for further validation at local sites. A CARB Study of Los Angeles Metro's average maintenance costs for its CNG fleet highlight costs of $0.85 per mile, and diesel buses maintenances costs are reported at a cost of $0.79 per mile.[97] By comparison, battery E-Buses have fewer moving parts than conventional pathways and lower costs. As a result, CARB estimates battery E-Bus maintenance costs to be on average about $0.19 per mile lower than diesel and $0.25 per mile lower than CNG for an average bus. According to CARB, "the savings reflects about $0.08 per mile maintenance savings from avoided regular maintenance like oil changes, valve adjustments, and filter changes, and about $0.11 per mile primarily associated with reduced brake wear." (CARB, VIII-10) These savings aggregate to a total savings of $0.25 per mile for battery E-Buses over CNG maintenance and $0.19 per mile over diesel bus maintenance. The unit economics of maintenance savings

---

[95] California Air Resources Board (CARB) (2017). Bus Price Analysis Discussion Draft. February 10, 2017. Available: https://arb.ca.gov/msprog/ict/meeting/mt170626/170626buspricesanalysis.pdf

[96] California Air Resources Board (CARB) (2017). Battery Cost for Heavy-Duty Electric Vehicles. August 14, 2017. Available: https://www.arb.ca.gov/msprog/bus/battery_cost.pdf

[97] Transit Agency Subcommittee-Lifecycle Cost Modeling Subgroup (2017). Report of Findings, April 2017

are similarly applicable to cutaway buses, and the CARB comparison of maintenance costs for standard buses and cutaway buses is shown in the figure below.

Table 1: Maintenance Cost for Standard Buses and Cutaway Buses (2016 $ per mile), (CARB, VIII-11)

Technology	Standard Bus	Cutaway Bus
CNG	$0.85/mile	$0.26/mile
Gasoline		$0.26/mile
Diesel	$0.79/mile	
Diesel hybrid	$0.68/mile	
Low-NOx CNG	$0.85/mile	
BEB	$0.60/mile	$0.20/mile
FCEB	$1.00/mile	

Midlife overhauls including engine rebuilds, battery replacement, and onboard software modernization should also be incorporated into maintenance cost estimates when evaluating the TCO of an E-Bus. CARB analysis assumes an overhaul in year seven. The following table summarizes the cost of midlife overhaul for different powertrains.

Table 2: Cost of Standard Bus and Cutaway bus Midlife Overhaul by Technology, (CARB, VII-9)

Technology	Standard Bus (at 7-year)	Cutaway Bus (at 5-year)
CNG	$35,000	$21,000
Gasoline		$6,000
Diesel	$35,000	
Diesel hybrid	$35,000	
Low-NOx CNG	$38,000	
BEB[a]	$75,000 (330 kWh)	~$20,000-$35,000 (150 kWh)[b]
FCEB	$200,000	

[a] Midlife battery replacement varies with battery size
[b] Assuming one battery replacement at the middle of cutaway bus's lifetime, and the cost for midlife varies with battery costs.

Charging Maintenance Costs: Maintenance costs for charging infrastructure, including depot charging and on route charging for range extension, should also be included in TCO evaluations. Wide ranges in charging infrastructure maintenance costs are reported depending on charger types and locations. CARB highlights annual maintenance costs for depot charging of $500 per charger per year and up to $13,000 per charger per year and $0.03 per kWh for on-route range extension charging, which may involve costly wireless charging infrastructure or very high-power overhead charging.

Bus Fueling Costs: Fueling costs of E-Buses are also central to the TCO evaluation. CARB staff performed an analysis of the fueling costs of conventional versus electric fueling based on the following assumptions.

- The energy use for a battery E-Bus is based on empirical data from Foothill Transit,[98] with an overall average energy use of 2.15 kWh per mile, or 0.47 mile per kWh. A 10 percent roundtrip efficiency of charging should be assumed during fueling.[99]
- The reported overall fuel efficiency from an Altoona bus testing report for a 32-foot CNG cutaway bus is 1.26 miles per pound, or 50.58 miles per MMBtu, which is about 6.4 miles per diesel gallon equivalent (or 5.8 miles per gasoline gallon equivalent).[100]
- For a Class C gasoline cutaway bus, Access Services in Los Angeles County estimates the fuel efficiency to be around 6 miles per gallon.[101]
- For the cost analysis, staff use a fuel efficiency of 6 miles per gallon for both gasoline and CNG cutaway buses. For a battery electric cutaway bus, based on the data from 16 electric shuttle buses[102] operating between a parking facility and the airport terminals at the Los Angeles International Airport, the average overall vehicle energy consumption is 1.23 kWh per mile, which includes all energy consumed during driving, idling and operation of utilities (e.g., HVAC unit for vehicle heating and cooling).[103] The energy consumption from the electrical grid is about 1.45 kWh per mile with the charging efficiency incorporated. Table 3 summarizes the average fuel efficiency used for this analysis. (CARB, VIII-12).

Table 3: Average Fuel Efficiency of Bus by Technology

Technology	Standard Bus	Cutaway Bus	Unit
CNG	2.91	6.0	mile/dge
Gasoline	NA	6.0	mile/dge
Diesel	3.87	NA	mile/dge
Hybrid Diesel	4.84	NA	mile/dge
BEB*	2.3	1.45	kWh/mile
FCEB	6.30	NA	mile/kg

* Energy use from grid, with the consideration of energy loss from charging.

When these results are combined with CARB's assumption of an average costs of electricity in SCE of $0.10 per kWh for managed Depot charging, and $0.20 per kWh for on-route range extension charging, a cost of $0.23 per mile and $0.46 per mile respectively is calculated. When compared to diesel prices, which

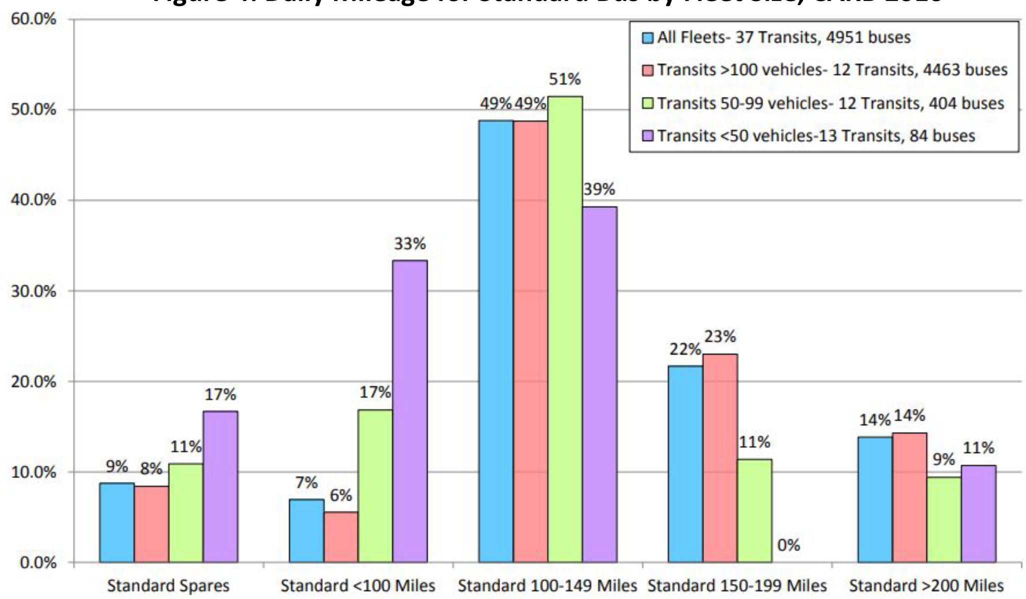
---

[98] National Renewable Energy Laboratory (NREL) (2016). Foothill Transit Agency Electric Bus Demonstration Results. January 2016. Available: https://www.nrel.gov/docs/fy16osti/65274.pdf.
[99] National Renewable Energy Laboratory (NREL) (2017). Foothill Transit Battery Electric Bus Demonstration Results: Second Report. June 2017. Available: https://www.nrel.gov/docs/fy17osti/67698.pdf.
[100] Bus Testing and Research Center (2011). STURAA Test, 7 Year, 200,000 Mile Bus from Supreme Corp/Startrans Bus - Model Senator HD Cutaway. April 2011. Available: http://altoonabustest.psu.edu/buses/reports/379.pdf?1329832711.
[101] Access Services. Access Services Projected Fleet Costs for the Service Fleet in Los Angeles Paratransit Services. Available: https://www.sacog.org/sites/main/files/file-attachments/access_la_life_cycle.pdf
[102] The electric shuttle buses are Class 3 cutaway buses. The energy consumption for a class 3 and class 4 is similar based on staff's communication with Phoenix Motorcars in 2017.
[103] Phoenix Motorcars (2017). Case Study: Wally Park Premier – Zero-Emission Utility Shuttles Fleet. July 28, 2017.

reached more than $4 per gallon in 2018,[104] this results in battery E-Bus fuel savings of $.53 per mile to $.77 per mile over diesel fueling.

Another key consideration for E-bus adoption is matching bus battery sizes to actual route requirements. Considerable savings are available by "right-sizing" the batteries to exact route requirements. CARB's 2016 Transit Agency Survey reports that 85 percent of the 37 California transit agencies operate buses at more than 100 miles per day, as shown in the figure below.[105]

Figure 4: Daily Mileage for Standard Bus by Fleet Size, CARB 2016



At a diesel price of $4 per gallon, fuel savings of more than $350 per bus per day can occur by switching from diesel to battery E-Buses equipped for high-powered on-route charging, and more than $370 per bus per day for switching to battery E-Buses equipped for regular depot charging. These savings do not account for variables based on effective charging management – which include: 1) charging at lowest cost time periods; 2) potential utilization of onsite solar and stationary energy storage assets; and 3) claiming of LCFS credits based on agency-specific fuel pathways (larger credits are available for onsite solar utilization, for example). In addition, as fossil fuel prices fluctuate, the cost advantage of E-buses will be impacted. In just the 2017-2019 period, diesel prices have varied from $2.50 to $4.00/gallon, while commercial natural gas prices ranged between $7.78 per thousand cubic feet and $10.39 per thousand cubic feet.[106] A myriad of unpredictable factors can send fossil prices into a rapid rise or decline. (By contrast, electricity price increases have been relatively steady and predictable. Further, on-site solar with battery storage provides a hedge against price spikes.) Given the many capital cost and operating cost

---

[104] EIA. Petroleum & Other Liquids: Weekly California NO 2 Diesel Retail Prices. Retrieved: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_SCA_DPG&f=W

[105] California Air Resources Board (2016) Transit Agency Survey Preliminary Results, ACT Workgroup Meeting, August 29, 2016. Available: https://www.arb.ca.gov/msprog/bus/transit_survey_summary.pdf

[106] EIA. California Price of Natural gas Sold to Commercial Consumers. Retrieved from: https://www.eia.gov/dnav/ng/hist/n3020ca3m.htm

variables associated with E-Buses, it is critical that each agency perform its own cost/benefit study to determine financial viability of E-Bus adoption.

Incentives and Public Funds Supporting Medium and Heavy-Duty Vehicle Electrification

The current TCO for E-Buses is only competitive with CNG, Diesel, Hybrid, and Low-NOx fueling pathways when state incentives are leveraged for E-Bus purchases and operations. Fortunately, there are several funding programs available able to help transit agencies and other fleet managers overcome the upfront cost barriers of E-Bus procurement. These programs are summarized below.

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project

CARB oversees a key funding program, the HVIP, referenced earlier in this report, to help the state transition to advanced clean technologies. This program encourages and accelerates the deployment of zero-emission trucks and buses, hybrid trucks and buses, and ICE vehicles with low-NOx engines. The table below highlights the 2018-2019 zero-emission bus, truck, and shuttle voucher amounts.

Table 4: HVIP - Zero Emission Truck Voucher Amounts (2018-2019) [107]

	Base Vehicle Incentive	
GVWR (lbs)	Outside Disadvantaged Community	In Disadvantaged Community
5,001 – 8,500	$20,000	$25,000
8,501 – 10,000	$25,000	$30,000
10,001 – 14,000	$50,000	$55,000
14,001 – 19,500	$80,000	$90,000
19,501 – 26,000	$90,000	$100,000
26,001 – 33,000	$95,000	$110,000
>33,000	$150,000	$165,000
>33,000 Hydrogen Fuel Cell Truck	$300,000	$315,000

Table 5: HVIP - Zero Emission Truck Voucher Amounts (2018-2019)

	Base Vehicle Incentive	
Bus Length and Bus Type	Outside Disadvantaged Community	In Disadvantaged Community
20 ft – 24 ft	$80,000	$90,000
25 ft – 29 ft	$90,000	$100,000
30 ft – 39 ft	$120,000	$135,000
40 ft – 59 ft	$150,000	$165,000
≥ 40 ft. Double Decker Bus	$175,000	$190,000
≥ 60 ft. Zero-Emission Battery- Electric Articulating Transit Bus	$175,000	$190,000
≥ 40 ft. Hydrogen Fuel Cell Electric Bus	$300,000	$315,000

[107] California HVIP. HVIP FY18-19 Funding tables. Retrieved from: https://www.californiahvip.org/wp-content/uploads/2018/11/HVIP-FY18-19-Funding-Tables-11-19-2018.pdf

Table 6: HVIP - Zero Emission Truck Voucher Amounts (2018-2019)

GVWR (lbs)	Base Vehicle Incentive	
	Outside Disadvantaged Community	In Disadvantaged Community
8,501 – 10,000	$25,000	$30,000
10,001 – 14,000	$50,000	$55,000
14,001 – 19,500	$80,000	$90,000
19,501 – 26,000	$90,000	$100,000
26,001-33,000	$120,000	$135,000
>33,000	$150,000	$165,000

Currently, the administration of HVIP funding is managed by CalSTART and the CARB AQIP. Funding is allocated on a first come, first served basis until vouchers are exhausted for the current funding cycle. While HVIP funding has increased over recent years it is not a guaranteed program and competes with other state Greenhouse Gas Reduction Fund programs, which in turn are dependent upon Cap and Trade proceeds. Additional HVIP incentive support is available to projects within Low-income and Disadvantaged Communities of up to $5,000-$15,000. Applications are processed through the HVIP web portal at http://www.californiahvip.org/.

Low Carbon Fuel Standard (LCFS) Credits

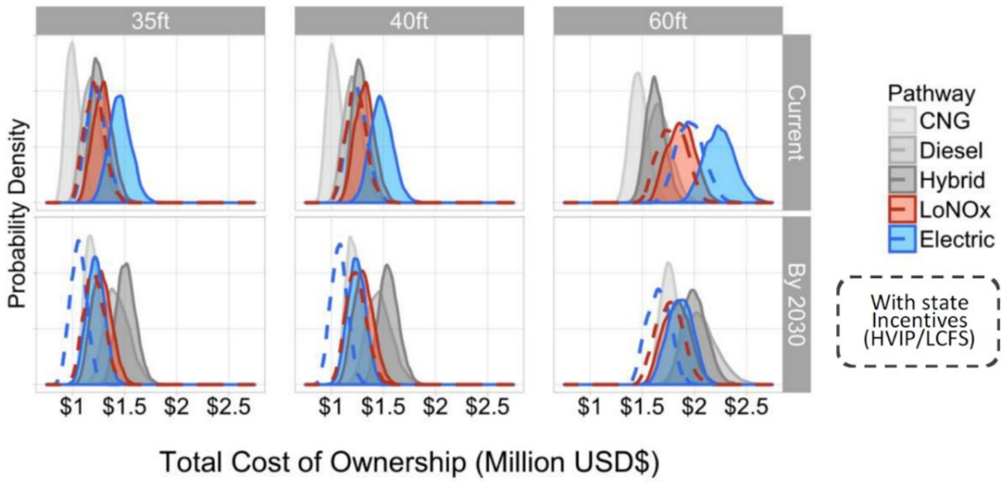
Supported by Cap and Trade Funds, LCFS incentives as described above provide fueling subsidies for zero emission and alternative fuels. As of June 2018, LCFS credit prices ranged from $100 to $185 per $MTC0_2$. [108] Currently, the Total Cost of Ownership assessments of E-Bus ownership are significantly advantaged by the LCFS program. In a conservative case, a $100 LCFS credit price would amount to a credit equivalent of $0.11-$0.12 per kWh consumed for electric vehicle charging. Without the LCFS credit, E-Buses and E-Trucks could deliver a fivefold reduction in per-mile fuel costs; with the LCFS credit, transit operators could conceivably fuel buses for free, and if the credit stays at the current $200 price, the fleet could earn $.10 per kWh per bus.

Both the HVIP and LCFS program incentives are critical to achieving a TCO that is competitive for medium and heavy-duty electric vehicles given current initial purchase prices. The figure below highlights the result of a 2017 University of California, Davis study that identifies TCO levels for E-Buses based on the inclusion of HVIP and LCFS incentives, while projecting declining technology costs. [109] Results for E-Trucks, which have similar price differentials relative to ICE equivalents, are expected to be comparable to E-Buses.

[108] California Air Resources Board (CARB) (2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons. March 6, 2018. Available: https://www.arb.ca.gov/regact/2018/lcfs18/isor.pdf.

[109] Ambrose, H. Pappas, N. Kendall, A. UC Davis. October 2017. Study Exploring the Costs of Electrification for California's Transit Agencies.

Figure 5: Total Cost of Bus Ownership in California (University of California, Davis)



Qualifying and Applying for LCFS Credits: As noted above, CARB administers credits based on fueling pathways rather than based on individual vehicles. As a result, electric fueling of diverse vehicles are eligible for credit-claiming. These include electric and hydrogen powered forklifts, and workplace charging of all types of electric vehicles, including via Level 1, Level 2, and DC Fast Charging Stations.[110] CARB currently facilitates applications for LCFS credits through the web-based LCFS Data Management system, as described in Chapter 3.

Low Carbon Transit Operations Program (LCTOP)

Administrated by Caltrans, the LCTOP was created to provide funding assistance to reduce GHG emissions and improve mobility, with a priority on serving Disadvantaged Communities. For FY 2017-2018, nearly $97 million was awarded to 152 public transportation projects, which include 32 projects for purchasing a total of 74 zero-emission buses or related infrastructure.[111]

The Carl Moyer Memorial Air Quality Standards Attainment Program

The Carl Moyer Program is a state supported grant program administrated by regional air quality management agencies. The Ventura County APCD administers the Carl Moyer program for Ventura County, which provides funding to reduce the incremental costs of engine upgrades. Since 1998, the program has provided funding to support the replacement of "older heavy-duty diesels with electric, alternative-fuel, or cleaner diesel technologies."[112] Since 1999, $39 million has been awarded within Ventura County. In 2018, approximately $4.4 million was available to fund projects in Ventura. Eligible projects included:

---

[110] CARB. LCFS Basics. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/background/basics.htm

[111] California Department of Transportation (Caltrans) (2018). Low Carbon Transit Operations Program FY 2017-2018 Final Draft Guidelines. January 2018. Available: http://www.dot.ca.gov/drmt/docs/lctop/1718final_draft_guidelines3.pdf

[112] AQMD. Incentives & Programs: Carl Moyer Memorial Air Quality Standards Attainment Program. Retrieved from: http://www.aqmd.gov/home/programs/business/carl-moyer-memorial-air-quality-standards-attainment-(carl-moyer)-program

- Repowering of farm tractors, construction equipment, and locomotives with new, lower-emission engines.
- Replacement of farm tractors and construction equipment with new, lower-emission equipment.
- Replacement of emergency vehicles (fire trucks) with new, lower-emission equipment.
- Repowering of model year 2006 and newer agricultural irrigation and water well pumps with electric motors or Final Tier 4 diesel engines.
- Repowering of commercial fishing boats with new, lower-emission engines[34]

The latest updates on program status and eligibility can be found at the VCAPCD website, http://www.vcapcd.org/grant_programs.htm.

CPUC and SB 350 Investor Owned Utility Incentive Programs

Since 2015, SB 350 has established requirements for state programs addressing energy efficiency, renewable energy, integrated resource planning, electric fueling for vehicles, vessels, trains, boats and other equipment and mobile sources of air pollution and GHGs.[113] In addition, SB 350 orders the CPUC to direct the six investor-owned electric utilities in the state to file applications for programs that "accelerate widespread transportation electrification."[114] SCE's transportation electrification programs are most relevant for the Ventura County region. The SCE Medium and Heavy-Duty Make Ready Programs provide the following levels of support across the SCE territory.

- $343 million to support make-ready installations at a minimum of 870 sites to support the electrification of at least 8,490 medium or heavy-duty fleet vehicles.
- A minimum of 15 percent of the infrastructure budget must serve transit agencies.
- A maximum of 10 percent of the infrastructure budget is to serve forklifts.
- A minimum of 25 percent of the budget to serve vehicles operating at ports and warehouses.
- A minimum of 40 percent of the program budget must be invested in Disadvantaged Communities
- Rebates must be provided of up to 50 percent of the cost of the EVSE for sites in Disadvantaged Communities and at sites that support electric transit and school buses.[115]

Further, SCE states intentions in the May 31, 2018 application to deploy its $544 million budget to "install, own, and operate the electric infrastructure, up to and including the make-ready stub, to serve charging equipment for medium and heavy-duty vehicles.[116] To participate in SCE's program, non-residential customers must own or lease the site, or be the customer on record for the participating site; agree to provide SCE continuous access to the site; participate in data collection and surveys; take service on an eligible TOU rate; and agree to maintain the charging equipment for at least five years. Notably, customers

---

[113] Mesrobian, A. Lead Analyst Transportation Electrification. CPUC. (February 8, 2018). SB 350 Transportation Electrification Applications Overview: Background and Proceeding Process.

[114] CPUC. SB350 Transportation Electrification. Retrieved from: http://www.cpuc.ca.gov/sb350te/

[115] CPUC. (May 31, 2018). Summary of Decision on Transportation Electrification Program Proposals from the Investor-Owned Utilities.

[116] Decision 17-05-040. (May 31, 2018). Decision on the Transportation Electrification Standard Review Projects. Retrieved from: http://www3.sce.com/law/cpucproceedings.nsf/vwMainPage?Openview&RestrictToCategory=2017%20TE%20Application&Start=1&Count=25

who purchase EVSE will be responsible for acquiring, installing and maintaining the equipment, but can claim a rebate to cover up to 100 percent of the base cost of the equipment and installation from SCE. The rebate amounts depend on the site's location, with the largest rebates available for sites located in Disadvantaged Communities (as designated under SB 535). It is recommended that Ventura County electric vehicle stakeholders continue to engage SCE to support local electrification efforts.

Electrify America/Volkswagen Settlement

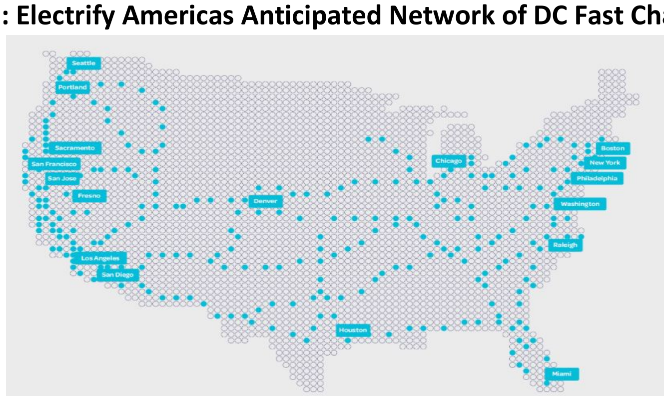
Following the Volkswagen NOx scandal, state and federal courts ordered the company to pay substantial fines, and to invest $2 billion in ZEV infrastructure, access, and brand-neutral education and outreach programs throughout the United States. Volkswagen formed Electrify America, a new wholly owned subsidiary, to install, own, and operate charging stations and provide education and outreach programs as ordered by the Court. A California-specific settlement investment of $800 million is also planned over the ten-year period from 2017–2026, in alignment with a program design developed by Electrify America and subject to review and approval by the CARB. [117] The investment cycle timeline is outlined below.

Figure 6: Electrify America Investment Cycles

	Cycle 1 (Q1 2017 – Q2 2019)	Cycle 2 (Q3 2019 – Q4 2021)	Cycle 3 (Q1 2022 – Q2 2024)	Cycle 4 (Q3 2024 – Q4 2026)	Full 10 years
California Plan	$200M	$200M	$200M	$200M	**$800M**

In addition to the California specific funding cycles, Electrify America has committed resources to the development of a network of approximately 900 DC Fast Charging Stations, with more than 5,000 charging ports across the country's major highway corridors and urban centers. The charging network is expected to be operational by mid-2019 and will enable a "Tesla-like" network of ultra-fast (150 kW – 350 kW) charging stations across the country. This first mass deployment of ultra-fast charging is expected to catalyze further deployment of the high-capacity charging necessary to electrify both intra-and inter-city heavy goods movement, in conjunction with the planned deployment of Class 8 electric tractor-trailer units from OEM such as Tesla, Cummins, Navistar, Daimler, and others, beginning in 2020 - 2022.

Figure 7: Electrify Americas Anticipated Network of DC Fast Chargers [118]



[117] Electrify America. Investment Cycle Planning Overview. Retrieved From: https://www.electrifyamerica.com/our-plan

[118] Electrify America. Our Plan. Retrieved from: https://www.electrifyamerica.com/our-plan

Electrify America also is developing a Green Cities Initiative with the goal of increasing access to ZEVs and increasing affordable mobility options. [119] In July 2017, Sacramento was selected as the first partner region for the program and will receive $44 million from Electrify America to launch ZEV mobility programs. Funding from the program has been allocated to Gig Car Share to support the roll-out of shared electric vehicles and public charging infrastructure in the Sacramento region. [120] Planning for Cycle 2 of the settlement program's funding is currently underway, and funding will be released between July 2018 and December 2021. According to the Cycle 2 Investment planning document, "Electrify America's Cycle 2 investments center on two core areas: ZEV Fueling Infrastructure and ZEV Education, Awareness, and Marketing. In addition, Electrify America will continue access efforts in Sacramento under the Green City Initiative." [121] Electrify America will also make 35 percent of the total investment available for Low-income and Disadvantaged Communities.

There are no Green Cities Initiative investments designated for the Cycle 2 period (2019-2021). However, Electrify America is currently considering priorities for re-starting the program in Cycle 3 (2022-2024). It is recommended that Ventura County coordinate with its member cities to develop and apply for future Green City Initiatives.

Within Cycle 2, $153 Million will be allocated to Fueling Infrastructure divided across programs for metro community charging, highway and regional routes, and emerging infrastructure opportunities. $47 Million will also be allocated to Education and Awareness efforts, as noted below.

Figure 8: Electrify America Cycle 2 Budget Breakdown[36]

Category	Estimated Budget ($M)[1]
Infrastructure	**~$153**
Metro Community Charging	$95 - $115
Highways and Regional Routes	$25 - $30
Residential	$8 - $12
Bus and Shuttle Charging	$4 - $6
Rural Level 2	~$2
Autonomous Vehicle Charging	$2 - $4
Brand-Neutral Efforts to Boost ZEV Adoption	**~$17**
Electrify America Efforts to Drive Station Utilization	**~$10**
Electrify America Business Operation & Organization[2]	**$20**
TOTAL	**$200**

[1] Costs include creditable operating expenses and on site storage where appropriate.
[2] According section 5.1 of Appendix C-1 of the Partial Consent Decree, Electrify America is permitted to spend 10% of the total budget on these costs.

[119] Electrify America. California ZEV Investment Plan: Cycle 2. Retrieved from: https://www.electrifyamerica.com/sites/default/files/inline-files/Cycle%202%20California%20ZEV%20Investment%20Plan.pdf

[120] Gig Car Share. Sacramento Gigs it: All-Electric Car Sharing. Retrieved from: https://gigcarshare.com/sacramento/?gclid=CjwKCAiA4t_iBRApEiwAn-vt-6jflJZWfQJKDlZZ9IDHnNO9R6k97oNth1QgtF9at3kALonFHDTp3xoCamcQAvD_BwE

The application process for Electrify America funding is conducted through the organization's web portal. However, Electrify America is not required to respond to all inquiries or submissions and bases their funding decisions on a combination of community and stakeholder input, as well as internal priorities. It is therefore recommended that the Ventura County stakeholders continue to monitor Electrify America funding cycles and develop compelling strategic partnerships and proposals for funding.

Recommendations for Bus and Truck Electrification

- **Recommendation #1 - Partner with leading local fleets to win public funding for new electric vehicle charging infrastructure and E-Bus and E-Truck procurement**. California's many grant and incentive programs provide generous support for transportation electrification efforts. By leveraging funding opportunities from CARB, the Energy Commission, local utility partnerships, Electrify America, and other sources, the Ventura County region can accelerate the electrification of medium and heavy-duty vehicle segment. Potentially impactful efforts include electric school and transit bus projects, and electrification initiatives for low-income and disadvantaged community members. (Note that most state grant programs score applications based on their ability to deliver direct benefits to Disadvantaged and Low-income Communities.) Finally, electric vehicle stakeholders should engage Electrify America to identify opportunities for Cycle 2 and Cycle 3 investment. The County and its member municipalities may make strong candidates for Green Cities Initiatives in future funding cycles.
- **Recommendation #2 - Facilitate access and applications to SCE's utility incentive programs for electric vehicle infrastructure development that will advance transit and fleet electrification**.
- **Recommendation #3 - Develop Electric Fleet Transition Plans with leading transit fleets: including GCT and the VCTC and other transit service providers**. These transit plans should address fleet-specific barriers and opportunities for electrification, addressing capital and operating costs, infrastructure needs, financing strategies, and environmental, customer, and community benefits.
- **Recommendation #4- Support fleet transition planning for the region's public agencies – including school districts, and the Port of Hueneme** -- to support fleet electrification. Close coordination between Ventura stakeholders and SCE staff on Charge Ready Program participation can accelerate the deployment of necessary charging infrastructure. Opportunities for co-siting EVSE with solar generation and energy storage capacity should also be considered for EVSE installations – especially for larger charging depots.
- **Recommendation #5 - Establish fleet electrification pilot projects for at least three freight companies contracting with the Port by 2020.**
- **Recommendation #6 - Commission a comprehensive E-Truck and E-Bus electrical load study to determine electrical infrastructure requirements to support comprehensive goods movement electrification (in partnership with SCE).**

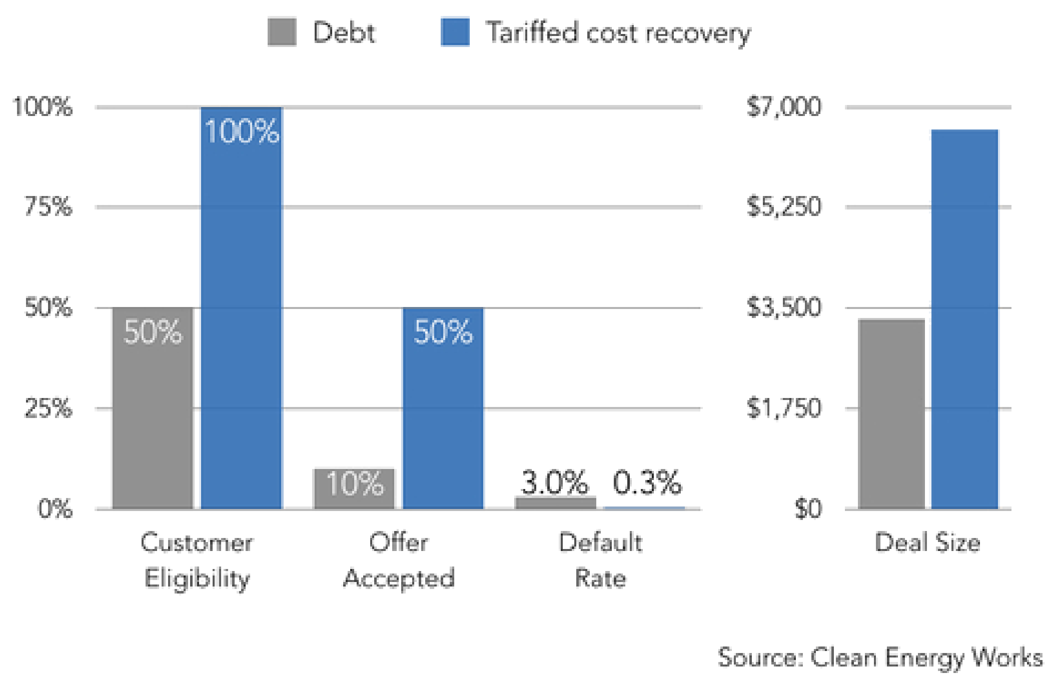
Overcoming Capital Costs with Innovative Financing

Pay as You Save

Private sector and third-party financing options that enable fleet managers to finance expensive E-Bus batteries over time are being advanced within California's regulatory proceedings. One such program is a proposed on-bill utility finance program known as "tariffed on-bill financing"- sometimes called "Pay as

You Save" (PAYS). If approved, this financing approach would operate similarly to a consumer on-bill repayment program and integrate the equipment financing directly into the underlying pricing of an E-Bus charging tariff. As a result, commercial PAYS customers (fleet operators) would be able to purchase an E-Bus body, without batteries, at cost parity with fossil fueled buses while paying for the E-Bus battery on their electric bill over time. The model is differentiated from debt financing or a loan program as it requires no outside debt nor is there any lien placed on the battery assets as the utility partner acts as the credit worthy counterparty for the battery purchase. According to Clean Energy Works, the creators of the PAYS tariff concept, customer eligibility would be broader and repayment rates on tariffed financing would be higher than traditional debt financing. This would in turn result in larger deal sizes as shown in the figure below:

Figure 9: Benefits of Inclusive Financing



Through PAYS, the utility would recover their costs via the customers' utility bills for batteries and potentially other electric vehicle-related infrastructure at the customer location. However, the monthly repayment amount would be less than the estimated savings achieved thanks to the lower TCO of electric buses. Charges for the battery assets and related improvements would appear as a line item on the customer bill. Most savings would be distributed to the utility until capital costs are recovered, at which point the full savings are retained by the customer. This enables customer ownership of the assets while also enabling increased electricity sales and full cost recovery for the utility.[122] Ultimately PAYS could provide the following array of benefits.

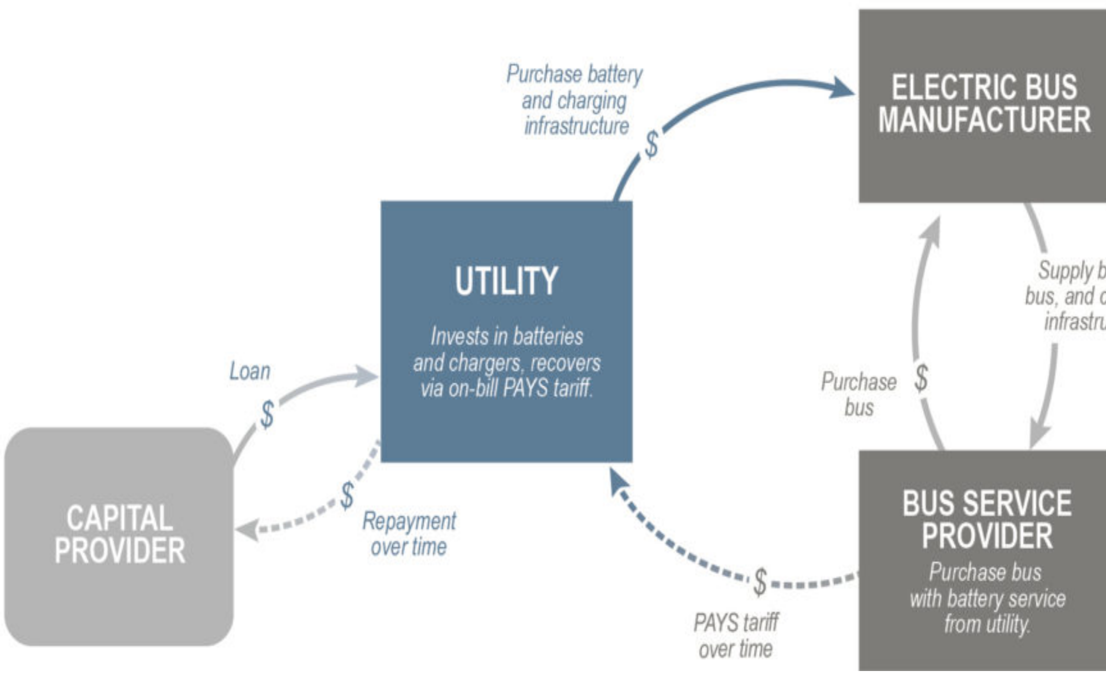
- The utility gains new load and revenue resulting from fuel switching to electricity. When linked to off-peak charging, the utility also enhances asset utilization efficiency

[122] http://www.cleanenergyworks.org/home/clean-transit/

- The capital provider can finance a clean energy asset through the balance sheet of the utility while being insulated from counter party risk
- The fleet manager can acquire an E-Bus at cost parity with conventional vehicles and finance the purchase over the life of the asset without taking on debt or a lien on the asset
- The electric vehicle OEM is able to transact with a wider range of customers with varying financial standing.

The following schematic demonstrates the transaction flow for PAYS, based on the E-Bus model, which could be applied to other medium and heavy-duty commercial vehicles by agreement with the sponsoring utility.

Figure 10: PAYS on Tariff E-Bus Battery Financing



Source: Climate Finance Lab, 2018.

PAYS is a promising financing mechanism that could solve some of the upfront cost barriers of E-Bus adoption. However, the program does require careful analysis to ensure that the financing makes sense for the fleet operator. The table below highlights the strengths and challenges of this program strategy.

Strengths	Challenges
Simplifies financing so that individual financing deals are not required with every new electrification project Low default risk as the arrangement provides ongoing positive cash flow for the end user based on efficiency gains TOU tariffs to promote managed charging can be paired with on-tariff repayment to create mutually beneficial outcomes for the utility and the fleet	Requires utility engagement and a positive CPUC decision, which may delay implementation Requires a careful analysis of cash flow and avoided costs of fueling to create financing confidence and ability to attract third-party financing support

New models of pays could incorporate the cost of electric vehicle purchase in addition to the battery cost	

Adoption of the PAYS approach will require that SCE or other utility sponsors petition the CPUC to modify a current statute that prohibits linking financing to the electricity meter. Clean Energy Works is currently building a coalition of transit agencies and other interested organizations in California to enable this change. The participation of Ventura County stakeholders in this coalition would likely further strengthen advocacy efforts.

Recommendations for Bus and Truck Electrification

Recommendation #7 - Partner with local utilities to explore development of innovative utility-linked financing strategies for commercial EV batteries, utilizing the PAYs tariff model: High capital costs remain one of the largest barriers to adoption of medium and heavy-duty electric vehicles. The PAYS on-bill tariffed financing model is a potential strategy for enabling utility credit to cover electric vehicle battery costs. The County of Ventura could support ongoing advocacy efforts and promote this financing model is support of fleet electrification goals and initiatives.

"Charging-as-a-Service" and "Mobility-as- a-Service" Payment Models

Upfront cost barriers to E-Bus adoption can be addressed through new business models and product offerings that are rapidly developing in the fleet electrification market. "Charging-as-a-Service" or "Mobility-as-a-Service" platforms typically bundle financing for the vehicle, site-specific electrical capacity upgrades, the EVSE, energy, and demand charges in a 10-plus year financing structure with a firm "pay-by-the-kWh" or "pay-by-the-electric-mile" third-party fee. In practice, the model requires minimal or no up-front financing and acts similarly to a Power Purchase Agreement for E-Fueling or E-Mobility. In principle, the financing approach is vehicle and EVSE agnostic and has the potential to provide greater fleet customer certainty with regard to fueling, operations, and maintenance costs. Perhaps most importantly, the charging-as-a-service model enables access to capital needed to address both the "soft" planning costs and "hard" battery costs and infrastructure upgrades required to make the initial transition to electrified transportation, within an operational expense (OpeEx) framework that is familiar to operators. Specific features of the charging- and mobility-as-a-service model include:

- **Pay-by-the-kWh or mile/all-inclusive financial solution:** The charging- and mobility-as-a-service model is a pay-by-kWh or pay-by-mile approach, and typically includes: a) EVSE equipment; b) electrical upgrades; c) a longer-term (e.g., 10 year) charging as a service power purchase agreement like structure; d) smart charge management, including telematics for both fleet and charging management, and e) EVSE and grid integration. End-to-end charging management – including labor, operations, and maintenance cost – is available as part of the fixed fee approach.
- **Demand charge management and energy cost certainty:** Contracts typically provide firm energy costs over the contract period. The charging-as-a-service provider typically "owns" the meter (i.e., the service contract with the utility), and is 100 percent responsible for demand charge and energy cost management.
- **100 percent renewable energy access:** Energy cost certainty can be supported by provision of appropriate stationary energy storage and low-cost solar, either on-site or remotely. For larger users that qualify for Direct Access to wholesale energy markets, charging-as-a-service providers

may be able to source 100 percent renewable wind or solar power at significantly lower rates than local utility offerings. (Note that new rules governing Direct Access in California will open up this option to more customers effective in 2019, per the discussion on Direct Access below).

- **Turn-key service, including labor and smart charging management:** Charging-as-a-service firms will optimize charging regimes based on duty cycle analysis that is intended to minimize energy and demand costs, taking into account TOU tariffs and any applicable Demand Charges (which are typically levied based on peak monthly use in a 15-minute billing window). Note that while SCE has agreed to provide a temporary demand charge "holiday" for some fleet operators, the demand charges will be progressively reinstated beginning in 2024, which will significantly change EV ownership economics for fleet providers. Sophisticated charge management solutions (often involving power management controls and local energy storage with solar charging) need to be in place by that time.
- **EVSE-agnostic**: Charging-as-a-service solution providers typically support a variety of EVSE hardware solutions most appropriate for a given fleet mix and duty cycle.

Considerations for Contracting Charging as a Service: Charging- and mobility-as-a-Service models are likely to be attractive to many of Ventura County's fleet operators. RFPs designed to identify qualified vendors and innovative approaches to the model can lower capital and operating costs, reduce risk, and enhance the flexibility of electric vehicles to offer grid services and demand response. Precedent for the charging-as-a-service business model can be found within large institutions and utilities that use "pay for performance" approaches to procure other strategic energy services.

One recent example, the Energy-as-a-Service contracting strategy, can be found in the new Community Choice Energy provider in Alameda County, known as East Bay Community Energy. East Bay Community Energy was determined to replace an aging jet fuel powered peaker plant in Jack London Square with clean Distributed Energy Resources solicited through a competitive process that included both a Request for Information (RFI) and RFP phase.[123] Rather than narrowly define (and thereby limit) the type of equipment or the pricing strategy to be employed by respondents, East Bay Community Energy defined its end-state vision and gave respondents latitude to propose a variety of types of equipment. In the Port of Hueneme context, Port stakeholders could define Port cargo-handling throughput goals with the stipulation that these be provided with the least number of kWh utilized and least emissions (both GHG and criteria air pollutant), based on the speed and uptime needed, at the best possible price, potentially administered on a "pay for performance" basis. This broad framework would of course require significant additional refinement and qualification, which would occur in the procurement process.

As part of preparation for an RFI or RFP development processes, Ventura County stakeholders and consultants would likely need to:

1. Baseline current fueling, emissions, and energy use at the target site
2. Define electrification, emissions, and energy outcomes to be met by proposers
3. Define a range of potential or desired payment terms, non-disclosure requirements, and contract terms

[123] East Bay Community Energy. Local Development Business Plan. Retrieved from: https://ebce.org/wp-content/uploads/Local-Development-Business-Plan_FINAL_7-12-18_hi-res.pdf

4. Define scoring criteria (for the RFP – not applicable to the RFI)
5. Release data as appropriate to enable financially viable bid responses that include pro-forma analysis and bundled financing terms

It is recommended that Ventura County assess similar RFI packages focused on goods movement to inform project development. The LACI recently issued a RFI as part of an effort to accelerate the Southern California goods movement sector's transition to zero emissions technologies: https://laincubator.org/zetruckrfi/. This model will be relevant to Ventura County, and LACI could be a useful technical assistance partner.

E-Bus Charging Infrastructure

Charging needs for E-Buses will vary by fleet specific routing characteristics, and physical infrastructure constraints. Like plug-in electric vehicles, E-Buses are capable of utilizing Level 2 and DC Fast Charging depending on vehicle type, and many models can be specified with ultra-high-powered on-route charging mechanisms in the 850kW+ range.

Depot charging is currently the most common charging locale for E-Buses in California and consists of drawing electricity at a slower rate over a longer period. However, routes and utilization needs often require supplementing depot charging with on-route charging through conductive overhead charging systems, typically involving a pantograph or other rigid connector, and inductive wireless charging, involving a charging apparatus just beneath the pavement. Both mechanisms can provide range extension required for frequent utilization or longer use, but the overhead systems can provide a much higher rate of charge (up to one megawatt or more) vs. a current maximum of 250 kW for wireless charging. However, rates of charge for all types of charging devices are increasing steadily.

Depot Charging

E-Bus charging is most commonly fulfilled by in-depot charging where overnight and longer charging times are possible during idle off-route hours. Typically, power levels range from 10-150 kW given the longer charging window. Plug-in charging at higher direct current rates are becoming commonplace in Depot settings. Standard SAE J-plugs are the most commonly used charger connection. Parking availability and siting of depot charging for fleet operators can be a challenge, and some fleets have reported that electrification retrofits of existing depots can disrupt normal operations, stalling shipping and transit schedules. As a result, electrification retrofits of depot charging must be carefully planned with local stakeholders, including permitting authorities, tenants, utilities, and fleet managers.

Wireless Charging

Wireless induction charging is an emerging on-route charging solution with emerging utilization throughout the country. A 200 kW system from Momentum Dynamics is currently available as well as a 250 kW system from WAVE.[124] Both 50 kW and 200 kW systems from WAVE have been deployed in

[124] Inside EVs. *U.S gets its First Wireless Fast charging Bus.* May 2017. Retrieved from: https://insideevs.com/u-s-gets-its-first-wireless-fast-charging-bus/

collaboration with BYD and Antelope Valley Transportation Authority in Lancaster, along with WAVE systems at Long Beach Transit.[125]

Momentum Dynamics Inductive Charging. Source: electricdrive.com

Conduction and Pantograph Charging

Roof accessed fast charging solutions are developing rapidly in a variety of configurations that are largely unique to each OEM – although standardization efforts are also underway. With configurations ranging from 45 kW to over one megawatt, these fast charging solutions works by connecting an overhead pantograph to conductive rails or charging ports on the top of bus, delivering on route charging needed to complete routes and refill battery charge. European deployments make up the majority of current conductive overhead charging, but US market adoption is growing steadily.

An overhead OppCharge fast charger. Source: inside EVs.

E-Bus Charging Technology Adoption

A 2018 Survey performed by the Center for Transportation and the Environment, *Battery Electric Buses -- State of Practice,* identified the current charging practices of operational E-Bus fleets of 18 transit agencies as of February 2017. Results of the survey are highlighted below.

- Of the 18 agencies, all used Depot charging
- Half of the agencies have on-route overhead conductive chargers
- Two agencies utilize on-route inductive wireless chargers

CARB reports that in California, as of May 2018, there were 132 zero-emission buses in operation, predominantly consisting of battery E-Buses, with a small number of Fuel Cell E-Buses. An additional 655

[125] Wave. *Long Beach Transit.* Retrieved from: https://waveipt.com/long-beach-transit-lbt/

zero-emission buses are either on order, have been awarded for funding, or have been planned. The map below provided by CARB shows the operational zero-emission buses throughout California as of late 2018.

Figure 11: Zero Emission Bus Deployment in California, CARB, May 2018

Additional deployments by transit agency are shown in the table below.

Table 4: California Transit Agency ZEB Adoption, CARB, 2018

Agency Name	Total Buses[a]	All ZEB Target (as of May 2018)
Antelope Valley Transit Authority	77	2018
Anaheim Resort Transportation	82	2019/2020
Porterville Transit	20	2025
San Joaquin Regional Transit District	111	2025
Foothill Transit	373	2030
Los Angeles County Metropolitan Transportation Authority	2,452	2030
Los Angeles Department of Transportation	357	2030
Santa Monica Big Blue Bus	200	2030
San Mateo County Transit District	369	2033
Santa Clara Valley Transportation Authority	485	2033
San Francisco Municipal Transportation Agency	620[b]	2035
Santa Cruz Metro Transit District	98	2040[c]
Total	**5,244**	

[126]

[126] Data Source: NTD 2016, including only vehicles reported in NTD 2016 as vehicle types bus, articulated bus, over-the-road bus, and double decker, and mode types CB, MB, DR, and RB. 327 electric trolley buses are not included

E-Bus and E-Truck Adoption in Ventura County

E-Truck adoption in Ventura County and elsewhere in California has been limited to date, largely due to the limited availability of affordable and competitive E-truck and E-Bus products. However, this situation is likely to change in 2020 and beyond, as many new medium and heavy-duty electric vehicle products begin entering the market. Data from the HVIP program shows only one medium-duty E-Truck and 68 hybrid truck vouchers being redeemed in Ventura County. GCT and several school districts have applied for grant funding for E-Buses. As of June 2019, Ocean View Elementary School District had received funding for two new electric school buses and Oxnard Union High School District received funding for three new electric school buses. Schools were provided $330,108 for each new electric school bus. An additional $60,000 was awarded per electric school bus for charging infrastructure development. Both school districts are located in the City of Oxnard and serve CalEnviroScreen 3.0 Disadvantaged Communities, which bear a disproportionate burden of the state's pollution impacts and have greater socioeconomic challenges.

As part of a larger regional project in collaboration with the Port of Los Angeles, the Port of Hueneme will begin construction of a high voltage electrical system that will power the next generation of zero-emission cargo handling equipment. Construction is anticipated to begin in the summer of 2019. As part of the collaborative project with the Port of Los Angeles, the Port of Hueneme will also receive two fully electric yard trucks and the use of a zero-emission hydrogen fuel cell long haul truck to move produce between the Port of Hueneme and the Los Angeles Ports. The updated electrical transmission and distribution infrastructure will also enable additional zero emission cargo handling equipment at the Port of Hueneme. The Port of Hueneme will continue to expand their medium and heavy-duty electric vehicle goods movement in future years as EV technologies mature.

E-Truck Technology and Market Outlook

The new California Sustainable Freight Plan, developed by CARB and multiple state agencies, calls for 100,000 E-Trucks to be deployed across the state by 2020.[127] This ambitious goal reflects the importance of the truck segment to driving GHG reduction, criteria air pollutant reduction, and improved health and living conditions across California's most impacted communities. In addition to emissions reduction, the benefits of E-Truck adoption include:

- Noise reduction when compared to internal combustion engines
- Competitive acceleration times, hauling capacity, and gradeability to internal combustion engines
- Improved fuel efficiency
- Potential grid benefit when paired with managed charging practices
- Workforce and local economic development resulting from local fueling, and EVSE installation and maintenance

---

in 2016 NTD total bus number. Total bus numbers exclude par transit vehicles. 2040 target is not a directive from Board. Achieving the target is subject to range, technology improvement, and funding.

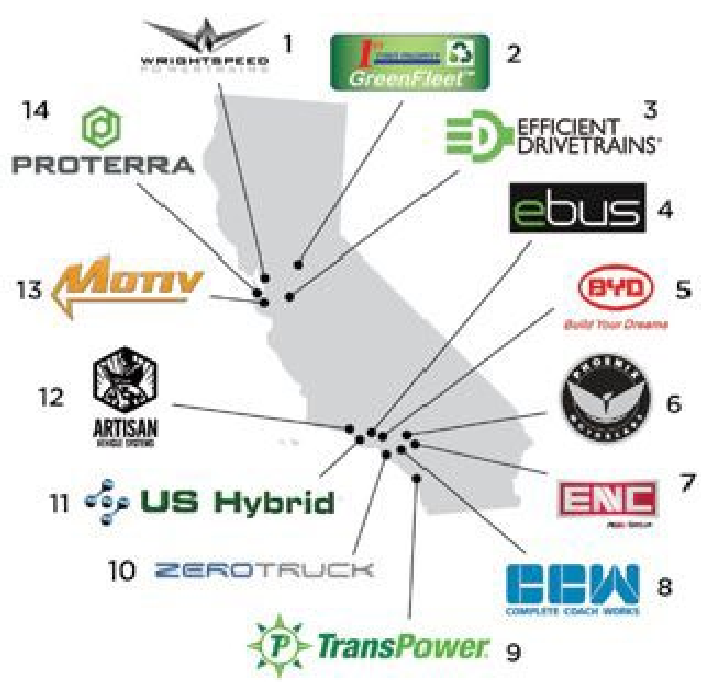
[127] ARB. 2016. *California Sustainable Freight Action Plan. Retrieved* from: http://dot.ca.gov/hq/tpp/offices/ogm/cs_freight_action_plan/Documents/CSFAP_Main%20Document_FINAL_07272016.pdf

E-Trucks can fill many roles in Ventura County including as refuse trucks, delivery vans, yard hostlers, utility work and work trucks, yard tractors, terminal trucks, forklifts, and drayage vehicles. Stepping up to fill these market segments are several OEMs -- including but not limited to:

- Balqon
- Efficient Drivetrains
- Electric Vehicles International
- ODYNE
- OrangeEV
- Motiv
- BYD
- Tesla (Semi and pickup)
- Cummins
- Daimler
- Thor
- MAN (VW Group)
- TransPower
- US Hybrid
- VIA
- Wrightspeed
- Zenith
- ZeroTruck
- Smith
- EDI
- E-Force One
- Renault & Groupe Delanchy
- Nikola (FCEV Class 8)
- Chanje

Thanks in large part to generous incentives provided by the state of California for R&D, manufacturing, and procurement of ZEVs, many of these OEMs have manufacturing centers in California, as shown in the figure below. Additional OEMs will be joining this group over the coming several years, as new electric vehicle startups are being well-funded by venture capital in California as well as on a global basis.

Figure 12: California Based E-Truck Manufacturers (Union of Concerned Scientist 2017)



Of the manufacturers listed above, some such as Motiv and others offer retrofit options in the form of electric drivetrains and chassis replacements on existing vehicles. Plug-in hybrid electric vehicle technology also holds a strong foothold in the segment, offering gasoline backup for smaller form factors such as pick-up trucks. Some fleet managers may find Plug-in hybrid electric vehicle technology to be the preferred option for their duty cycles and range requirements.

E-Truck deployments in the Class 4-6 vehicle category are now beginning in commercial scale thanks to high-profile adoptions by companies such as UPS, FedEx, Coca-Cola, and Frito-Lay. Both FedEx and UPS have committed to orders of 1000 EVs from Chanje and Workhorse respectively. Prior to these announcements in 2019, according to the Union of Concerned Scientists, since 2010, companies in California have deployed more than 400 electric delivery trucks. About half of these truck purchases benefitted from incentive funding from California's ongoing HVIP. [128] E-Trucks also have a significant role to play in supporting California's ports through adoption as drayage vehicles. A 2013 CalStart survey identified that drayage truck operators in Southern California reported 75 percent of typical trips are 60 miles or shorter. [129] This range requirement is well suited to the capabilities of E-Trucks.

E-Truck Costs

E-Truck adoption faces the same cost barriers as found in the E-Bus segment, with high capital costs for both vehicles and fueling infrastructure being the biggest barriers to adoption. Based on literature and OEM pricing review, the upfront costs of a Class 5 E-Trucks range from $95,000-$115,000, while diesel trucks cost around $60,000 new and low-NOx CNG engines range in cost between $75,000-$80,000.
Cost savings from electrification are principally derived from greater fuel efficiency, as well as avoided maintenance costs over the lifetime of the E-Truck. Vehicle lifetime maintenance savings alone for electric delivery trucks have been estimated at between $17,000 to $25,000, depending on duty cycles and local factors. [130] As with E-Buses, the electricity costs, demand charges, charging infrastructure, and other external pricing factors can reduce the financial viability of E-Truck adoption if left unmanaged. It is recommended that prospective buyers of E-Truck technology conduct their own lifecycle cost analysis to identify the financial viability of an E-Truck transition, considering the many incentive programs from public agencies, along with tax credits, LCFS credits, and operations and maintenance savings.

E-Truck Charging Infrastructure

Depending on make and model, charging connectors, and battery size, E-Trucks can make use of charging options at Level 1 and Level 2, as well as DC Fast Charging, induction charging, and overhead systems. However, site specific infrastructure costs must be specifically addressed, along with demand charge mitigation strategies, to inform a comprehensive E-Truck deployment and charging strategy. Key issues that should be addressed prior to E-Truck adoption include:

---

[128] Union of Concerned Scientist. May 2017. Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California.

[129] Papson, A., and M. Ippoliti. 2013. Key performance parameters for drayage trucks operating at the ports of Los Angeles and Long Beach. Pasadena, CA: CALSTART. Retrieved from: www.calstart.org/Libraries/I710_Project/Key_Performance_Parameters_for_Drayage_Trucks_Operating_at_the_Ports_of_Los_Angeles_and_Long_Beach.sflb.ashx

[130] Lee, D.Y., V.M. Thomas, and M.A. Brown. 2013. Electric urban delivery trucks: Energy use, greenhouse gas emissions, and cost-effectiveness. Environmental Science & Technology 47(14): 8022–8030.doi:10.1021/es400179.

- Existing usage patterns of truck fleets, including loading and unloading locations, schedule, and procedures as well as parking and fleet storage
- Range requirements and route gradeability and impact on fuel efficiency
- Existing electrical infrastructure at potential charging locations, utility grid capacity and existing switchbox and electrical wiring compatibility with increased load
- Electric vehicle charging rate options with local utilities and load serving entities (SCE and CPA in the case of Ventura County)
- Driver training and workforce education needs for transitioning to E-Truck use
- Application of incentives such as the LCFS and HVIP
- Availability of financing programs offered by OEMs or other local partners
- Vehicle specifications such as battery warranty, cycle ratings, charging compatibility, and maintenance schedules
- Selection between new vehicle purchase or chassis or hybrid-electric retrofit on existing fleet

Bus and Truck Electrification Recommendations

Recommendation #8 - Collaborate with key regional transportation electrification stakeholders on regionwide goods movement electrification planning: Regional electrification planning is essential to ensure maximum availability of funding for Ventura County stakeholders and appropriate coordination with utilities and public agencies. Relevant partners likely include: LACI, SCAG, SCE, CPA Port of Los Angeles, Port of Long Beach, Port Hueneme, and major freight companies and transportation planning agencies.

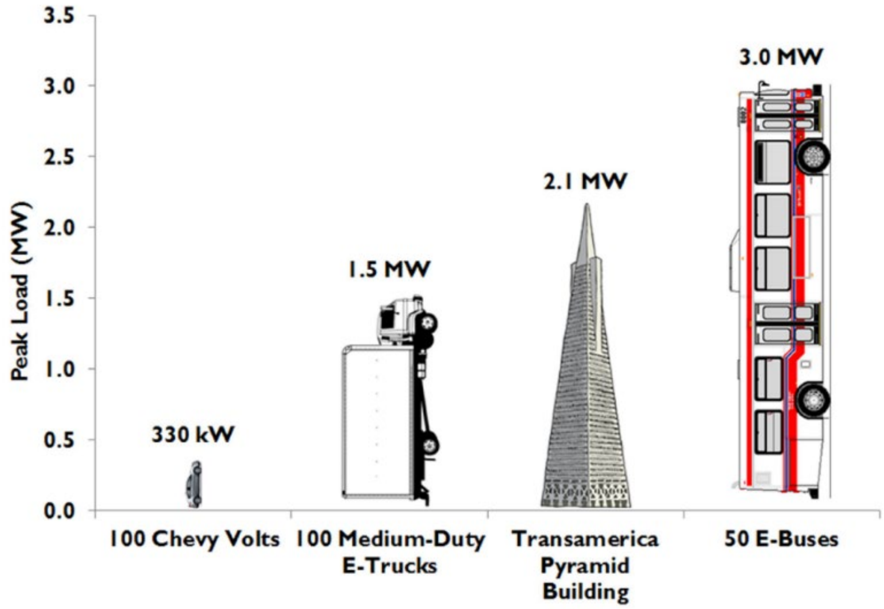
E-Bus and E-Truck Grid Integration

An unmanaged increase in load from both E-Bus and E-Truck charging in Ventura County can be damaging to the electric grid. According to a 2015 report from CalStart on E-Truck and E-Bus Grid Integration, peak charging needs can far surpass existing grid conditions. For example, 100 medium-duty E-Trucks charging at the same time would demand 1.5 MW of power on the grid and 50 E-Buses would demand 3.0 MW. This is the same order of magnitude as the Transamerica Pyramid building in San Francisco, a major skyscraper. [131] This load use is illustrated in the figure below.

[131] CalStart. 2015. Electric Truck & E-Bus Grid Integration.

Figure 13: Peak Loads for Various Electric Vehicle Fleets -- Based on Concurrent Charging

(CalStart 2015)



If left unmanaged, E-Bus and E-Truck charging can cause major grid reliability and stability concerns. However, if managed appropriately, both the charging equipment and vehicles batteries can become grid resources that offer valuable frequency regulation, voltage control, and demand response value for local utilities and grid managers. Further opportunities for grid integration become viable when E-Bus and E-Truck charging is integrated with onsite renewable energy generation and energy storage. When used in concert, these resources can enable fleet managers to prevent nearly all demand charges, enable resilient charging from an onsite renewable source, and unlock potential new revenue streams from demand response programs, or energy dispatch to the grid (in the case of two-way energy flow via V2G enabled vehicles, chargers, and utility interconnections).

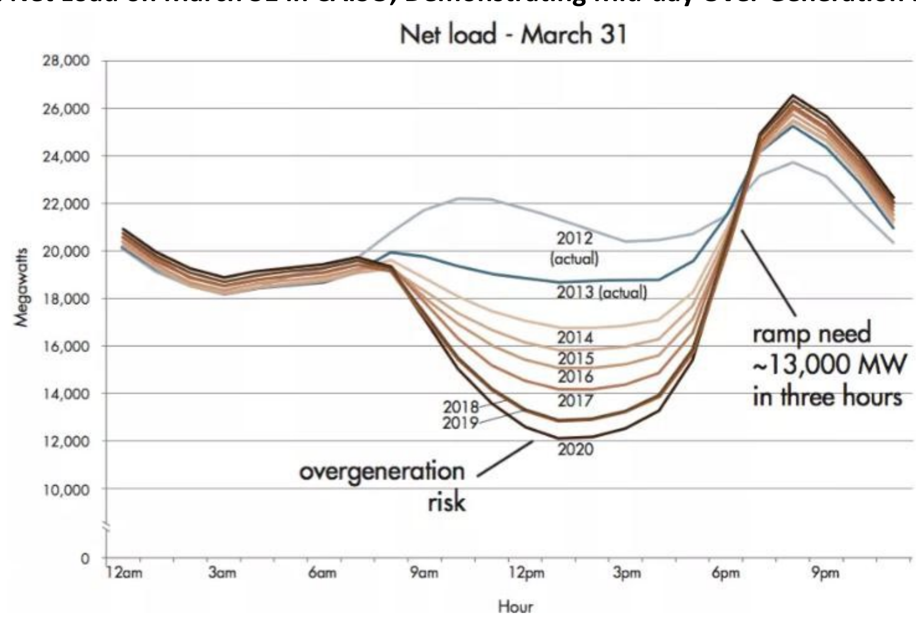
VGI energy services will only achieve full commercial viability when vehicles are aggregated into a controllable network of a certain minimum size. In the case of the CAISO, the minimum size required for wholesale market participation has been 500 kW of controllable battery capacity per sub-Load Aggregation Point, which is a location on the grid associated with a particular substation, with a specific Locational Marginal Price for electricity. To minimize deep cycling of batteries, larger VGI aggregations are desirable that would call on the vehicle battery for just a short time period. Such usage minimizes additional degradation impacts over the vehicle lifetime. Vehicles in a VGI aggregation can also be combined with fixed battery storage arrays to provide the necessary CAISO minimum for participation of storage resources on the wholesale market.

According to Energy Commission-sponsored studies and other technical papers referenced in the *California VGI Roadmap,* the value of V2G services, including but not limited to Frequency Regulation, can be as much as $1,000 per vehicle per year or more. This assumes that plug-in electric vehicles participating in a VGI aggregation are parked in a location with a V2G compliant charger and that they have two-way energy flow capability. The added value provided by two-way power, while still somewhat speculative, may be sufficient to fully recoup electric vehicle battery costs over the vehicle's life without substantially degrading the vehicle's battery life. When V2G capable plug-in electric vehicles become deployed in the millions of units, as projected for California in the late 2020s, they could serve in the aggregate to fill the existing valleys of electricity supply and reduce the peaks of demand, also known as the "duck curve." In this scenario, plug-in electric vehicles providing grid services could enable payments to drivers and fleet managers worth hundreds of millions of dollars per year in the aggregate, as reduced grid costs and other benefits are monetized in fully developed commercial VGI solutions.

Most literature sources identify VGI/V2G technology as several years away from commercial adoption in the light-duty segment. However, many medium duty electric vehicles, including electric school buses, will begin shipping in 2020 with V2G connections enabled at the factory.

School Buses and Vehicle Grid Integration: The electrification of school buses presents a standout opportunity to create grid benefits through VGI. This is a direct result of the use patterns of school buses and their alignment with California's unique renewable generation context. In California, increasing mid-day solar generation as well as robust wind generation at night is creating excess renewable capacity on the electric grid, resulting in numerous grid stability and reliability concerns, curtailment of solar energy from flowing into the grid, and very low or negative pricing during peak production periods on the wholesale markets. Introducing flexible loads that can increase energy demand during periods of electricity "over generation" can save ratepayers money on their electric bills and provide grid operators with greater system flexibility, reliability, and stability. Given their morning and evening routes, electric school buses present an ideal window for inexpensively charging during the mid-day generation peaks and mitigating over generation risks. The well-known "duck curve" indicating the magnitude of California's renewable energy production, is illustrated below.

Figure 14: Net Load on March 31 in CAISO, Demonstrating Mid-day Over Generation Risk, CAISO



School bus electrification is particularly compelling because electric school buses will significantly reduce the particulate and pollution burden experienced by at-risk children in the K-12 age range. If left unaddressed, criteria air pollution from tailpipe emissions puts children at increased risk for higher asthma rates, heart problems, cancer, and reduced health.[132] Given these risk factors, Ventura County school districts are in a unique position to lead the way towards cleaner air and better health outcomes. In 2018, Ventura County APCD worked with several school districts to help secure grant-funding for school bus electrification and is considering expanding current incentives programs to include school bus charging infrastructure. It is recommended that the County continue to collaborate with local school districts to secure grant funding and build utility partnerships that will bring clean all-electric school buses to local communities.

Recommendations for Vehicle Grid Integration

- **Recommendation #1 - Develop VGI Pilot Projects with leading fleets and industry partners** that will enable payments to electric vehicle operators for smart charging and VGI services.
- **Recommendation #2 - Develop school bus electrification projects**. Optimally, these projects can enable mid-day charging from solar energy and earn extra revenue from vehicle-to-grid connections, while providing clean transportation alternatives for Ventura County students.
- **Recommendation #3 - Link EVSE incentives to networked** electric vehicle charging infrastructure. Both SCE and CPA will have opportunities to link EVSE incentives to enable customers to earn extra revenue (or discounts on charging) by responding to utility price signals, and by participating in demand response programs and/or Virtual Power Plant configurations.
- **Recommendation #4 - Develop electric vehicle charging station projects that are paired with solar carports at workplaces, MUD properties, and public destinations** to enable mid-day charging from solar energy and reduce on-going costs associated with electricity demand.

[132] American Lung Association (ALA). 2016. *State of the Air*. Retrieved from: www.lung.org/assets/documents/healthy-air/state-of-the-air/sota-2016-full.pdf.

Chapter 4 References

"Design Guidelines for Bus Transit Systems Using Electric and Hybrid Electric Propulsion as an Alternative Fuel". Transit-safety.fta.dot.gov. 2001-12-15. Archived from the original on June 10, 2010. Retrieved 2010-07-28.

22 February 2018, archived at https://web.ar- chive.org/web/20180222224244/https://www. transit.dot.gov/funding/grants/urbanized-area- formula-grants-5307.

22 February 2018, archived at https://web.ar- chive.org/web/20180222224244/https://www. transit.dot.gov/funding/grants/urbanized-area- formula-grants-5307.

ABB. *TOSA Electrical bus Charging Infrastructure.* Retrieved from: https://new.abb.com/substations/railway-and-urban-transport-electrification/tosa-electrical-bus-charging-infrastructure

Betsy Lillian, "Portland General Electric's Transportation Electrification Plan Moves Forward," NGTNews, 27 February 2018.

Bloomberg New Energy Finance, Electric Buses in Cities, 29 March 2018.

Blue Bird Corporation, "Blue Bird Introduces All-New Electric School Bus Solutions" (press release), 11 July 2017, available at https:// blue-bird.com/blue-bird/Press-Releases/Blue- Bird-Introduces-All-New-Electric-School-Bus-So-104.aspx.

BYD, K11 Electric Transit Bus - World's First and Only 60ft Electric Transit Bus, accessed 28 March 2018, archived at https://web.archive.org/ web/20180328175732/http://www.byd.com/usa/ bus/k11-electric-transit-bus. Jonathan Church, Worcester Regional Transit Authority, "Battery Electric Bus Deployment Project" (presentation), 28 September 2017

California Air Resources Board, Implementation Manual for The Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP) And Low NOx Engine Incentives Implemented Through HVIP, 10 January 2018.

California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, "Health Effects of Diesel Exhaust," 21 May 2001, accessed at https://oehha.ca.gov/ air/health-effects-diesel-exhaust, 12 January 2018.

Center for Climate and Energy Solutions, Transitioning to Electrification: Funding Resources (factsheet), November 2017.

Charles Morris, "NREL report: Battery-electric Buses Are Four Times More Fuel-Efficient than CNG," Charged EVs, 23 February 2016.

Christopher Rauwald, "VW to Roll Out Electric Trucks, Buses in $1.7 Billion Push," Bloomberg, 11 October 2017, archived at https:// web.archive.org/web/20180216210359/https:// www.bloomberg.com/news/articles/2017-10-11/ vw-to-roll-out-electric-trucks-buses-in-1-7-bil- lion-project.

Clean Energy Works, "Tariffed On-Bill to Help Accelerate Clean Transit," accessed 27 March 2018, archived at https://web.archive.org/ web/20180329131535/http://cleanenergyworks.org/clean-transit.

David Roberts, "Electric Buses Are Coming and They're Going to Help Fix 4 Big Urban Problems," Vox, 25 October 2017.

David Roberts, "Millions of Used Electric Car Batteries Will Help Store Energy for the Grid. Maybe." Vox, 29 August 2016, archived at https://web.archive.org/web/20180329132658/ https://www.vox.com/2016/8/29/12614344/ electric-car-batteries-grid-storage.

Federal Transit Administration, “Urbanized Area Formula Grants – 5307,” accessed
Federal Transit Administration, “Urbanized Area Formula Grants – 5307,” accessed
Federal Transit Administration, Low or No Emission Vehicle Program – 5339(c), accessed 12 January 2018, archived at https://web.archive. org/web/20180412200723/https://www.transit. dot.gov/funding/grants/lowno.

Frank Lambert, “Hyundai Unveils All-Electric Bus With 180 Miles of Range on A 256 Kwh Battery Pack,” Electrek, 31 May 2017, archived at https://web.archive. org/web/20180216210205/https://electrek. co/2017/05/31/hyundai-electric-bus

Fred Lambert, “New All-Electric School Buses Unveiled by Blue Bird with Vehicle-To-Grid Feature,” Electrek, 14 July 2017.

Hyundai: Frank Lambert, “Hyundai Unveils All-Electric Bus With 180 Miles of Range on A 256 Kwh Battery Pack,” Electrek, 31 May 2017, archived at https://web. archive.org/web/20180216210205/https:// electrek.co/2017/05/31/hyundai-electric-bus; New Flyer and Proterra: David Roberts, “Electric Buses Are Coming, And They’re Going to Help Fix 4 Big Urban Problems.” Vox, 25 October 2017, archived at https://web.archive.org/ web/20180216215956/https://www.vox.com/energy-and-environment/2017/10/24/16519364/ electric-buses.

Jo Borras, “Volvo Upgrades Its 7900 Series Electric Bus,” GAS2, 16 October 2017, archived at https://web.archive. org/web/20180216222715/https://gas2. org/2017/10/16/volvo-upgrades-its-7900-series-electric-buses.

Kari Lydersen, “Utilities Among Advocates for Electric School Buses Under Volkswa- gen Settlement,” The Gazette, 11 July 2017.

Kelly Blynn, “Accelerating Bus Electrification: Enabling a Sustainable Transition to Low Carbon Transportation,” Master in City Planning and Master of Science in Transportation thesis, Massachusetts Institute of Technology, February 2018.

Lance Noel and Regina McCormack. 2014. “A Cost Benefit Analysis of a V2G-Capable Electric School Bus Compared to A Traditional Diesel School Bus,” Applied Energy, 126: 246-265. Available at https://www1.udel.edu/V2G/ resources/V2G-Cost-Benefit-Analysis-Noel- McCormack-Applied-Energy-As-Accepted.pdf.

Leslie Eudy et al., National Renewable Energy Laboratory, Foothill Transit Battery Electric Bus Demonstration Results, January 2016.

Mark Chediak, “Electric Buses Will Take Over Half the World Fleet by 2025,” Bloomberg New Energy Finance, 1 February 2018, archived at https://www.bloomberg.com/news/articles/2018-02-01/electric-buses-will-take-over-half-the-world-by-2025.

Martha T. Moore, “Billions from VW Settlement Boost Push to Clean Vehicles,” The Gazette, 7 January 2018.

Proterra, Financing Your Electric Bus, accessed 28 March 2018 at https://www.proterra.com/financing.

Public Utilities Commission of the State of California, Application of San Diego Gas and Electric Company for Approval of SB 350 Transportation Electrification Proposals, 20 January 2017.

Robert Prohaska, Kenneth Kelly, Leslie Eudy, National Renewable Energy Laboratory, *Fast Charge Battery Electric Transit Bus In-Use Fleet Evaluation,* May 2016.

Russ Mitchell, “Proterra Claims World Record, Says Its Electric Bus Traveled More Than 1,100 Miles on A Single Charge,” Los Angeles Times, 19 September 2017.

Ryan Popple, Proterra, “Will Electric Buses Take over the Transit World?” The Energy Gang (podcast), 10 February 2017, available at https://www.greentechmedia.com/articles/ read/electric-buses-are-going-to-dominate#gs. dYS03b0.

S. Adar, J. D’Souza, L. Sheppard, J.D. Kaufman, T.S. Hallstrand, M.E. Davey, J.R. Sul- livan, J. Jahnke, J. Koenig, T.V. Larson and L.J. Liu, 2015, American Thoracic Society, “Adopting Clean Fuels and Technologies on School Buses, Pollution and Health Impacts in Children,” available at https://www.ncbi.nlm.nih.gov/pmc/ articles/PMC4476560/.

SCAQMD, SCAQMD Approves $8 Mil- lion to Fund 33 New Electric School Buses (newsletter), Vol. 24, Number 4, July/August 2017.

Siemens. *Charging Systems for ebuses.* Retrieved from: https://new.siemens.com/global/en/products/mobility/road-solutions/electromobility/ebus-charging.html

State of Washington Department of Ecology, VW Mitigation Fund Plan, accessed 28 March 2018, archived at https://web.archive.org/ web/20180329031007/https://ecology.wa.gov/ Air-Climate/Air-quality/Vehicle-emissions/VW- federal-enforcement-action/VW-plan.

Stu Robarts, “Proterra Catalyst XR Electric Bus Delivers 258-mile Range Results,” New Atlas, 2 October 2015, archived at https:// web.archive.org/web/20180328181455/https:// newatlas.com/oroterra-catalyst-xr-electric-bus- 258-miles/39692.

The California Air Resources Board, Innovative Clean Transit Regulation Discussion Document, December 15, 2017.

U.S. Environmental Protection Agency, Emissions and Generation Resource Integrated Da- tabase – eGRID 2016; As America’s electricity grid switches to cleaner renewable energy sources like wind and solar, the savings from electric buses will grow.

Union of Concerned Scientists, Sixteen California Mayors Say Their City Buses Should Be Zero-Emission (press release), 30 January 2018.

Chapter 4 Appendix

A. List of Bus Manufacturers

U.S. Based Manufacturers (or made in USA)

- BYD electric bus factories in Changsha and Dalian in China and Lancaster, CA
- Blue Bird: Electric School Buses, https://blue-bird.com/electric, Fort Valley, Georgia
- Chanje, Hangzhou, electric shuttle and delivery vehicles, www.chanje.com, China and Los Angeles, CA
- Complete Coach Works remanufactured electric bus in Riverside, CA
- Ebus,[13] minibuses: 22 feet (6.7 m) buses, Downey, CA
- GreenPower Motor Company manufactures a suite of high-floor and low-floor battery-powered buses
- Lion, electric school buses (Class C), https://thelionelectric.com/en/products/electric, Newton PA, Quebec, Canada
- Motiv, Electric School Bus chassis supplier (Type A, C), Foster City, CA, https://www.motivps.com/motivps/
- New Flyer Industries Offers a wide range of electric bus options, Ontario, CA, Renton, WA, and other locations
- Proterra [21] in Greenville, SC and Santa Clara, CA. 35 feet (11 m) 40 feet (12 m) full-size bus
- Specialty Vehicle Manufacturing Corp. (SVMC) in Downey, CA.
- Smith Electric Vehicles, Kansas City, KS. Speedster and Edison[23] electric minibuses.[24][25]
- Thomas: Electric School Buses, https://thomasbuiltbuses.com/school-buses/saf-t-liner-c2-jouley/
- Trans Tech, Type A and B Electric School Buses, http://www.transtechbus.com, Warwick, NY

Global Manufacturers

- ABB TOSA Flash Mobility, Clean City, Smart Bus, Geneva, Switzerland, A mass transport system with electric “flash” partial recharging of the buses at selected bus stops.[4]
- APS Systems, Oxnard, CA, shuttle buses in partnership with Enova Systems[5] and Saft[6]
- Astonbus,[7] Marina del Rey, CA: E-city midi and full-size models, with a range between 250 and 500 km. Astonbus is the Zonda Electric bus sole distributor in all EU states.
- Astra Bus,[8] Arad, Romania: Citelis full-size models, with low power consumption and regenerative electric brakes. Digital control of all systems of electric buses allow easy maintenance and repair of the vehicle.
- Avass[9], Full Electric City Buses and Touring Coaches, manufactured in Australia.
- Belkommunmash, in Minsk, Belarus. Models E420 «Vitovt Electro» and E433 «Vitovt Max Electro».[10]
- Bolloré Bluebus.[11]
- BredaMenarinibus [12] in Bologna, Italy. Zeus M-200 E model, with Ansaldo Electric Drive motor and 288V - 200 Ah lithium-ion batteries.
- City Smile electric bus designed and manufactured by AMZ-Kutno in Poland.
- Ekova,[14] in Ostrava, Czech Republic. Design and production of electric low-floor buses, trams and trolleybuses.
- Electron in Lviv, Ukraine. Electrobus E19101.[15]
- Environmental Performance Vehicles(EPV), previously known as DesignLine, in New Zealand: EcoSaver range extender bus.

- Iveco, in Turin, Italy: EuroPolis model.
- Jiangsu Alfa Bus company,[16] Jiangsu, China, delivered in Italy by Rama Company.
- Kayoola Solar Electric Bus by Kiira Motors Corporation (KMC) in Uganda.[17] sdd
- Linkker, Finland. Design and production of battery-electric buses that use opportunity charging (3-5min fast charging). Initial development together with VTT Technical Research Centre of Finland.[18]
- Lujo EV, in Weihai City, Shandong Prov., China.:[19] Lujo YX Bus69 LHD (9 m, maximum speed 80 km/h, maximum range 220 km).
- Microbuses de Lujo, S.L. (Car-bus.net) (Electric Minibus Wolta, 6m long) www.car-bus.net // www.wolta.es - Spanish manufacturer.
- Mercedes-Benz Citaro, battery-powered articulated bus in Aachen, Germany
- Mitsubishi Heavy Industries is developing electric buses capable of battery swapping.
- Optare: Solo EV, Versa EV.
- PVI, near Paris, France : Oreos 2X, Oreos 4X distributed under the brand Gepebus [22]
- Solaris Urbinos 8.9, 12 and 18 meters[26] with about 100 km (60 miles) range and about 120 kWh battery pack, introduced in September 2011. Optional pantograph inductive.
- Tecnobus,[27] in Frosinone, Italy. The Gulliver model is currently used in several cities in Canada, England, France, Germany, Italy, Portugal and Spain.
- Temsa developed two electric buses; one model with a high capacity battery pack[28] and one model with quick charge capability.[29]
- Thunder Sky Energy Group[32] of Shenzhen, China (near Hong Kong) builds lithium-ion batteries and has four models of electric buses, the ten passenger EV-6700 with a range of 260 km (160 mi), the TS-6100EV and TS-6110EV city buses (top speed 80 km/h), and the 43 passenger Thunder-Sky-EV-2008 highway bus (top speed 100 km/h), which has a range of 300 km (190 mi). The batteries can be recharged in one hour or replaced in five minutes. The buses are also to be built in the United States and Finland.
- VDL Bus and Coach has the largest fully electric fleet in the EU.
- Volvo, based in Gothenburg, Sweden manufactures battery electric buses
- Wuzhoulong, based in Shenzhen, China manufactures a range of urban battery electric buses
- Zonda Bus, in Jiangsu, China:[35] YCK6128HEC (12 m), YCK6118HEC (11 m) and the Zonda Bus New Energy (with a 500 km only-electric range)

Appendix B: Electric Bus Vehicle Comparison

Brand	Release Year	Price	Charging Time	Battery type, capacity, power rating, and range	Grade Rating	Seats	Warranty	Manufacturing location	Notable California deployments
BYD K9 E-Bus [1]	2010	~$550,000	- Plug in, overhead, or wireless - 5 hours	- Fe Battery - 200Ah x 3, 324Kwh - 155-186 Miles	15%	25	12 year unlimited[3]	Lancaster, CA, International	Los Angeles County, Santa Barbara MTD
Proterra Catalyst E-Bus[2]	2014	$700,000-$750,000	- Plug in, overhead, or wireless - 1-4.5 hours plug in charge time *dependent upon model	- Lithium Nickel Manganese Cobalt Oxide, and other configurations depending on model - Variable battery capacity, 94-660 Kwh (depending on model - 55-350 Miles (dependent upon model)	18-22% (depending upon model)	Up to 40	- Bus: 1 year or 50,000 miles - Battery: 12 years unlimited miles	Burlingame, CA	Burlingame, Yolo County, Stockton, Stanford, Santa Clara County, San Joaquin Valley, San Jose, 2019: San Mateo County, Los Angeles
GreenPower[4]	2018	$820,000	2-5 hours	- LiIon (NMC or LiFe PO4), PG Porous, Polymer Graphene (depending on model) - 100 kWh -478 kWh (depending on model) - 75 - >240 Miles (depending on model)	18%	48-72 (dependent upon model)	15-20 Years (dependent upon model)	Vancouver, British Columbia	Porterville, Rialto, San Luis Obispo
GILLIG[5]	2018	$150,000		- BAE Systems, HDS200 - 444 kWh - 200 miles		38	12 years	Livermore	one set to soon be delivered to Santa Monica's Big Blue Bus
El Dorado national-California[6]	2014	$9,500-$69,888	2-5 hours	- 8-D battery - 200-350 Miles	20%	21- 43	8- 12 years	Riverside, CA, Salina, Kansas	Coachella Valley

[1] BYD. K9 E-Bus. Retrieved from: http://en.byd.com/usa/bus/k9-electric-transit-bus/
[2] Proterra. 40-foot catalyst. Retrieved from: https://www.proterra.com/products/40-foot-catalyst/
[3] Mass Transit. BYD Announces 12-year battery Warranty. Retrieved from: https://www.masstransitmag.com/home/press-release/12058920/byd-motors-llc-byd-announces-12-year-battery-warranty
[4] GreenPower. https://www.cleanenergybc.org/wp-content/uploads/2015/09/Transportation_GreenPowerBus_CRichardson.pdf
[5] GILLIG. https://www.gillig.com/buses
[6] El Dorado national-California. https://www.metro-magazine.com/bus-showcase/detail/1093

Ventura County Electric Vehicle Ready Blueprint

Chapter 5: Accelerating Fleet Electrification

Introduction to Fleet Electrification

Benefits and Opportunities

Electrification of fleet vehicles throughout Ventura County represents a significant opportunity to reduce transportation-related emissions and provide community benefit. Many fleets are well suited for electrification as they are often used on predictable routes, with well understood duty cycles, range parameters, and operating costs. Both privately owned fleets as well as public fleets managed by local governments or other public entities can benefit from accelerated fleet electrification. The benefits of fleet electrification can include:

- Lower TCO over the life of the vehicle as result of reduced fuel and maintenance costs (including SCE's new electric vehicle TOU rates with waived demand charges)
- Reduced emissions, resulting in improved public health and reduced climate impact
- Enhanced vehicle longevity (fewer mechanical parts to wear out)
- Cleaner roadways, parking lots, and waterways due to reduced runoff of contaminants (no oil, transmission, or coolants in electric vehicles)
- Reduced noise pollution
- Improved driver satisfaction (less noise and vibration, zero emissions, pre-heating and pre-cooling)

Lower fuel and maintenance costs: Usage of electric vehicles can reduce fleet fueling cost because of the low cost of electricity versus traditional fossil fuels. Powering a light-duty electric vehicle with a fuel efficiency of 34 kW per 100 miles [133] with SCE's off-peak electricity rate of about $.07 per kWh [134] costs only about $.02 per mile. In contrast, fueling a gasoline car with a fuel economy of 27.5 miles per gallon costs about $0.14 per mile and exposes fleet managers to wide variability in fossil fuel prices. On a gasoline equivalent standard, today's light duty electric vehicles can exceed fuel efficiency of 130 miles per gallon equivalent.

According to analyses by electric vehicle rental fleet operators such as EverCar, the break-even point for total cost of ownership advantage on new electric vehicles is reached when the vehicles are driven at least 12,000 miles a year. The operating cost advantage of electric vehicles becomes highly compelling at 20,000 miles per year or more. These mileage requirements are rapidly met in some fleet settings with heavy vehicle usage requirements.

With fewer moving parts than ICE vehicles, and no catalytic converters or oil changes, the maintenance savings available with electric vehicles can be significant. However, very few fleets have managed electric vehicles for a full 10-year operational life cycle, and long-term maintenance cost data is therefore incomplete. To date, New York City has reported some of the best real-world maintenance cost data through the management of their electric vehicle fleet. Keith T. Kerman, the Chief Fleet Operator for New York City reports that "servicing costs with our all-electric vehicle models is dramatically less than with gas, hybrid, or hybrid plug-in models. In general, our hybrid models also achieve benefits from gas models,

---

[133] Alternative Fuels Data Center. Charging Plug-in Electric Vehicles. Retrieved from: https://afdc.energy.gov/fuels/electricity_charging_home.html

[134] Southern California Edison. Schedule TOU-EV-1. Retrieved from: https://www1.sce.com/NR/sc3/tm2/pdf/ce114-12.pdf

though the most dramatic results are with the all electrics." [135] According to the New York City Department of Citywide Administrative Services, maintenance costs of electric sedans are 65 percent less than combustion vehicles – saving an average of $550 per vehicle per year. [136]

Emission reductions and sustainability: One of the most attractive benefits of electrification, especially in the public fleet segment, is the ability to reduce transportation related emissions. Direct tailpipe emissions of electric vehicles are zero, resulting in a dramatic reduction in associated transportation emissions in the local area, even when factoring in emissions associated with electric generation and embedded carbon in the manufacturing of vehicles. On a per-mile basis, electric vehicles also decrease carbon emissions by 70 percent compared to gas or diesel vehicles utilizing current California emission factors. [137] Emissions associated with electric vehicle fueling will drop further as SCE and CPA ramp up to state mandates of 60 percent renewable energy by 2030 and 100 percent clean electricity by 2045. The upstream emissions associated with electricity use for electric vehicles can also be reduced to near-zero today using paired solar with charging -- or via the 100 percent renewable energy options available from CPA and many utilities throughout California.

For local governments, workplaces, and fleet operators with sustainability and climate goals in place, the ability to reduce transportation emissions will directly contribute towards achieving voluntary and mandatory emission goals. Electrification also demonstrates environmental leadership and helps expose the public to electric vehicle technology and its many benefits. For local governments, fleet electrification is an important step to model the way towards a clean transportation future and inspire broader electric vehicle adoption.

Driver satisfaction and safety: Electric vehicles offer a superior driver experience compared to internal combustion engine vehicles, with features such as quiet drive, quick acceleration, plentiful torque, and reduced maintenance requirements. Electric vehicles are subject to the same safety standards as all other vehicles in the United States and are less prone to rollovers given the lower center of gravity provided by the battery placement in the vehicle. Many electric vehicle manufacturers are also in the forefront of the movement to provide driver assisted safety features (such as automated lane-keeping) that improve safety performance and mitigate risks of human error.

Challenges and Barriers to Fleet Electrification

Central Coast Electric Vehicle Fleet Accelerator: In 2017-2018, the Central Coast Electric Vehicle Fleet Accelerator project collected important fleet data from 85 fleets in the three counties of Santa Barbara, San Luis Obispo, and Ventura. In this process, information was gathered about the composition of regional

---

[135] Kerman K. NYC DCAS. Reducing Maintenance Costs with Electric Vehicles. Retrieved from: https://www1.nyc.gov/assets/dcas/downloads/pdf/fleet/NYC-Fleet-Newsletter-255-March-8-2019-Reducing-Maintenance-Costs-With-Electric-Vehicles.pdf

[136] Kerman K. NYC DCAS. A Sustainable Future for Fleet. (June 3, 2019). Retrieved from: https://www1.nyc.gov/assets/dcas/downloads/pdf/fleet/Keith-Kerman-Presentation-A-Sustainable-Future-for-Fleet-NYC-Fleet-Montreal-Canada-June-3-2019.pdf

[137] Southern California Edison. Electric Transportation. Retrieved from: https://www.edison.com/home/innovation/electric-transportation.html

fleets, existing or planned usage of electric vehicles, and the main barriers to electrification faced by fleets. Most importantly, the project provided updated information to the engaged fleet operators about electric vehicles models available; answered questions about technical and operational aspects of fleet electrification; and informed them about many of the programs California has developed to help fleets electrify. Twenty-one fleets completed spreadsheets of vehicle data and the project in turn disseminated electric vehicle information to 27 fleets through presentations and webinars. In addition, the project partners developed seven customized Fleet Transition Plans that provided detailed information on vehicle and infrastructure costs, operations, fueling, and maintenance, and available incentives. Through the project, the team helped many fleet managers understand electric vehicles and the state's incentive programs more thoroughly, which is leading to greater fleet adoption of electric vehicles.

In interviews with fleet managers, the largest barriers to fleet electrification identified were:

- Upfront cost, both of electric vehicles and charging infrastructure
- Lack of appropriate electric vehicle models
- Lack of familiarity with electric vehicles and their benefits
- Reluctance to try new technologies and uncertainty about long term operational savings
- Inertia and lack of time to devote to exploring electric vehicle options

Upfront Costs: Cost of new electric vehicles combined with the additional cost and complexity of installing charging stations was identified as a top barrier. Light-duty vehicles are approaching price parity, especially with incentives, but initial purchase prices remain higher than ICE equivalents in most cases. Some fleet managers were unaware of HVIP, uncertain how to monetize the federal tax credit, and unaware of other programs such as the LCFS. Payback period was also hampered by the low operational mileages allowed by the limited ranges of some first-generation electric vehicles. Because fleet managers were worried about employees running out of charge and being stranded, they restricted vehicles to local usage. For example, the County of Santa Barbara's fleet of four first generation Nissan Leafs, purchased in 2013, only averaged 3,714 miles per year. Second and third generation vehicles have operating ranges in the 150 to 300-mile range, and thus range anxiety is being progressively reduced as a challenge for fleet managers.

Impact of Model Availability: In the light-duty category, there are now over 40 electric vehicle models available in California, with all-electric ranges up to 325 miles. Most of these are sedans. SUV selection is more limited, though some new offerings in 2019 and 2020 provide more opportunities for electrifying fleets. Many public fleets have significant numbers of light-duty trucks. While there are currently no mainstream light-duty pick-up truck options on the market, brands like Ford, Workhorse, Havelaar, and Rivian have committed to delivering light-duty electric trucks in the early 2020s.

Lack of appropriate electric vehicle models is reported as a large barrier for many fleets, especially in the medium and heavy-duty sectors. For medium and heavy-duty vehicles, there are limited options from major manufacturers, though there are many offerings from smaller companies. However, many fleet managers are hesitant to deploy vehicles from smaller start-up companies because of high pricing and uncertainty as to whether the company will survive into future years and honor warranties.

School and transit buses are the most mature of medium and heavy-duty electric vehicle technologies and are seen as a key sector to lead the electric vehicle transition in many communities. As a result, the EV Alliance, operator of the E-Fleet Accelerator, focused on school and transit district electrification opportunities. School districts benefited from special Prop 39 grant funding for electric school bus procurement, while transit agencies have been supported by federal and state grant programs and pushed by a new mandate for all California transit districts to ramp up purchases to 100 percent zero emission buses by 2040.

Both plug-in hybrid and battery electric models suitable for diverse fleet applications are proliferating rapidly. Equally important, California purchase incentives (CVRP for light duty and HVIP for medium and heavy-duty) can bring the purchase cost to parity (or better) with internal combustion engine vehicles, while providing significant funding for charging infrastructure. These incentives can in turn be combined with utility and APCD incentives to fund close to 100 percent of charging infrastructure costs in some cases.

Lack of Familiarity with Electric Vehicles and Their Benefits: The third major barrier identified was an unfamiliarity with electric vehicles and their benefits. Fleet managers are often risk-averse by nature as their primary job duties are to maintain existing vehicles in reliable working order, and electric vehicles pose new operational uncertainties and risks. Many fleets also had challenging experiences with past alternative fuels such as CNG and are cautious about expending resources on electrification until the product is fully proven. Concurrently, there has been a lack of fleet electric vehicle mandates or green fleet policies in many organizations. These factors have resulted in very limited electric vehicle adoption in regional fleets to date.

Ownership and Facility Challenges: Fleet depot ownership scenarios also affect the cost and feasibility of siting new charging infrastructure. For fleets based out of leased facilities, understanding the contractual agreements between landlords and tenants is essential to determining who will be responsible for electricity metering, energy costs, infrastructure upgrades, and related operational issues. Fleet managers must also decide if they will own or lease the needed charging infrastructure to fuel their fleet. Multiple ownership arrangements, leasing, and financing approaches are available to fleets. Choosing the right approach is critical to achieving long term savings and electrification benefits. EVSE ownership and infrastructure decisions must also be assessed in light of diverse future scenarios for tenant turnover, property sales, or significant fluctuations in fleet size.

Examples of ownership structures available to fleets include:

- <u>Direct purchase:</u> Paying for the vehicle in one payment after acceptance of the vehicle.
- <u>Loans and financing</u>: The vehicle is paid for over time with interest charges applying to the balance of the financed amount. Vehicle title is transferred at the completion of payment.
- <u>Vehicle leases:</u> Vehicle is paid for through monthly lease payments for a pre-negotiated lease term. Lease payments are based on initial vehicle price minus predicted residual value. Leasing company retains title to the vehicle after the lease period. Agency can purchase, re-lease, or cede vehicle at the end of the lease period.
- <u>Battery lease</u>: In this arrangement, the fleet owns the vehicle body, but leases the battery through a financing agreement with a third party such as a utility or financial capital provider.

- Service lease or "Mobility as a Service": Vehicles and most or all related vehicle services are leased on an agreed "per vehicle mile traveled" basis. Services may include vehicle, infrastructure, fuel, maintenance, and monitoring.
- Charging as a Service: Charging services (and related infrastructure) are procured and bundled with energy costs based on a per kWh or per electric mile travelled basis.

Access and Charging Considerations: Fleet managers should also consider the possibility of providing public access to charging infrastructure when not in use by the fleet. Such "dual use" charging may provide a pathway to securing additional grant support from state and local funders. Of course, providing public access requires well-considered charging rules and priority access requirements. Increased security needs and lot patrols may also be required in the event that dual access is offered. Allowing employees to utilize charging infrastructure during the day and charging fleet vehicles at night is one approach that can increase charger utilization and decrease costs without requiring extensive management of charging station access.

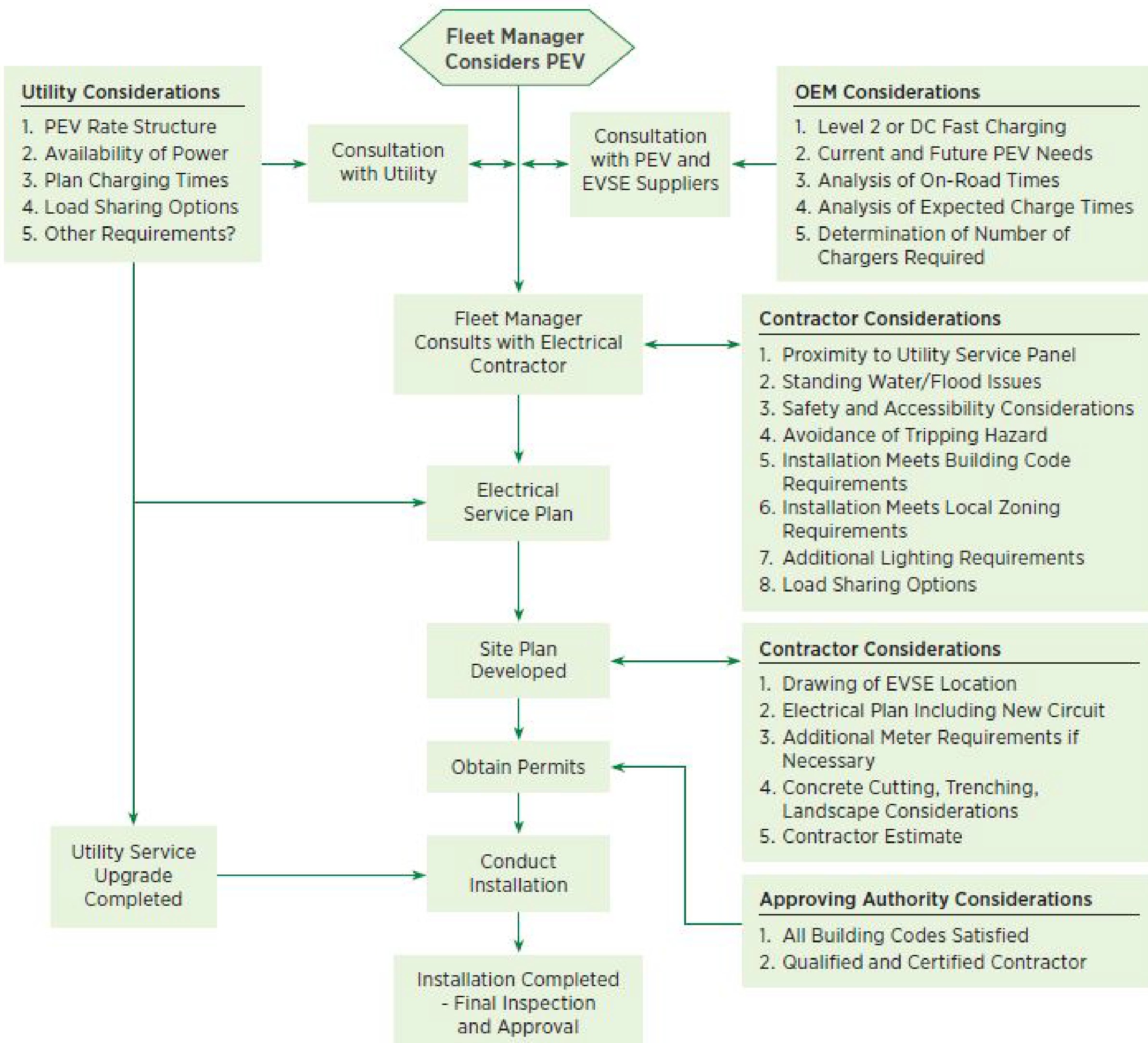
Time of Charging and Load Management: For large fleets, the switch to electric fueling can incur major changes to electrical bills. These impacts can be significant and result in high costs if left unmanaged. As a result, fleet managers should look to local utilities for guidance in taking advantage of rate design options such as electric vehicle-specific TOU rates that offer off-peak charging at lower costs. SCE recently released its new electric vehicle TOU rates that waive demand charges for a period of five years and offer significant discounts for off-peak charging. Fleet consultants and utility staff can help determine if fleet charging needs align with existing rate structures, and project the estimated impact on total fueling costs. Fleet managers may also need to explore other solutions to manage charging load such as the addition of on-site solar generation or energy storage, which can help reduce electricity use during off peak hours when the per kWh cost for electricity from utilities is higher. New electric fleet service companies are also emerging that offer charging management at a fixed cost based on energy use or e-miles travelled.

Electrical Capacity: Physical infrastructure constraints such as panel and conduit capacity can also limit the charging capability for an electric fleet. Fleet managers will need to evaluate if their specific site can accommodate the power requirements of their vehicles. A load study and site inspection by a qualified electrician will be needed, optimally conducted in concert with an electric vehicle infrastructure expert. SCE recently launched Charge Ready Fleet, which provides free site evaluations and pays for "make-ready" infrastructure upgrades for medium and heavy-duty fleets, as well as pays for a portion of the costs of charging infrastructure (up to 100 percent in Disadvantaged Communities). SCE's Charge Ready program can also pay for fleet or workplace chargers at qualifying properties. The SCE Charge Ready Fleet program provides free load studies and site inspections of electrical infrastructure for eligible sites that apply and are selected for consideration by utility staff.

ADA and Signage: Navigating permitting and building code requirements is a critical step in the electrification process. Fleet managers will need to conform to local ordinances regarding EVSE installation in consultation with local permitting authorities. Aligning with ADA guidelines are particularly important to local authorities having jurisdiction, and these guidelines are subject to varying local interpretations. Key guidance on ADA issues is provided by the California State Governor's Office of Planning and Research through their *ZEV Guidebook* and related publications. (See http://www.opr.ca.gov/docs/ZEV_Guidebook.pdf.) Project developers are advised to check the OPR website regularly for the most recent guidance. Signage for EVSE equipped parking spaces is also very important. Signage guidelines are also available in the ZEV Guidebook and should conform to both state motor vehicle code and local ordinances.

Putting it All Together: The diagram below describes the critical pathway for fleet electric vehicle infrastructure planning. It is highly recommended that fleet managers identify a trusted partner in navigating the fleet electrification process in its initial stages, as a means to build internal capacity and avoid costly mistakes. Electric Vehicle Service Providers (such as ChargePoint or Greenlots), vehicle OEMs, or independent consultants (such as EV Charging Pros or electriphi) can provide guidance and recommendations on expert assistance to navigate the various dimensions of fleet electrification and electric vehicle charging management.

Figure 1: Navigating Electric Vehicle Charging Installation for Fleets[138]



---

[138] Climate Mayors Purchasing Collaborative: Theevproject.com/document.php

Strategies and Recommendations for Accelerating Fleet Electrification

As summarized above, fleet electrification is impeded by several well-known electric vehicle adoption barriers. To address these challenges, a variety of program strategies are critical to help fleet managers make a rapid and successful electric transition. These strategies optimally involve the coordinated efforts of state agencies, utilities, Air Districts, county and city agencies, and Electric Vehicle Service Providers.

Creating electrification goals and policies: The most important factors for successful fleet electrification are overarching goals and electric vehicle purchasing policies. The State of California Green Fleet [139] is one of the most successful electric vehicle fleets in nation, with over 700 ZEVs. The State Fleet is exceeding goals of 25 percent of light duty vehicle purchases being zero emission by 2020, which increases to 50 percent by 2025. The State Fleet instituted a ZEV-and-hybrid-first purchasing policy, which mandates departments to consider a ZEV first, then a plug-in hybrid, and then a conventional hybrid. If a state agency proposes the purchase of an internal combustion engine despite the availability of low or zero emissions alternatives, that agency must provide a justification for not selecting one of the available ZEV, plug-in hybrid, or hybrid vehicle options. The State Fleet has had success in exceeding their ZEV goals by setting electric vehicles as the default, creating accountability, and centralizing fleet purchasing authority.
Additional strategies for accelerating fleet electrification at both the communitywide and organizational level are described below.

Recommendations for Fleet Electrification

- **Recommendation #1 - Provide outreach and education to fleet managers on all aspects of the fleet electrification value proposition**, including: 1) distributing educational materials and electrification guidance documents; 2) facilitating webinars, Lunch and Learns, and other educational events to raise awareness and demand among vehicle users; and 3) forming working groups to promote high-level planning and share best practices.
- **Recommendation #2 - Provide Electric Vehicle Coach** support that will help fleet operators access direct incentives to cover EVSE equipment and installation costs with an emphasis on solutions that include smart charging deployment when duty cycles allow, which will help reduce fleet charging electricity costs.
- **Recommendation #3 - Provide technical assistance with fleet transition planning**, giving priority to the region's largest fleets and fleets that operate in Disadvantaged Communities. Technical assistance could include vehicle and EVSE selection, electrical upgrades and infrastructure design, charging management, selection of the most cost-effective electric utility rate plan for electric vehicle charging, and funding support. The plans should assess electrification viability, operational benefits, high-level capital cost, vehicle duty cycle, and routing to determine the most cost-efficient electrification pathway given current electric vehicle choices in the marketplace. (Note that the analyses conducted in the City of Ventura and City of Oxnard Electric Vehicle Accelerator plans provide potential models.)
- **Recommendation #4 - Establish a ZEV policy** requiring fleets to purchase electric vehicles based on a model comparable to the California State Department of General Services policy which prioritizes: (1) ZEVs (BEVs and Fuel Cell Electric Vehicles), (2) Plug-in hybrid electric vehicles, and (3) Conventional hybrids. This will ensure that ZEVs and plug-in hybrids are the first options considered for new vehicles. To make the "ZEV first" policy binding, fleets should

[139] State of California Green Fleet. Retrieved from: https://www.green.ca.gov/fleet/

implement additional policies to: (1) Require that the proposed procurement for each non-ZEV or non- plug-in hybrid electric vehicles option includes a written justification explaining why the fleet manager was unable to select a ZEV or plug-in hybrid electric vehicles; and (2) Centralize fleet procurement authority with an appropriate department head, so they can review the selected vehicles proposed for procurement, approve vehicles as appropriate, and require revisions of selected vehicles if the justification for non-ZEV options is lacking.

- **Recommendation #5 - Conduct Electric Vehicle Ride and Drive events** aimed at employees and fleet operators to help induce greater demand for electric vehicles in fleets.
- **Recommendation #5 - Identify fleet electrification projects that can leverage LCFS credit markets** to help reduce the cost - or potentially cover the full cost - of fleet electric vehicle charging.

Targeted Opportunities for Accelerating Fleet Electrification in Ventura County

Recent efforts to accelerate fleet electrification in Ventura County have been advanced by the E-Fleet Accelerator program operated by EV Alliance, and complementary outreach and engagement by VCREA, the Community Environmental Council of Santa Barbara, the Ventura County APCD, and other stakeholders. The EV Alliance and other partners have found that public agencies – which tend to have proportionately more light-duty vehicles vs. medium- and heavy-duty vehicles – are currently most receptive to electrification initiatives given that most electric vehicles available today are in the light-duty segment. Additionally, many transit and school bus operators are significantly engaged in the electric vehicle transition as electric bus products come onto the market with attractive incentives and robust performance.

Within the public fleet segment, counties have more compelling use cases for fleet electrification than cities. Counties are much larger agencies and cover larger geographic areas, which increases the potential for higher electric vehicle utilization and significant emission reduction benefits. The County of Ventura has over 1,700 fleet vehicles. Some employees are regularly making long trips from the county's administrative center in the City of Ventura to Thousand Oaks, Moorpark, or Simi Valley. These trips could be made with a longer-range battery electric vehicle such as a Chevrolet Bolt, leading to a higher number of electric miles travelled and a shorter payback period for new electric vehicles. Counties also operate many departments with high numbers of employees using assigned cars that travel over 30 miles per day, such as Social Services, Probation, Child Welfare Services, Building Inspectors, and more. These departmental use cases are prime targets for electric vehicles given the faster payback on high mileage utilization.

In contrast, many Central Coast municipal fleet vehicles rarely drive outside of city jurisdictions, and total fleet size is small. In general, most cities in the region do not have departments with frequent travel requirements. Therefore, to maximize electric vehicle miles traveled per dollar expended, it is recommended that electric vehicle and EVSE investments be focused on vehicles utilized at least 30-60 miles per day. New, higher range electric vehicles should be purchased for pool cars, with protocols developed via fleet management software to assign these cars to employees that are traveling the highest mileage each day. The County of Ventura is taking the lead to implement many of these recommendations by developing their own Electric Vehicle Action Plan.

As noted above, leading transit and school bus operators throughout the County are already engaged in electric vehicle transition planning. Many Central Coast school districts applied for recent electric school bus funding provided by the California Energy Commission under GFO-18-604. Two school districts in Ventura County -- Oxnard Union High School District and Ocean View Elementary School District -- were selected to receive funding awards.[140] Additional funding opportunities are anticipated to become available in future years. In addition, it is recommended that District Transportation Directors keep abreast of new models for financing electric school buses through innovative approaches (described in Chapter 4). These include strategies for financing the entire E-Bus fleet as well as the supporting electric vehicle charging infrastructure through wrap-around financing that includes V2G integration. Companies such as Highland Electric Transportation and Amply are pioneering in these solutions.

While the County's major transit operators are engaged in electric vehicle related planning, the project team did not identify any regional paratransit agencies that operate electric vehicles to date. However, many were interested in fleet electrification for their light- and medium-duty vans and shuttles. Several local agencies run dozens of these vehicles, often traveling 50-100 miles per day with day-ahead scheduling, making this segment ripe for electrification. Through the E-Fleet Accelerator project, presentations on relevant electric vehicle products were arranged with local paratransit agencies. However, most agencies are waiting for better pricing and increased model availability before moving ahead with electric vehicle procurement. It is recommended that Electric Drive 805 and local government partners consider engaging with Ventura County paratransit service providers on a future grant opportunity or electric vehicle infrastructure project to overcome initial cost barriers to paratransit fleet electrification.

Workplace charging for public agency "employee fleets": Local public agencies are some of the largest employers in the region, with the County of Ventura having over 8,000 employees. On average, County employees have workplace commutes that are under 30 miles round trip and are will within the electric driving range of most battery electric vehicles. A more detailed analysis of County commuting data at the departmental level could help VCREA identify departments that present the best opportunities for electric vehicle adoption. VCREA could then conduct targeted workplace outreach to these departments based on their commuting needs. Electric Drive 805 and regional stakeholders should also prioritize plans to develop workplace charging at larger public and private organizations in the County and develop turnkey education and outreach materials for employers to help workers electrify their commutes.

[140] California Energy Commission. GFO-18-604. Notice of Proposed Award. Retrieved from: https://www.energy.ca.gov/contracts/GFO-18-604_NOPA.pdf

Chapter 5 References

Alternative Fuels Data Center. Charging Plug-in Electric Vehicles. Retrieved from: https://afdc.energy.gov/fuels/electricity_charging_home.html

Climate Mayors Electric Vehicles Purchasing Collaborative. Retrieved from: https://driveevfleets.org/

Kerman K. NYC DCAS. A Sustainable Future for Fleet. (June 3, 2019). Retrieved from: https://www1.nyc.gov/assets/dcas/downloads/pdf/fleet/Keith-Kerman-Presentation-A-Sustainable-Future-for-Fleet-NYC-Fleet-Montreal-Canada-June-3-2019.pdf

Kerman K. NYC DCAS. Reducing Maintenance Costs with Electric Vehicles. Retrieved from: https://www1.nyc.gov/assets/dcas/downloads/pdf/fleet/NYC-Fleet-Newsletter-255-March-8-2019-Reducing-Maintenance-Costs-With-Electric-Vehicles.pdf

State of California Green Fleet. Retrieved from: https://www.green.ca.gov/fleet/

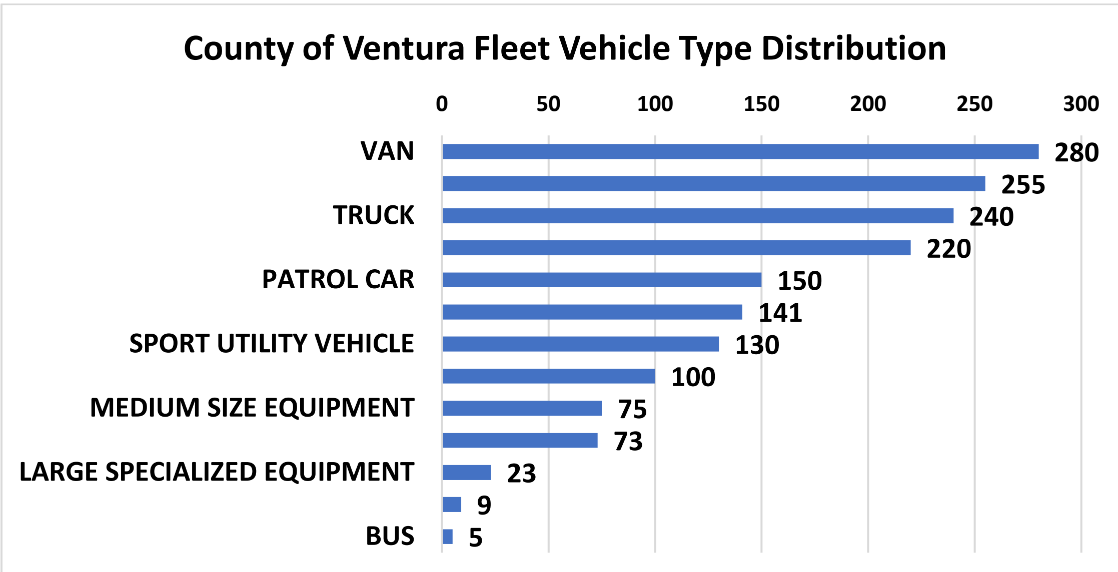
Southern California Edison. Electric Transportation. Retrieved from: https://www.edison.com/home/innovation/electric-transportation.html

Southern California Edison. Schedule TOU-EV-1. Retrieved from: https://www1.sce.com/NR/sc3/tm2/pdf/ce114-12.pdf

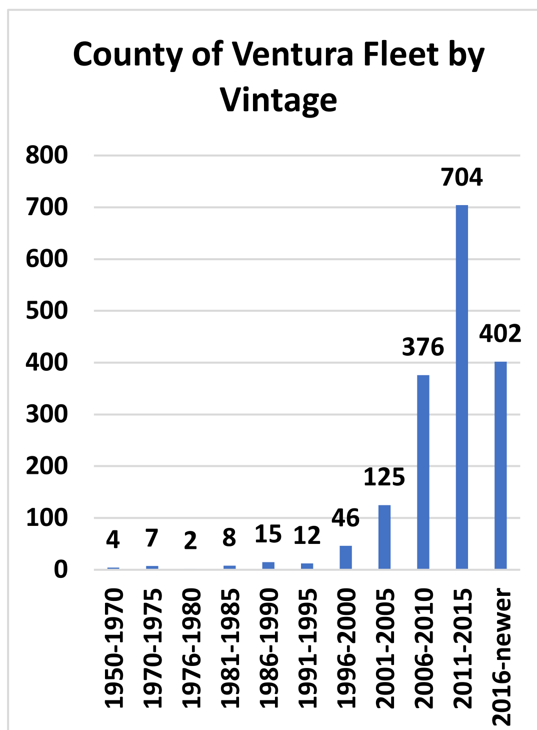
Chapter 5 Appendix: Data on Public and Private Fleets in Ventura County

County of Ventura

The County of Ventura currently manages a fleet of 1701 vehicles across multiple departments and diverse use cases. The fleet is comprised predominantly of light-duty sedans, vans, trucks, and specialized equipment (including motor graders, chippers, dozers, cranes, pavers, golf carts, boats, forklifts, and cement mixers), as well as medium and heavy-duty trucks, along with other vehicle categories noted below. Out of the entire fleet there are currently 11 plug-in hybrids, one pure battery electric, and two electric maintenance vehicles. Fleet vehicles are predominantly manufactured after 2006.

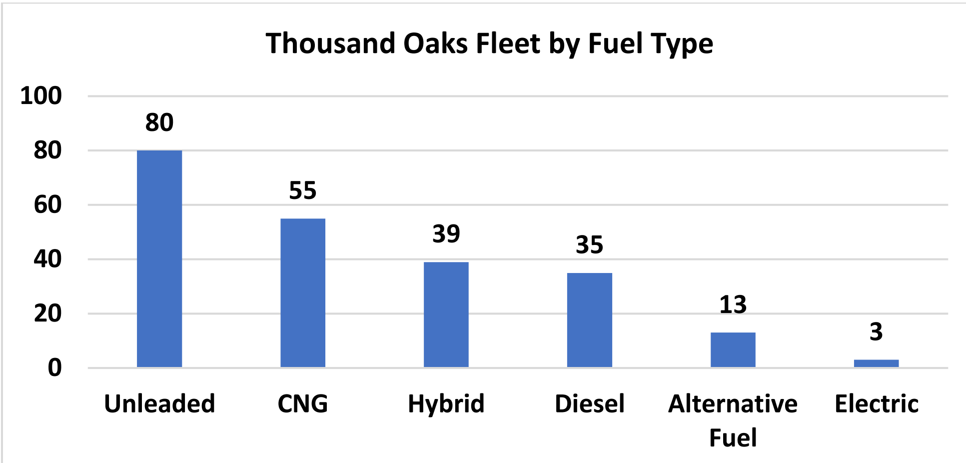


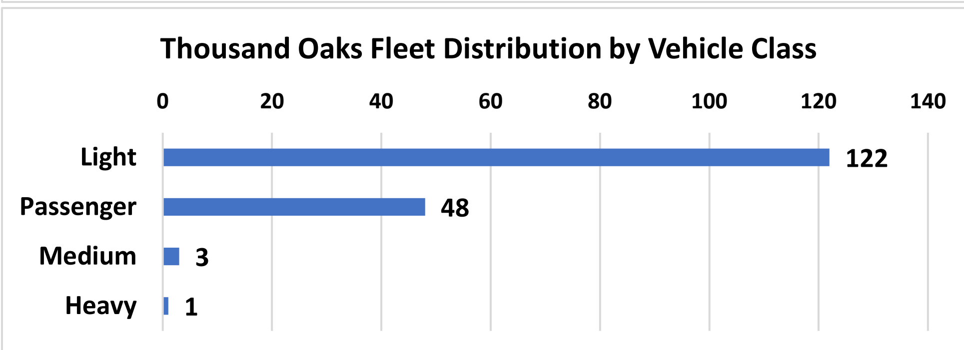
County of Ventura Fleet Vehicle Mileage	
Vehicle Type	Average Mileage
LARGE EQUIPMENT	61,953
MEDIUM AND HEAVY TRUCK	57,610
BUS	55,889
VAN	52,729
TRUCK	51,365
PATROL CAR	50,873
SHERIFF VEHICLES	46,762
SPORT UTILITY VEHICLE	42,746
SEDAN	38,349
LARGE SPECIALIZED EQUIPMENT	31,060
MEDIUM SIZE EQUIPMENT	25,123
SMALL EQUIPMENT	1,147
MOTORCYCLE	113

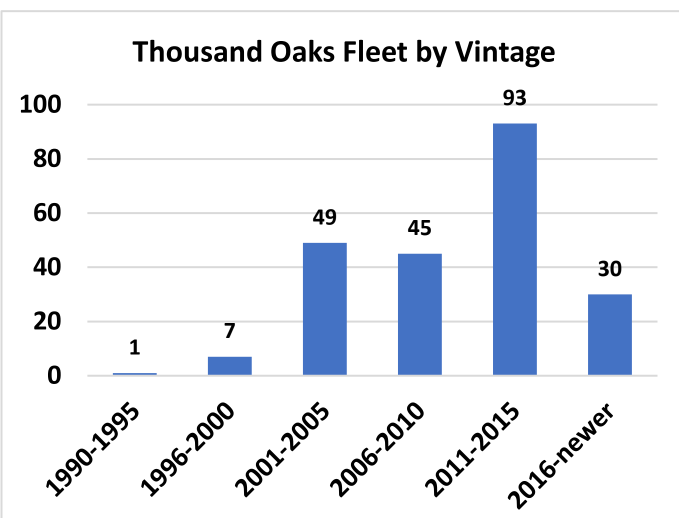


City of Thousand Oaks

The City of Thousand Oaks manages a fleet of 174 vehicles, predominantly light duty Vehicles. The fleet is mainly fueled by gasoline and compressed natural gas. Most of the fleet vehicles were manufactured between 2011 and 2015 and, on average, are reported with mileage between 33,000 and 68,490 miles, with the exception of the city's six CNG buses which range in mileage between 88,144 and 446,465 miles.



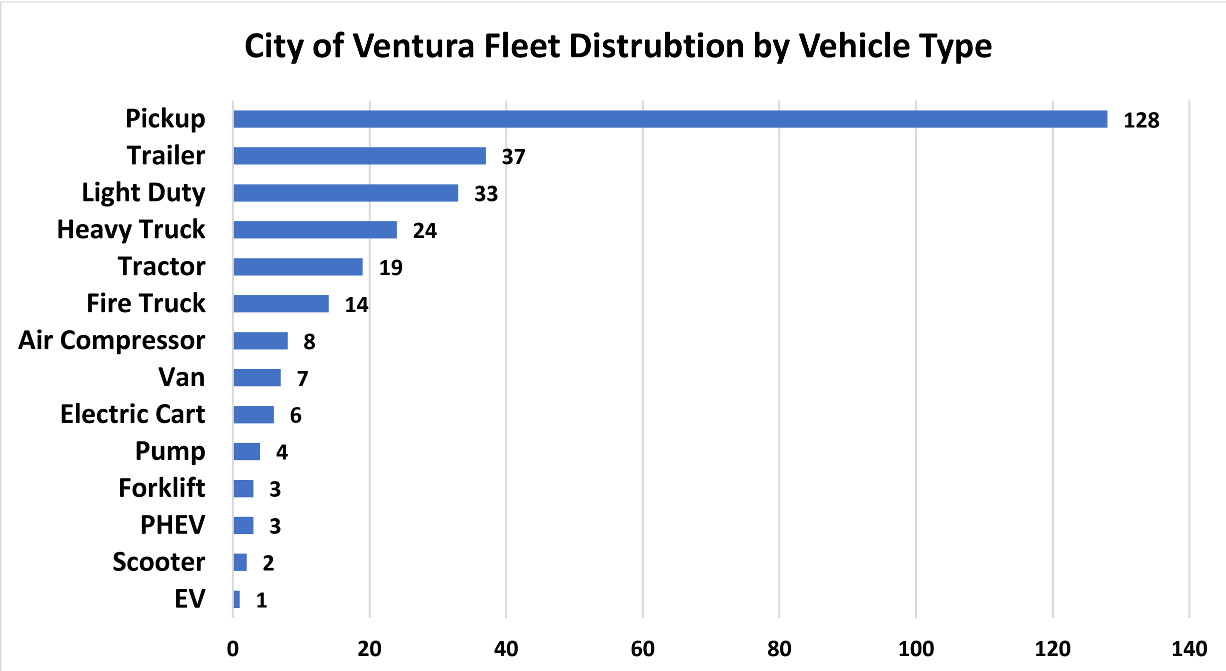


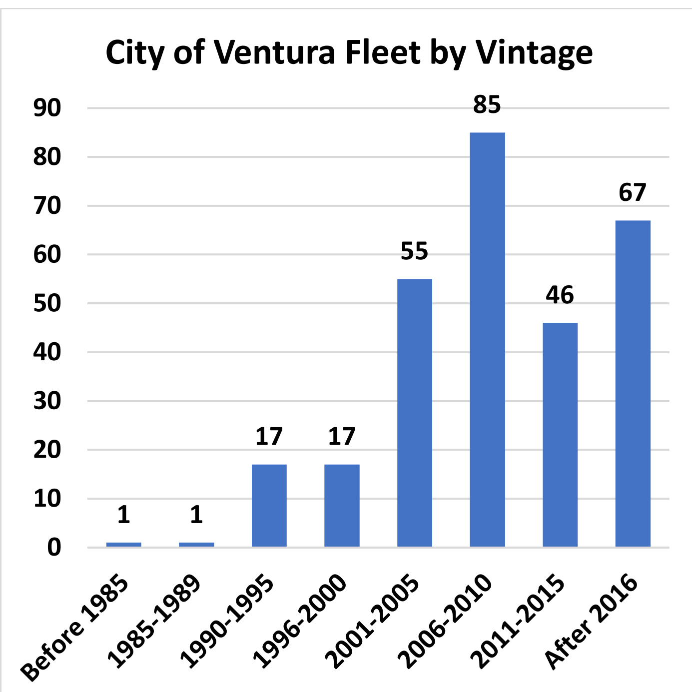


Thousand Oaks Average Mileage by Vehicle Type	
Vehicle Type	Average Mileage
Bus	307,047
medium	68,490
light	55,599
heavy	52,370
passenger	33,646

City of Ventura

The City of Ventura's fleet is largely comprised of pickup trucks and other light duty vehicles, with heavy duty trucks and equipment making up the balance of the fleet. The City utilizes three plug-in hybrid vehicles and three battery electric vehicles, two Kia Souls and a 2003 Toyota RAV4 electric vehicle. (More detailed analysis and information is available in the 2019 City of Ventura Electric Vehicle Accelerator Plan.)

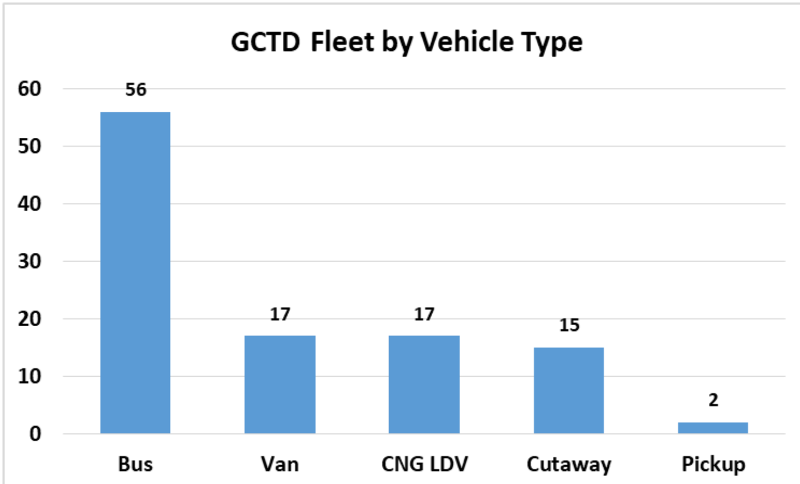


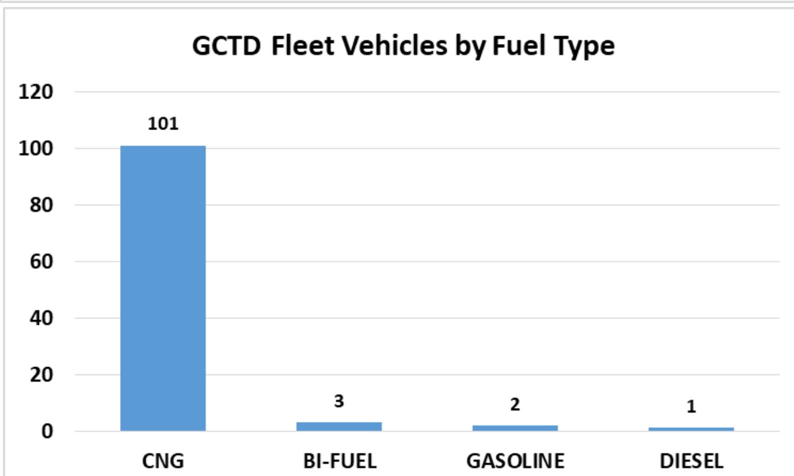


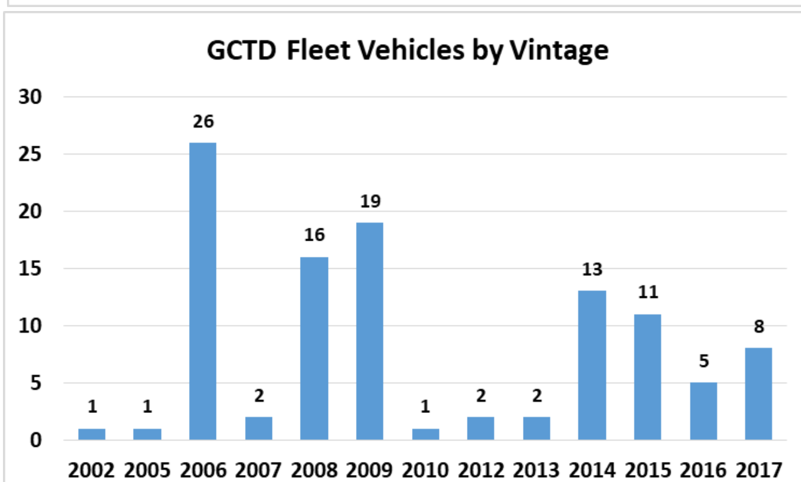
City of Ventura Fleet Vehicles Average Mileage	
Vehicle type	Average Mileage
Fire Truck	73,234
Light Duty	64,858
Pickup	57,570
Van	55,800
EV	50,992
PHEV	36,638
Heavy Truck	30,966
Air Compressor	4,489
Electric Cart	2,524
Tractor	1,771
Scooter	1,672
Forklift	1,554
Pump	852
Trailer	687

Gold Coast Transit

GCT manages a fleet of 107 vehicles primarily fueled by compressed natural gas. Most of the fleet was manufactured after 2006. Buses are the most common vehicle in the GCT fleet, with 56 vehicles. No information on mileage of the fleet was provided. GCT recently applied to the low or no emission bus program, if approved they will receive up to three fully electric buses.

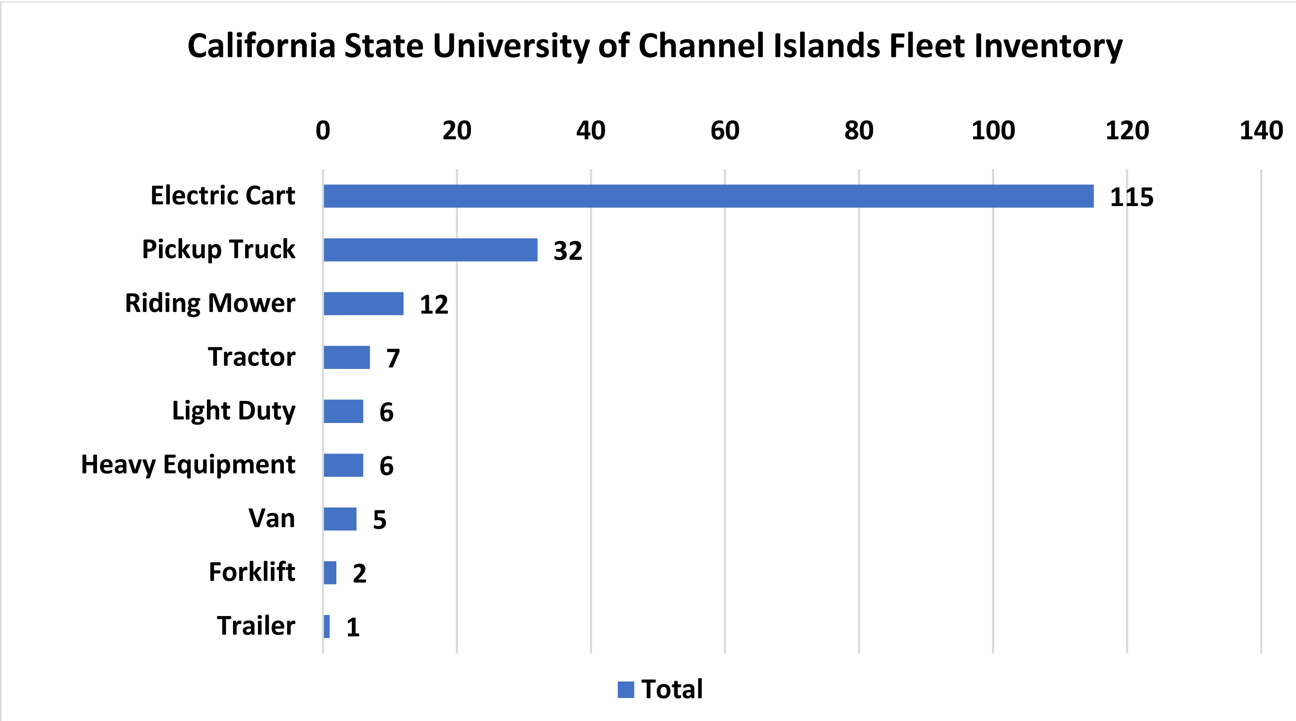


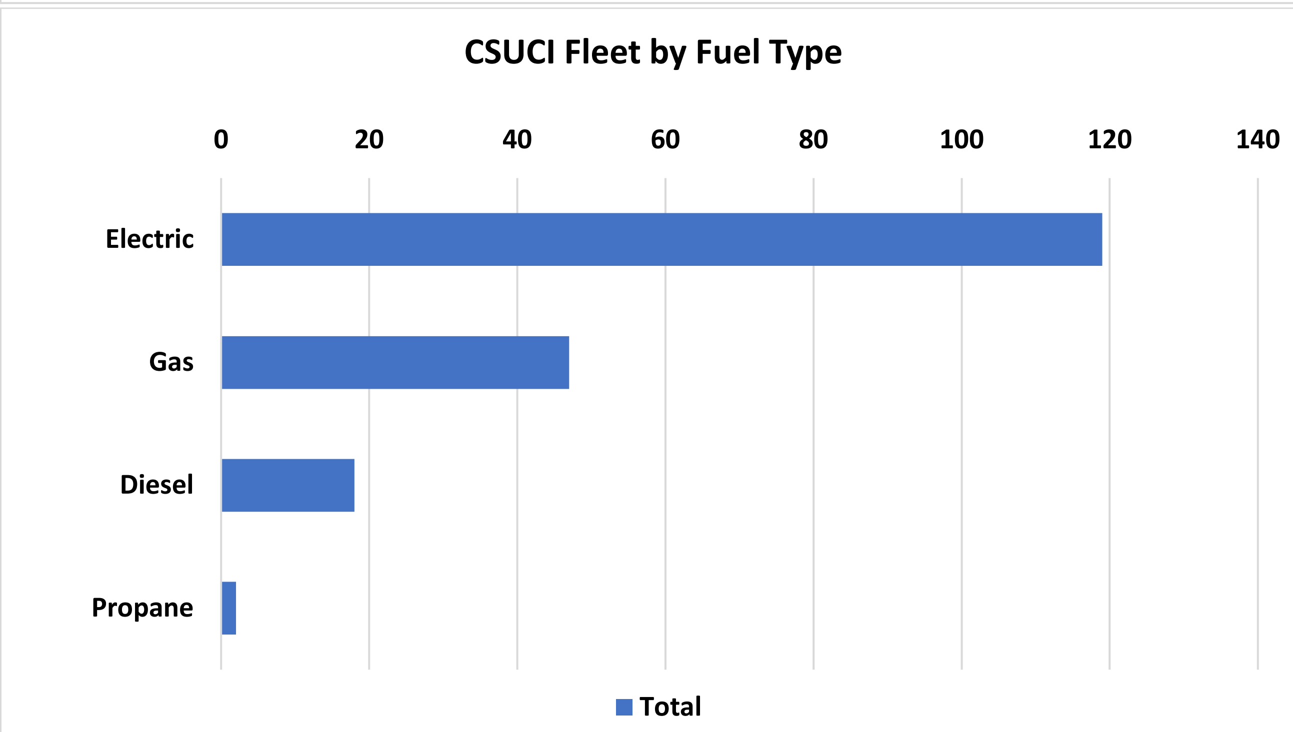




California State University of Channel Islands (CSUCI)

CSUCI fleet of 186 vehicles is mainly comprised of electric carts and pickup trucks. No mileage or vintage information was provided.





School Districts

Moorpark Unified School District (MUSD)

MUSD manages 17 buses ranging in age from 1989 to 2007. No mileage information was provided.

MUSD School Bus Fleet

Year	# Pass.	Make	Model
1989	87	CROWN	SUPER COACH
1999	84	INTERNATIONAL	3800
2001	84	INTERNATIONAL	MAXXFORCE
1998	53	INTERNATIONAL	AMTRAN
1998	53	INTERNATIONAL	AMTRAN
1986	78	CROWN	SUPER COACH
2017	81	BLUEBIRD	T3RE
1989	90	CROWN	TANDEM
1994	84	BLUEBIRD	ALL AMERICAN
2001	84	INTERNATIONAL	MAXXFORCE
2001	84	INTERNATIONAL	MAXXFORCE
2007	22	FORD	THOMAS
2007	62	INTERNATIONAL	MAXXFORCE
2010	79	INTERNATIONAL	MAXXFORCE
2010	79	INTERNATIONAL	MAXXFORCE
2007	50	THOMAS	Unknown
2007	50	THOMAS	Unknown

Oxnard School District

Oxnard School District manages a fleet of 10 BlueBird diesel buses ranging in age from 2002-2016.

Oxnard School District Bus Fleet

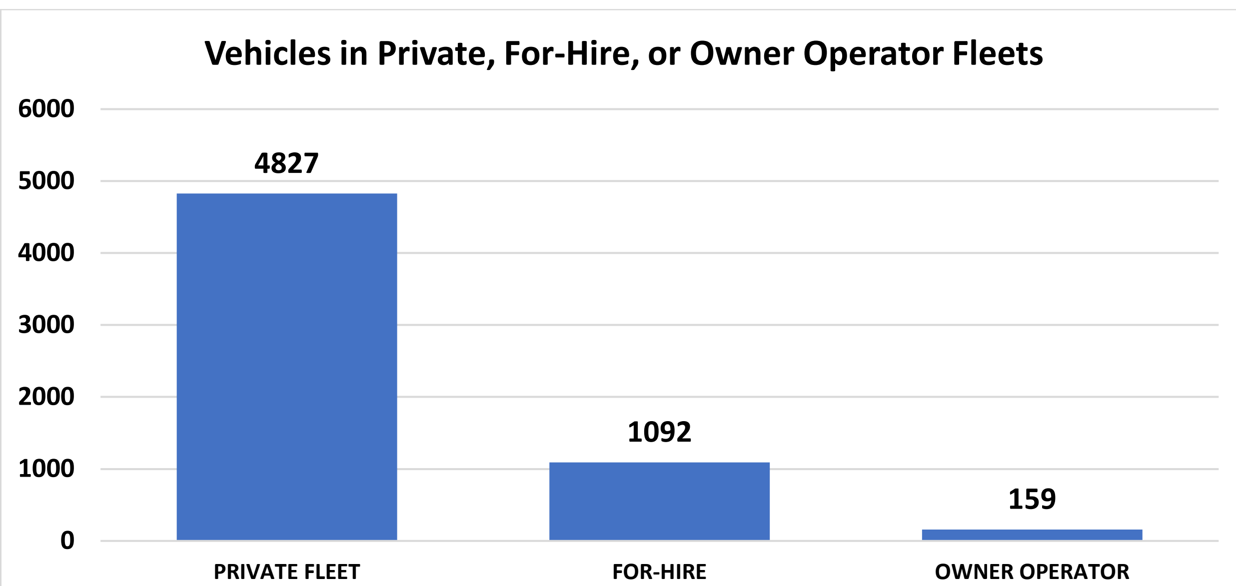
YEAR	MAKE	Current Mileage	ENGINE MAKE
2014	Bluebird	40260	Cummins
2002	Blue Bird	157816	John Deere
2014	Bluebird	32225	Cummins
2005	Bluebird	139763	John Deere
2003	Bluebird	166747	John Deere
2006	Bluebird	141157	John Deere
2008	Bluebird	100368	John Deere
2008	Bluebird	98038	John Deere
2008	Bluebird	93820	John Deere
2016	Bluebird	17312	Cummins

Electric Vehicles in Private Fleets

Based on available FleetSeek data, there are currently 496 fleets domiciled in Ventura County, consisting of 6078 vehicles. These fleets include 218 trucks and 404 tractors. The City of Oxnard hosts the largest population of private fleet vehicles, with a total of 2018 vehicles. The Verizon fleet is almost as large (at more than one thousand vehicles) as the other top eight fleets combined.

Figure xx: Private Fleet Vehicles by City

City	Total Fleet Vehicles	Total Owned Vehicles	Total Leased Vehicles	Total Trucks	Total Tractors
Santa Rosa Valley	11	3		2	3
Somis	16	2			2
Thousand Oaks	17	11		1	10
Port Hueneme	26	9		2	9
Piru	32	6		6	4
Ojai	50	6			6
Fillmore	113	9		6	8
Newbury Park	137	21		16	9
Moorpark	149	10	1	5	10
Simi Valley	303	60	3	23	41
Camarillo	312	31	7	22	28
Santa Paula	326	37	6	16	37
Westlake Village	1189	4	4	4	2
Ventura	1379	71		44	49
Oxnard	2018	203	29	71	186
Grand Total	**6078**	**483**	**50**	**218**	**404**



Top 10 Private Fleets in Ventura County by Size		
Fleet	**Total Vehicles**	**Percent of Total Fleet Vehicles**
Verizon California, Inc.	1178	19%
E J Harrison & Sons, Inc.	262	4%
Hiji Brothers Ranches	240	4%
Fast Undercar, Inc.	212	3%
AG RX	164	3%
Fence Factory	126	2%
Great Western Building Materials	114	2%
Reiter Affiliated Companies, Inc.	108	2%
T&T Truck & Crane Service	104	2%
Tidwell Excavating, Inc.	104	2%
TOTAL	**2612**	**43%**

Top 10 For-Hire Private Fleets in Ventura County by Size		
Fleet	**Total Vehicles**	**Percent of Total Fleet Vehicles**
Oilfield Service and Trucking--OST Trucking	147	2.4%
West Coast Refrigerated Trucking Inc.	72	1.2%
B E McCarty Inc.	72	1.2%
Channel Islands Logistics, Inc.	55	0.9%
Black Gold Industries Inc.	52	0.9%
Conico Wholesale LLC	48	0.8%
MJ Tank Lines	46	0.8%
Lujan Transport Inc.	42	0.7%
A&S Transportation, Inc.	36	0.6%
Hoskins Bros. Trucking Co. Inc.	26	0.4%
TOTAL	**596**	**9.8%**

Ventura County Electric Vehicle Ready Blueprint

Chapter 6: Electric Vehicle Market Acceleration

Factors Influencing Electric Vehicle Purchase Decisions

The decision to purchase an electric vehicle reflects multiple motivations, which typically includes the desire for cleaner mobility; cost savings from electric fueling and reduced maintenance requirements; the "electric experience" of superior acceleration, handling, and a quiet ride; cutting-edge styling and engineering; and the opportunity to join a growing community of passionate electric vehicle owners. Additional key factors in deciding among electric vehicle models include:

- Purchase and operating costs
- Availability of attractive lease deals
- Availability of secure, low-cost financing
- Vehicle range
- Charging time
- Availability and convenience of residential, public, and workplace charging
- Brand perception and status
- Availability of incentives, especially HOV lane access, increased parking access (e.g. electric vehicle-only parking spaces for charging), and point-of-purchase rebates.

While the array of benefits that electric vehicles provide are largely the same across model type, commercial fleet managers may put a greater emphasis on reduced maintenance and fueling costs, while long-distance travelers may care most about range and access to reliable fast charging. Given the diversity of customer interests and motivations, electric vehicle-related educational resources and campaigns should be tailored to the unique needs and values of diverse customer types. The following table aims to distinguish the factors that can influence people's decision making for electric vehicle purchases or leases.

Table 1: Electric Vehicle Utilization by Stakeholder Segment

Stakeholder	Main vehicle types used	EV charging infrastructure equipment typically used	Driving behavior and vehicle usage description
Public agency	A mix of light, medium, and heavy-duty vehicles including sedans, vans, pick-ups, and utility vehicles	Level 2 supported by DC fast charging in larger fleets or fleets with heavy driving needs; some Level 1 charging for employee and fleet vehicles that are parked more than six hours a day	Light to heavy usage depending on the vehicle and application
Transportation network company Taxi company	A mix of light duty vehicles which may include sedans, SUVs and vans. Vehicle ownership may include independent contractors and employee drivers	Level 1, Level 2, or DC Fast Charge depending on access to charging. Potential heavy reliance on public infrastructure	Intermittent heavy usage depending on the day of the week, time of day, local geography, and customer demand
Transit agency	Heavy duty vehicles including buses,	Level 2, DC Fast Charge, or individually tailored	Heavy daily usage, with potential for long

	paratransit vehicles, vans, and some light duty support vehicles	charging technology such as induction or pantograph systems	range, frequent stops, and long-duration duty cycles
Port & delivery fleet	A mix of cargo vans and light, medium, or heavy-duty vehicles, port and shipping fleets with unique heavy-duty vehicle and yard vehicle needs	Level 2 supported by potential DC Fast Charging in some fleets with heavy usage cycles	Heavy usage with intensive on-site charging demands for some users.
Individual driver	Light duty vehicles potentially including smaller e-mobility options (e-bikes, e-scooters, etc.), as well as forthcoming medium and heavy-duty e-trucks	Level 1 or Level 2 home charging, use of public and workplace charging, and DC Fast Charge use for longer trips or quick recharging	Variable usage, commuting, local trips

Electric Vehicle Awareness

Nearly a decade after the first introduction of mass-market electric vehicles, electric vehicle category awareness remains quite low. In late 2016, the research firm of Altman Vilandrie & Co. reaffirmed findings from other studies in which 60 percent of U.S. drivers said they were "unaware of electric cars." Of those who were aware, most cited these issues as persistent impediments to an electric vehicle purchase:

- Perceived lack of charging stations (mentioned by 85 percent of respondents)
- High electric vehicle purchase costs (83 percent)
- Range anxiety (74 percent) [141]

While electric vehicle awareness varies by region, even in California -- the state with the highest electric vehicle uptake – a late 2017 study indicates that most households are not well-informed about electric vehicles. According to the Institute of Transportation Studies at the University of California at Davis, in 2016, fewer than 35 percent of households were aware that the state offers electric vehicle rebates, and the percentage of households which had considered an electric vehicle is no higher in 2017 than it was in 2014. [142] In 2017, barely 5 percent of Californians already owned a battery electric vehicle or had actively shopped for one. Approximately 13 percent said they had gathered some information about battery electric vehicles but were not seriously considering one. On a more positive note, more than 60 percent of consumers said they would consider an electric vehicle for their next vehicle purchase. [143]

---

[141] Business Wire. High Costs, Lack of Awareness Threaten to Short Out Electric Vehicle Adoption. Retrieved: https://www.businesswire.com/news/home/20161208005809/en/High-Costs-Lack-Awareness-Threaten-Short-Electric

[142] UC Davis, Institute of Transportation Studies. Kurani, K., Caperello, N., TyreeHegeman. J. July, 2016. *New Car Buyers' Valuation of Zero-Emission Vehicles in California.*

[143] https://its.ucdavis.edu/blog-post/automakers-policymakers-on-path-to-electric-vehicles-consumers-are-not/

Electric Vehicle Demand Surveys: As part of the project team's efforts to better understand barriers to vehicle electrification in Ventura County, electric vehicle charging demand surveys were sent out to several large workplaces and multi-family housing developments. Among electric vehicle drivers who responded, the overwhelming majority (97 percent) are in favor of additional charging at their workplace. While most respondents with an electric vehicle charge at home (68 percent), a strong majority of electric vehicle drivers would charge at work if it would cost as little as charging at home. A majority of these electric vehicle drivers use a Level 2 charger, and far more have charging access at home (79 percent) than at work (25 percent).

In their survey comments, electric vehicle drivers' most common concerns were evenly split between lack of chargers (51 percent) and cost of chargers (49 percent). Among non-electric vehicle drivers, 60 percent said they would consider purchasing a plug-in electric vehicle for their next vehicle, which is in line with previous survey results. Additionally, an overwhelming majority (87 percent) of those considering an electric vehicle would be more likely to purchase one if they had access to charging at work. The most commonly cited concerns about purchasing an electric vehicle among this group are: lack of charging stations at work, cost of charging at work, having to monitor their vehicles' charge status, and the upfront cost of the vehicle. Respondents not considering an electric vehicle as their next vehicle cited cost, not being in the car market, no access to charging, range anxiety, uncertainty about electric vehicle technology, and concerns about battery disposal.

Respondents from the County of Ventura provided recommendations for new or additional charging locations at their County worksites that staff will use for future charging station planning efforts. The project team conducted three "Electric Vehicle Lunch and Learns" with groups of County staff to increase awareness of electric vehicles and learn more about transportation barriers among County employees. Given the high interest in electric vehicles, more charging stations and outreach to employees could greatly increase the already high electric vehicle adoption rate among County employees.

Strategies for Increasing Electric Vehicle Awareness

As of October 2018, cumulative electric vehicle adoption in Ventura County comprises a little more than one percent of total vehicle ownership in the County, with 8,589 plug-in vehicles and 50 hydrogen fuel cell vehicles.[144] On a statewide basis, electric vehicle market growth has been rapid. Electric vehicle purchases as a percentage of new car sales hit almost 8 percent in California in 2018. However, to achieve Ventura's share of statewide electric vehicle targets, a 24 percent combined annual rate of growth is needed. Based on the County's population, Ventura will need 116,777 ZEVs by 2030 to reach its pro rata share of state goals. To achieve this level of market saturation, electric vehicle purchases as a percentage of new car sales must increase from approximately 7-10 percent today to approximately 30-40 percent in 2030.

To achieve this new level of growth in electric vehicle adoption, the region's electric vehicle stakeholders must promote increased awareness and understanding of the benefits of electric vehicles, work to enhance charging infrastructure, and boost both vehicle and charging incentives where feasible and

[144] Based on 2018 DMV statistics, full EV adoption tables available in chapter 1 of this report

appropriate. Fortunately, a variety of locally actionable strategies have been demonstrated to improve electric vehicle awareness and increase sales and utilization. These include:

- Identifying priorities and allocating sufficient funding for electric vehicle awareness activities
- Targeted and multilingual electric vehicle awareness activities to promote the next wave of electric vehicle adoption
- Ride and drive and employer engagement campaigns with the support of local Electric Vehicle Champions, similar to existing efforts at County of Ventura work sites
- Brand-neutral promotion of electric vehicles through local events, media, and digital marketing
- Development of electric vehicle information resources from trusted entities, including local governments, community-based organizations, and collaboratives such as Electric Drive 805
- Improved charging networks including workplace, destination, and multi-family charging
- Dealer and sales training and incentives to improve the electric vehicle customer experience and sales rate
- Electric vehicle charging infrastructure and vehicle incentives supported by local utilities and APCDs.

Prioritizing and Funding Electric Vehicle Awareness Activities

Improved awareness of electric vehicle and charging infrastructure development is critical for market acceleration. Effective awareness activities include brand-neutral marketing and direct community outreach events, Ride and Drive events, incentive program publicity and assistance, and high-visibility charging infrastructure deployment (including prominent signage). Mass market electric vehicle education and outreach is beginning to scale up in California, funded through the Volkswagen settlement, utility mandates, and other sources. These California-wide messages should be supplemented by local electric vehicle messaging.

Effective public outreach requires sufficient funding to:

- Develop initial plan outreach strategies
- Create targeted messaging and distribute outreach materials
- Deliver information to the community through multiple channels, such as press releases and news stories, social media, the ElectricDrive805.org website, and electric vehicle charging related information at municipal building counters
- Conduct direct community outreach events such as Electric Vehicle Showcases, Ride and Drives, or workplace Lunch and Learns
- Review and evaluate the impact of awareness activities on an iterative basis
- Refine outreach approaches to improve outcomes and adapt strategies to meet emerging needs
- Conduct community and workplace surveys to better understand transportation needs and barriers to electric vehicle adoption.

Insufficient funding for effective outreach is one of the main reasons that public awareness campaigns fail to broadly increase awareness and create change. Local governments can incorporate electric vehicle awareness and engagement activities into their annual budget planning processes to help ensure that funding is prioritized according to local electric vehicle goals and community needs. Developing a set of clearly defined goals and measurable outcomes for electric vehicle awareness activities can also help local governments identify the necessary resources for outreach and prioritize specific strategies. Local governments and stakeholders should use key performance indicators and impact tracking frameworks to evaluate the success of engagement activities over time.

Forging strategic alliances with community partners and utilities can help broaden the reach and impact of electric vehicle awareness activities. Collaboration with community-based organizations and local electric vehicle owner groups, including the EV Advocates of Ventura County, can help local governments deliver more effective awareness activities and events. Local governments should also seek to forge partnerships with transportation electrification stakeholders, such as CPA and SCE, to secure additional funding for activities. SCE has plans to conduct electric vehicle marketing and education activities. CPA is likely to follow in the footsteps of other Community Choice Energy programs by launching electric vehicle awareness activities, as well as programs to support electric vehicle adoption and infrastructure development.

Targeted and Multilingual Electric Vehicle Engagement

To help expand electric vehicles adoption beyond early adopter markets, special attention should be given to Ventura County's Low-income and Disadvantaged Communities.[145] Transportation costs account for a large percentage of household expenses in the Ventura County region, second only to housing costs. According to data from the Center for Neighborhood Technology, the average household in Ventura County devotes 33 percent of their total income to housing and another 22 percent of their income to transportation costs, leaving only 45 percent of their income to meet other needs such as education, food, and healthcare.[146] Disadvantaged and low-income households can take advantage of state incentive programs that offer increased rebates for low-to-moderate income households that buy or lease an electric vehicle. With incentives, and especially with purchase of a used electric vehicle, the total cost of ownership can be much lower for electric vehicles relative to internal combustion engines.

As discussed in Chapter 3, a review of CVRP rebate data for the Ventura County region suggests that there is low awareness of the increased low-to-moderate income rebates offered as part of the CVRP. Targeted outreach to Low-income and Disadvantaged Communities will position Ventura County as a statewide leader in clean transportation equity and help generate the next wave of electric vehicle adoption. Reaching these lower-income purchasers will require creative new strategies, however. According to the United States Census, over 38 percent of Ventura County's population speaks a language other than English at home. Ventura County also has a large population of indigenous people from Mexico. Moreover, a large percentage of the immigrants from Mexico speak Mixtec, an indigenous language. Mixtecs make up the largest proportion of the region's indigenous population but there are also Zapotecs, Purepecha, and others indigenous peoples from Mexico that live in Ventura County. To ensure that electric vehicle outreach is effective across all population groups, additional translation and interpretation services are needed.

---

[145] As defined for California Climate Investments under Senate Bill 535 (De León, Chapter 830, Statutes of 2012) and Assembly Bill 1550 (Gomez, Chapter 369, Statutes of 2016).

[146] Housing & Transportation Index. *County of Ventura Fact Sheet*. Center for Neighborhood Technology. https://htaindex.cnt.org/fact-sheets/?focus=county&gid=395

Ride and Drive Campaigns

A growing body of outcomes data indicates that well-executed Ride and Drive events are powerful and relatively low-cost means to increase electric vehicle sales. Ride and Drive events allow people to directly experience more electric vehicle model choices than they could test-drive if they visited a local car dealership. Also, Ride and Drives can be structured as fundraisers whereby attendees pay a small fee to participate (e.g., ten dollars) -- with funds going to local non-profits to generate viral buzz. Typically, local Ride and Drives are promoted to a particular stakeholder group with the help of internal champions. Whether at a workplace or other community setting, organizers strive to have as many diverse electric vehicle model choices as possible, as well as real-world drivers of those vehicles to act as "Electric Vehicle Ambassadors." Often events are paired with food or other attractions (such as sustainability events) to promote strong attendance and buzz.

Results from more than 5,200 test drives facilitated by REACH Strategies, an e-mobility consulting firm, across California and Massachusetts [147] indicate that:

- Following a test drive, participants' average stated probability of purchasing an electric vehicle as their next car was 71 percent, with 79 percent of participants improving their overall opinion of electric vehicles
- Within 90 days following events, 85 percent of participants had spoken with family or associates about electric vehicles -- and 74 percent had looked online for electric vehicle information
- Within six months of the event, 52 percent had driven another electric vehicle, and 34 percent had visited an electric vehicle dealership in person
- Within six months of their test drive, 6 percent of participants reported purchasing an electric vehicle and 6 percent leased an electric vehicle – totaling a 12 percent conversion to sales from Ride-and-Drive campaign.

Because of their strong results, Ride and Drive campaigns are being co-sponsored by an increasing number of employers, public agencies, utilities, and electric vehicle manufacturers. In 2019, Peninsula Clean Energy in San Mateo County is investing $250,000 in Ride and Drive activities, and Electrify America is expected to invest several hundred thousand dollars in statewide Ride and Drives as part of its California Cycle 2 Investment Plan. Of course, any significant local investment in Ride and Drives should be based on industry best practices, as a poorly executed event will fail to produce both strong attendance and strong conversion to sales. The following best practices can help to optimize Ride and Drive results.

- Conduct ride and drives at existing community gatherings or events to meet communities and potential participants where they already are [148]
- Work with an experienced and successful Ride and Drive event producer
- Partner with leading employers to drive event traffic with an emphasis on most likely electric vehicle buyers
- Utilize well-trained electric vehicle drivers as "Electric Vehicle Category Ambassadors" with dealer salespeople available as a backup

[147] Based on REACH Strategies Ride and drive campaigns. Internal emails. 2018.

[148] UC Berkeley Safe Transportation Research & Education Center (SafeTREC). Webinar on Meeting Communities Where They Are: Innovative Engagement and Partnerships. April 30, 2019. Recording available at: https://youtu.be/Xl4DU2od89I

- Implement robust tracking via original equipment manufacturers and dealer partnerships
- Share anonymized and aggregated sales stats with key stakeholders
- Assess and improve campaign strategies and sales results through data tracking and conversion rates
- Provide food, music, and/or other amenities to attract participation
- Consider offering incentives or events benefits to incentive participation from both electric vehicle dealerships and community members who can take test drives

Case Study: 2018 Oxnard Ride & Drive Event for National Drive Electric Week

The National Drive Electric Week (NDEW) creates a special opportunity to build broader awareness of electric vehicles through brand-neutral electric vehicle car shows and/or Ride and Drive events, which can be connected to farmers markets or existing community events that coincide with NDEW. The EV Advocates of Ventura County have organized an annual NDEW event at Channel Islands Harbor in Oxnard since 2017. In addition, in 2018, the EV Advocates of Ventura County partnered with the Los Padres Chapter of the Sierra Club to conduct the third annual Oxnard NDEW event at West Channel Park in Oxnard. The EV Advocates of Ventura County applied for and received a $2,500 grant from SCE to organize, manage, and conduct the Ride and Drive event. Kent Bullard, the 2018 Oxnard NDEW City Captain, led overall planning and coordination for the event and Kathy Bullard led planning and coordination for the Ride and Drive. James Reach of the Sierra Club's Los Padres Chapter supported planning and coordination for the static EV showcase. In addition, another 17 members of the EV Advocates of Ventura County volunteered to support the event in a variety of ways, and also put their own electric vehicles on display in the Oxnard electric vehicle showcase.

In total, there were 89 electric vehicles on display at the static showcase. Most of the vehicles were privately owned but about one-third were electric vehicles from local automobile dealerships. A total of 61 electric vehicle owners from the Ventura County region participated in the showcase and shared their experience with the community. Among them was a collective 1.5 million miles electric vehicle driving experience. The vehicles displayed represented 15 different commercially available BEV and PHEV models.

Five manufacturers or dealers participated in the Ride and Drive portion of the event and offered test-drives in six different commercially available models, as well as two neighborhood electric vehicles, and several electric bicycles. A total of 147 event visitors participated in 87 test drives. The 2018 Oxnard NDEW event was the largest and most successful electric vehicle event conducted in the Ventura County region to date. It highlights the opportunity to increase awareness with community-led electric vehicle advocacy at existing community gatherings. On September 17, 2019, a NDEW Ride and Drive event will be hosted at the County of Ventura Government Center, and it is intended that this will also become an annual event.

Brand Neutral Promotion of Electric Vehicles Through Innovative Regional Events

In addition to Ride and Drive events, a number of organizations are pioneering new approaches to electric vehicle awareness that may have a role to play in future electric vehicle market development efforts. For example, in the state of Oregon, the region's electric vehicle advocacy organization -- known as Forth -- has developed the Go Forth Electric Vehicle Showcase, located in the heart of downtown Portland at the

Portland World Trade Center. This exhibit offers a physical showroom for electric vehicles and includes a rotating display of leading electric vehicles. These are made available for test drives by brand-neutral electric vehicle educators.[149] Although Forth does not directly sell cars, there are multi-brand electric vehicle showrooms elsewhere. In Canada, Iceland, and Norway, a company known as Even Electric has developed a brand-neutral electric vehicle dealership that offers electric vehicle buyers the convenience of driving and buying electric vehicles from a variety of electric vehicle OEMs under one roof. The development of this alternative test drive and procurement infrastructure is a response in part to data that show many dealers are not effectively selling electric vehicles and are not well incentivized to do so by OEM sales strategies, which tend to favor higher margin and easier-to-sell internal combustion engine vehicles.

Electric vehicle-focused dealerships and Ride and Drive producers have observed that there is a unique potency in bringing together a large number of diverse electric vehicle brands in one setting. When consumers see the variety of electric models gathered in one venue, they are most likely to discover that some kind of electric vehicle – whether it is a battery or plug-in hybrid electric vehicle, an SUV, compact, or luxury sedan – is a better solution for their needs than the internal combustion engines alternative they might otherwise have been directed to in a conventional dealership. Further, these electric vehicle-focused organizations are commonly staffed by electric vehicle drivers who are more informed and passionate about EVs compared to sales staff working at a conventional dealership.

In Ventura County, an increase in brand-neutral electric vehicle promotion strategies and car shows could further motivate electric vehicle awareness and attract consumers to electric vehicle adoption. The Community Environmental Council revived an annual Electric Vehicle showcase for the City of Ventura 4th of July Street Fair in 2018, with generous volunteer support from the EV Advocates of Ventura County.[150] Moving forward, local governments and their partners should continue to expand brand-neutral Electric Vehicle showcases in partnership with the EV Advocates of Ventura County, the Community Environmental Council, local organizers of existing events, and other partners. Potential opportunities for future Electric Vehicle Showcase events include:

- City of Ventura 4th of July Street Fair
- City of Oxnard Multicultural Festival
- Oxnard Strawberry Festival
- City of Thousand Oaks Rotary Street Fair
- City of Thousand Oaks Earth Arbor Day
- Ventura County Fair
- Earth day events
- Farmer's markets
- Health fairs
- Chamber of Commerce events
- Simi Valley Street Fair
- Moorpark County Day
- Camarillo Salsa Festival

Transportation Network Company Engagement

The growth of new mobility options in recent years has been rapid in Ventura and other communities around the state. The broad range of emerging mobility solutions includes ride-hailing services such as Uber and Lyft, as well as the broader category of TNCs – which include car sharing firms like ZipCar,

---

[149]See https://forthmobility.org/showcase.

[150] The Los Padres Chapter Sierra Club had organized 4th of July Street Fair EV showcase until 2015 but was unable to continue the EV showcase at that time due to increased fees and costs.

Getaround, or General Motor's Maven. In addition, new form factors have entered the urban mobility space, including the shared e-bike, e-scooter rentals offered by Lime, Scoot, and others. To the extent that these mobility companies adopt fully electric vehicles, they can become an important force multiplier for electric vehicle awareness at the community level. For example, some cities have partnered with TNC operators to accelerate electric vehicle adoption by strategies such as:

- Providing electric vehicle with road access incentives, such as priority access to airport pickups, HOV lane stickers, or admission to Zero Emission Zones, which have banned internal combustion vehicles
- Providing appropriately sited charging infrastructure
- Encouraging deployment of "green ride" programs whereby customers (as in a current Lyft program) can order an electric vehicle rather than an internal combustion engine vehicle.
- Utility programs that offer free or discounted charging incentives

Given the increasing popularity of ride-hailing services, special efforts to promote electric vehicle adoption within the TNC segment can expose thousands of potential electric vehicle buyers to the experience of driving an electric vehicle, while creating positive environmental benefit from reduced fossil fuel use. Pro-electric vehicle TNC programs will also prepare the sector for the possibility of a state electrification mandate similar to the Clean Transit Rule requiring adoption of zero emissions buses in California. Specifically, the California Clean Miles Standard and Incentive Program – established under SB 1014, requires ride-hailing services to:

- Track their emission footprints by 2020
- Create fleet emissions reduction targets by 2023 (based on the 2020 emission baseline)
- Create a GHG reduction plan every two years [151]

As noted above, the development of utility or public agency incentives tailored specifically to TNC drivers will help accelerate the TNC electrification goal. In response to the combination of customer preference, local government support, and state regulation, TNC market leaders Uber, Lyft, and Maven have all announced new initiatives to promote the adoption of electric vehicles by their drivers. Lyft also recently became one of the top ten voluntary purchasers of carbon offsets for remaining internal combustion engines vehicles and has partnered with public transit agencies to achieve a goal of 50 percent shared rides by the end of 2020. The company has stated that it will provide at least 1 billion rides per year using electric autonomous vehicles by 2025. [152] While TNC electric vehicle incentive programs can be developed and administered by diverse entities, Georgia Power has notably received their state's CPUC approval to provide a $500 incentive to Lyft drivers choosing electric vehicles to lease or buy for their TNC work. [153] Uber is incentivizing drivers by offering a per-trip bonus for driving electric vehicles. In Sacramento, a partnership between Uber and Sacramento Municipal Utility District provides $1.25 of the $1.50 incentive.

---

[151] California Legislative Information. SB-1014 California Clean Miles Standard and Incentive Program: zero-emission vehicles. (2017-2018). Retrieved from: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1014

[152] Andrew Hawkins. (June 19, 2018). Uber will start paying some drivers to switch to electric cars. Retrieved from: https://www.theverge.com/2018/6/19/17480044/uber-electric-vehicle-ev-driver-cash-incentive

[153] https://www.smartgridtoday.com/members/Georgia-Power-offers-EV-incentives-for-Lyft-drivers.cfm?utm_source=Real%20Magnet&utm_medium=email&utm_campaign=132962482

Sacramento Municipal Utility District also provides Uber's electric vehicle drivers free access to the utility's network of DC Fast Chargers. A similar program is also in place in Pittsburg, Pennsylvania, where Uber is providing a $1 electric vehicle driver incentive and engaging in talks with Duquesne Light Company to expand the city's high-speed charging infrastructure. Uber has stated goals to increase electric vehicle trips in the eight cities where it is currently focusing its electric vehicle goals from 2 million trips this year to 5 million trips next year. Uber will also increase local education regarding available tax incentives and advocate for additional resources for their electric vehicle drivers. [154]

Maven is a short-term car rental company focused on providing vehicles to gig economy drivers working for companies like Lyft and Uber. It has recently announced a partnership with General Motors to provide Chevy Bolts for TNC drivers in Los Angeles, San Francisco, and San Diego. Currently, drivers can access the Chevy Bolt for $189 to $229 per week including unlimited mileage, free charging, maintenance, and roadside assistance.

Public Electric Vehicle Charging Build-out

Increased availability of public charging throughout Ventura County can drive electric vehicle adoption by alleviating range anxiety and (potentially) increasing parking convenience. Especially when combined with prominent signage, a robust public charging network communicates to would-be electric vehicle drivers that Ventura County is "Electric Vehicle Ready" and that public charging is convenient and ubiquitous. Local siting of electric vehicle charging infrastructure in high traffic locations can be an especially impactful way to advertise the electric vehicle lifestyle and local support for the technology. Additional strategies for enhanced public charging are expanded upon in Chapter 3 of this report, and a survey of existing chargers is available in Chapter 5.

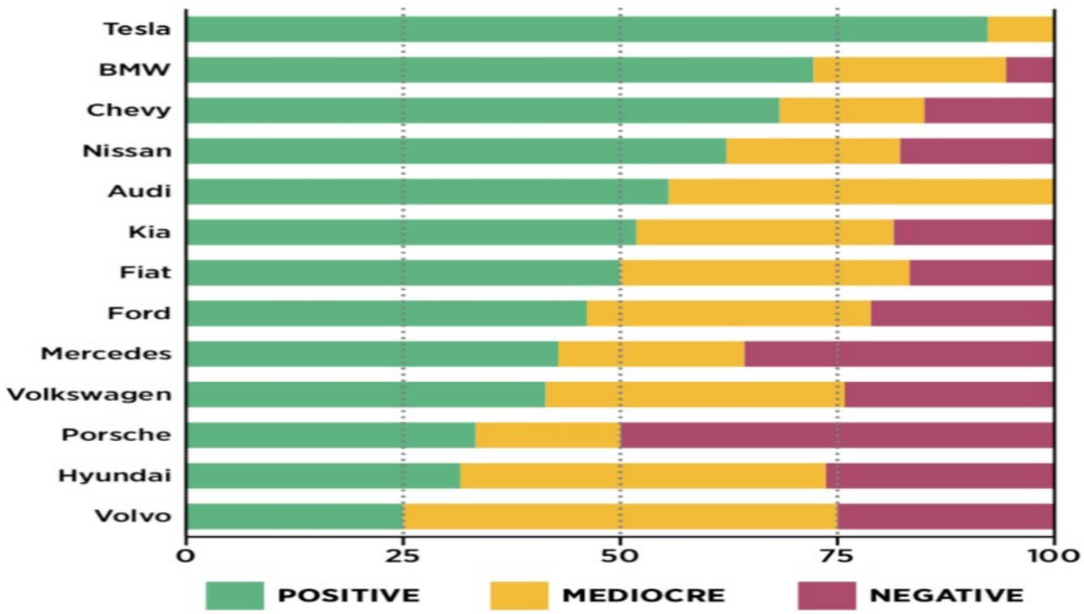
Improving the Electric Vehicle Sales and Dealer Experience

Improving the sales experience can also increase electric vehicle adoption among both new and used vehicle customers. A recent Sierra Club study [155] on multi-state electric vehicle shopping experiences identified substantial room for improvement in well over half of the manufacturers surveyed. The report indicated 50 percent or more of customers at seven out of the 13 electric vehicle-producing OEMs provided scores of their dealership experience from "mediocre" to "negative" on the five-point rating scale. Only Tesla received positive scores from more than 75 percent of customers.

[154] https://www.ssti.us/2018/07/uber-and-lyft-look-toward-electric-vehicles/

[155] Sierra Club. REV UP Electric Vehicles: Multi-State Study of The Electric Vehicle Shopping Experience. Retrieved from: https://content.sierraclub.org/creative-archive/sites/content.sierraclub.org.creative-archive/files/pdfs/1371%20Rev%20Up%20EVs%20Report_09_web.pdf

Figure 1: Customer Satisfaction with Electric Vehicle Sales Experience by OEM



Source: Sierra Club, REV UP EVs: Multi-State Study of the Electric Vehicle Shopping Experience, 2017, p. 3.

In addition to the low customer satisfaction with the dealer experience, other barriers currently hindering electric vehicle sales include the following:

- **High cost thresholds for dealers to sell electric vehicles:** Several leading automakers require dealers to pay certification fees to sell electric vehicles, even as other automakers provide certification free of charge. Nissan provides certification at no cost, but Volkswagen has charged a $50,000 fee, which includes two electric vehicle charging stations and maintenance, and sales and service team training. Ford also charges a $50,000 certification fee. Some dealers claim they cannot afford these fees or cannot afford the cost of adequate on-site charging infrastructure, which can cost $150,000 or more depending on inventory size and test drive activity.
- **Increased salesperson time to sell electric vehicles**: Dealers report that an electric vehicle sale takes as much as two to three times longer than a conventional internal combustion engine sale, due to the novelty of electric vehicle technology, customer concerns about charging, incentive processing, battery warranty, and other issues.
- **Dealer concerns related to electric vehicle service revenue:** Data indicate that most electric vehicles, especially battery electric vehicles, have significantly lower service needs than internal combustion engines, leading to lower dealer service earnings – a key source of dealer profits. Sales incentives must be scaled to mitigate this challenge.
- **Dealer satisfaction scores on electric vehicle sales are lower than internal combustion engine sales:** JD Power dealer satisfaction scores indicate that electric vehicle buyers are on average less satisfied with their dealer experience than internal combustion engine buyers. In many cases, this is due to salespeople pushing consumers not to buy electric vehicles for a variety of reasons, such that electric vehicle buyers must persist against salesperson resistance. With many auto OEMs, the Dealer's JD Power satisfaction scores are a major factor in dealership recognition and

compensation. Therefore, if dealers can maintain higher JD Power scores by not stocking and selling electric vehicles, some will choose this path of least resistance.

Compounding these challenges are sub-optimal practices related to the management of electric vehicle incentives, distribution of electric vehicles, and the installation of residential charging systems. The following list of additional barriers could be addressed by either state action or a combination of state, utility, and local collaboration to develop new incentives and program designs.

- **Electric vehicle incentive design issues:** Analysis of electric vehicle rebates suggests that more efficient application of incentives could result in more sales. The current California rebate amount for electric vehicles ranges from \$2,500 to \$5,000, and a \$5,000 incentive is available for buyers of fuel cell electric vehicles. However, comparative market studies by the International Council on Clean Transportation[156] have suggested that the lower-end state incentives offered to electric vehicle buyers are not large enough to move most buyers from a "no" to a "yes." To increase the impact of state incentive funds, they need to be larger and targeted to buyers for whom incentives matter most. To date, much of the incentives budget has been allocated to very high-income Tesla buyers to purchase luxury cars, with many Tesla buyers not even claiming the incentives since a \$2,500 discount is not necessarily compelling for vehicles that have been selling in the \$60,000 - \$150,000 range and for buyers with the means to purchase these vehicles. To address these limitations, new proposals for a "feebate" are circulating in Sacramento. One such proposal shifts the revenue mechanism away from Cap and Trade dollars, which now effectively taxes the energy of all Californians equally, while disproportionately hurting the poor since their share of income devoted to energy costs is much higher than the rich. The fee part of the "Feebate" would be set progressively, with a higher rate levied on higher cost new internal combustion engine vehicles. Thus, the feebate could be designed to be levied only on vehicles above the new median vehicle cost in California (e.g., approximately \$38,000 MSRP), using a sliding scale that levies a higher fee for internal combustion engine vehicles as they approach the \$100,000 threshold. With more than 90 percent of new car sales expected to be internal combustion engine for some years to come, a relatively small fee levied only on higher-than-median-cost vehicles would raise a substantial amount of revenue to provide electric vehicle rebates in the neighborhood of \$10,000+ (or over \$15,000 with the federal rebate.) Rebates of this magnitude have a track record of accelerating sales to and beyond the critical 10 percent electric vehicle market share barrier in countries like Norway.
- **Limited distribution of electric vehicles:** The Sierra Club National Electric Vehicle Study found that many electric vehicle dealerships only stock three to five electric vehicles at once, and some carry no electric vehicles at all. It is essential to local market acceleration that local dealers' stock electric vehicles and that access to diverse models is enabled through brand-neutral campaigns (e.g. electric vehicle showcases and Ride and Drive events).
- **Limited marketing of electric vehicles:** Traditional auto OEM marketing campaigns have focused on internal combustion engines vehicles, and nationwide electric vehicle campaigns in print, TV, other electronic and social media are still limited or nonexistent. In the absence of effective

[156] Mock, P., Yang, Z. ICCT. (May, 2014). Driving Electrification: A Global comparison of Fiscal Incentive Policy for Electric Vehicles. Retrieved from: https://www.theicct.org/sites/default/files/publications/ICCT_EV-fiscal-incentives_20140506.pdf

national campaigns, there is a need and opportunity for statewide and regionally focused electric vehicle marketing campaign development and implementation. The development of social media-driven Electric Vehicle Awareness campaigns that can provide direct-to-dealer links for interested and motivated electric vehicle dealerships can provide enhanced community awareness among some target customer segments. A well-managed social media campaign can be more intensive, targeted, and cost-effective than the go-to strategies of auto OEMs, which often rely on much more costly print, radio, TV, and billboard ads. Regional Electric Vehicle Awareness Campaigns can also communicate the full value of electric vehicle incentives that are locally available, taking into account federal, state, utility, Air District, and any other incentives.

- **Digital Marketing Strategies:** On the ground digital marketing strategies and outreach to local communities can also help to broaden the reach low-to-moderate income households. Some local governments and transportation planning agencies are beginning to place increasing emphasis on direct collaboration with community-based organizations that already have strong community relationships and a high-level of trust. Depending on the audience, community-based outreach may be more effective than traditional advertising campaigns or digital marketing efforts. According to the SB 350 low-income barriers report, many communities rely on grassroots network, community groups, and word of mouth for information sharing. Therefore, grassroots engagement activities and community-based partnerships should be incorporated into electric vehicle awareness activities to broaden the reach of information sharing and promote equitable access to clean transportation solutions.
- **Inconvenience and challenges of installing home charging:** Too many auto OEMs and dealers expect electric vehicle buyers to muddle through the potentially complex challenge of installing residential charging on their own. Moreover, while most electric vehicle owners living in single family homes are able to charge overnight on existing 120 volt or 240 volt outlets in their home garage or driveway, over 38 percent of Ventura County's population (an estimated 329,730 out of 854,233 residents) live in multi-unit buildings or rental properties that typically requires more complex and costly installations, as well as upgrades in electrical capacity. Many customers face EVSE installation costs that can range widely -- from several hundred dollars to $8,000 or more to install a Level 2 charger.
- **Complexity and challenges related to accessing incentives:** State, utility, and local agencies have created multiple electric vehicle incentive programs - each with different application processes and eligibility requirements. Prospective electric vehicle customers need to navigate several different programs if they wish to receive all the available rebates and incentives. Additionally, waitlists or long processing time (as much as four months for the CVRP) can be a barrier to prospective electric vehicle drivers that cannot afford a large down payment. In some cases, prospective electric vehicle buyers also need to choose between two different incentive programs, the CVAP and CVRP. Both programs have slightly different eligibility requirements and provide different incentives. The CVAP needs to be accessed before the point of sale, whereas the statewide CVRP is accessed after the point of sale. Local governments and utilities should provide support to help prospective buyers understand, navigate, and apply for these incentive programs. One option would be to create a dedicated EV Coach position. The EV Coach could provide direct one-on-one assistance to prospective electric vehicle buyers or leasers, as well as charging infrastructure development support. Local governments should also track development of a one-stop-shop application for electric vehicle incentives, which GRID Alternatives is currently creating

on behalf of CARB. The one-stop-shop application will allow an electric vehicle buyer or lessor to submit a single application for all state and utility electric vehicle incentives. GRID Alternatives is planning to work with local governments, community partners, and other electric vehicle stakeholders to make this one-stop-shop application for incentives broadly accessible. Partners will likely be able to white label the application with their own logos and branding. The one-stop-shop application is anticipated to launch in late Winter 2019/20.

Improving the Electric Vehicle Dealership and Sales Experience

Customer interaction with salespeople and their dealership teams can have an enormous influence on electric vehicle sales and customer satisfaction. Sales knowledge, training, and strategies can be enhanced by third party initiatives, such as the Plug-in America PlugStar dealer training program. The PlugStar electric vehicle dealer programs supplement and extend factory training to equip new car dealers with training, tools, and support to successfully sell electric vehicle approximately. The no-cost PlugStar program also includes a one-stop website for all incentives that can be shared with local electric vehicle customers. This site also refers ready-to-buy customers directly to PlugStar dealers, including customer leads from NDEW and other promotional events.

Some utility programs, including those of Sonoma Clean Power and Peninsula Community Energy (in San Mateo County) have also provided additional incentives directly to sales people to promote electric vehicle sales goals. These incremental incentives help reduce the compensation gap for sales people between quick-moving internal combustion engine sales transactions and slower-moving and more complex electric vehicle transactions. Incentives in the range of $500 - $800 per electric vehicle sold can be a powerful differential incentive and help compensate the salesperson for the actual increased time required to sell an electric vehicle. An incentive directed to the sales person may prove more efficient and effective in moving electric vehicles than relying exclusively on modest consumer-facing utility incentives (which typically range from approximately $500 - $1000) that represent only a small proportion of the total electric vehicle purchase price.

Provision of loaner cars: Some auto OEMs and dealers have instituted loaner programs to provide back-up conventional vehicles or plug-in hybrid electric vehicles for customers purchasing battery electric vehicles and fuel cell electric vehicles. These programs can provide a number of annual free loaner uses (e.g. rentals for up to 12 days) to help overcome any concern regarding the ability of battery electric vehicles to meet all the travel needs of a “one car family.”

Concierge service for residential electric vehicle charging: As noted above, some electric vehicle purchasers choose to tackle residential electric vehicle charging installation on their own without benefit of a turn-key third-party or utility solution. However, some auto OEMs have worked closely with utilities and third parties to create a truly customer-friendly electric vehicle charging infrastructure procurement and installation process. For example, BMW has worked with industry partners to proactively qualify charging infrastructure installers, provide an elegant web-based interface to conveniently schedule installations, and created a project tracking and feedback process to ensure rapid installation and quality assurance. This kind of “concierge service” – as well as flat-rate residential installation pricing – may be the future of utility electric vehicle charging infrastructure programs.

Utility Engagement Strategies

Electrification of the transportation sector represents a massive opportunity for California's utilities in the form of load growth, revenue growth, and more efficient utilization of the grid, as well as opportunities for new services enabled by grid-connected electric vehicles. Revenue potential from electric vehicle adoption is substantial. Assuming typical annual mileage of approximately 15,000 miles per year at SCE's off-peak electric rate of $.23 per kWh, annual utility revenue per electric vehicle reaches $924 per year for a vehicle with fuel efficiency of approximately 28 kWh per 100 miles. For the 7 million electric vehicles by 2030 expected by SCE in their recent Transportation Electrification white paper, [157] this would increase annual utility revenue in California by $4.4 billion. Given the contribution of electric vehicles to load and revenue growth, many California utilities, including SCE, are implementing innovative strategies to accelerate electric vehicle adoption. Electric vehicle-friendly programs being deployed in various utilities across the state include:

- Free or reduced cost chargers for specific customer segments, including lower-income customers, public fleets, and multi-unit residential developments
- Utility-sponsored electric vehicle rebates and incentives
- Smart Charging Pilots such as incentives to participate in Demand Response programs, or other load shaping or load shifting pilot projects
- Tailored rate design such as electric vehicle TOU rates found in SCE, Pacific Gas & Electric and other utility territories
- Education and outreach initiatives -- including use of direct mail and electronic communications with customers, outreach at community events, and Ride and Drive programs
- Fleet assistance initiatives providing technical assistance to fleet managers on all aspects of fleet electrification
- Outreach to owners, managers, and residents of multi-unit residential developments
- Technical assistance programs including interconnection pre-approval, and design, engineering, and financing support for large scale charging infrastructure [158]

Recommended Actions for Electric Vehicle Market Acceleration

- **Recommendation #1: Sustain the Ventura Electric Vehicle Ready Communities Coalition to scale up regionwide initiatives to accelerate transportation electrification.**
- **Recommendation #2: Conduct Ride and Drive campaigns and Electric Vehicle showcases** throughout the County at existing community events and at locations targeted to key stakeholders – including workplaces, local governments, high-density urban centers, multifamily properties, and the meeting locations of organized community groups.
- **Recommendation #3: Partner with the EV Advocates of Ventura County for awareness activities and events, so target audience can engage directly with local electric vehicles owners.**

[157] The Clean Power and Electrification Pathway, SCE https://www.edison.com/content/dam/eix/documents/our-perspective/g17-pathway-to-2030-white-paper.pdf

[158] Additional, utility program details can be found in chapters 1, 3 and 4 of this report.

- **Recommendation #4: Target incentives and pilot project funding to accelerate electric vehicle adoption by mobility service providers, including ride-hailing and shared micromobility companies.**
- **Recommendation #5: Create a Ventura County Electric Drive 805 campaign** in partnership with key electric vehicle stakeholders to expand electric vehicle-focused outreach and engagement activities, including the Electric Vehicle Ready Communities Coalition, Ventura local governments, SCE, CPA, Electrify America, other Electric Vehicle Service Providers, local dealers, the Ventura County APCD, VCREA, non-governmental organizations, and community-based organizations. The campaign should address the following: a) dealership and sales training and incentives (including strategies to increase incentives for sales people to move electric vehicles); b) sales and marketing strategies to accelerate electric vehicle deployment; c) Ride and Drive events; and d) incentive program awareness campaigns, and other relevant strategies. The campaign planning team should assess best practices in electric vehicle education and outreach, such as PlugStar (by Plug-in America), the MyGreenCar smartphone app for electric vehicle selection, the GRID Alternatives one-stop-shop application for electric vehicle incentives, and other strategies, tools, and best practices. The campaign should utilize key performance indicators to evaluate and continuously improve the success of electric vehicle engagement activities.
- **Recommendation #6: Collaborate with community-based organizations to expand multilingual electric vehicle outreach and engagement** and pilot projects that will expand awareness of electric vehicles among households that speak a language other than English as their first language. (The Los Angeles Department of Transportation Vision Zero application defines community-based organization engagement activities that can inform a program model for Ventura.)
- **Recommendation #7: Incorporate electric vehicle awareness and engagement activities into municipal budgets** to help ensure that funding is prioritized and aligned with each city's electric vehicle goals and community needs
- **Recommendation #8: Pilot test an EVSE Concierge service** in partnership with utilities and Electric Vehicle Service Providers to provide a "hassle-free" residential charging installation experience. To launch the service, SCE and/or CPA electric vehicle program staff could work with Electric Vehicle Service Providers and auto OEMs to develop a hassle-free residential charger program that will pilot test: a) flat rate pricing for residential installations; and, b) "white glove" service that is inclusive of all key design, permitting, construction, user orientation, and troubleshooting tasks.
- **Recommendation #9: Partner with CPA to design an optimized electric vehicle support pilot program for Ventura County.** Ventura electric vehicle stakeholders have a unique window of opportunity to provide input into future CPA Electric Vehicle Programs. This optimized program design could: a) streamline incentives administration; b) optimize education and outreach in alignment with the Ventura Go Electric Vehicle Campaign; c) provide fleet transition assistance; d) support MUD charging; e) target electric vehicle awareness to reach low-to-moderate income households, with special emphasis on the region's Disadvantaged and Low-income communities; and f) launch an electric vehicle group purchasing program that makes it simpler and less costly to buy an electric vehicle (potentially building on the Choose Electric Vehicle procurement platform developed by the Yenter Group).
- **Recommendation #10: Use electric vehicle outreach and engagement activities to support community-informed electric vehicle infrastructure development planning**, using The Greenlining Institute's Clean Mobility Equity Framework and practices similar to those used for

the Los Angeles Department of Transportation's Dignity-Infused Community Engagement approach.[159]

- **Recommendation #11: Create a package of toolkits to support transportation electrification and regional electric vehicle charging infrastructure development** including a) fleet electrification toolkits targeting public agencies, transit, and goods movement; b) MUD charging toolkits targeting property managers to support multifamily residential electric vehicle charging infrastructure development; c) workplace charging toolkits targeted to support electric vehicle charging infrastructure development with the region's employers; and d) local government toolkits targeted to support policy development and public electric vehicle charging infrastructure development.
- **Recommendation #12: Create and fund, for at least three years, a Ventura County Electric Vehicle Coach** who will assist key stakeholders with electric vehicle charging infrastructure development and provide direct support to help the region's drivers transition to electric vehicles.
- **Recommendation #13: Deploy a one-stop-shop application for electric vehicle incentives.** GRID Alternatives is currently creating a one-stop-shop application with CARB support that will allow an electric vehicle buyer or lessor to submit a single application for all state and utility electric vehicle incentives. GRID Alternatives is planning to work with local governments, community partners, and other electric vehicle stakeholders to make this one-stop-shop application for incentives broadly accessible. Partners will likely be able to white label the application with their own logos and branding. The one-stop-shop application is anticipated to launch in late Winter 2019/20.

[159] Los Angeles Department of Transportation. *Dignity-Infused Community Engagement - Vision Zero Los Angeles*. Accessed: June 12, 2019. More information available at: http://visionzero.lacity.org/dignity-infused-community-engagement/

Chapter 6 References

Business Wire. High Costs, Lack of Awareness Threaten to Short Out Electric Vehicle Adoption. Retrieved: https://www.businesswire.com/news/home/20161208005809/en/High-Costs-Lack-Awareness-Threaten-Short-Electric

UC Davis, Institute of Transportation Studies. Kurani, K., Caperello, N., TyreeHegeman. J. July, 2016. *New Car Buyers' Valuation of Zero-Emission Vehicles in California.* Retrieved from: https://its.ucdavis.edu/blog-post/automakers-policymakers-on-path-to-electric-vehicles-consumers-are-not/

California Legislative Information. SB-1014 California Clean Miles Standard and Incentive Program: zero-emission vehicles. (2017-2018). Retrieved from: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB1014

Andrew Hawkins. (June 19, 2018). Uber will start paying some drivers to switch to electric cars. Retrieved from: https://www.theverge.com/2018/6/19/17480044/uber-electric-vehicle-ev-driver-cash-incentive

https://www.smartgridtoday.com/members/Georgia-Power-offers-EV-incentives-for-Lyft-drivers.cfm?utm_source=Real%20Magnet&utm_medium=email&utm_campaign=132962482

https://www.ssti.us/2018/07/uber-and-lyft-look-toward-electric-vehicles/

Mock, P., Yang, Z. ICCT. (May, 2014). Driving Electrification: A Global comparison of Fiscal Incentive Policy for Electric Vehicles. Retrieved from: https://www.theicct.org/sites/default/files/publications/ICCT_EV-fiscal-incentives_20140506.pdf

Chapter 6 Appendix

EV Programs Sponsored by Community Choice Energy Authorities

California's Community Choice Energy agencies, also known as Community Choice Aggregations (CCAs) will soon be providing retail electric services to approximately half the population of the state, growing toward 80 percent over the next several years. While the incumbent Investor Owned Utilities are still providing distribution operations, maintenance, and billing services, the CCAs are in many cases beginning to offer their own energy efficiency and electric vehicle programs direct to their own customers. The following table briefly summarizes some of the typical program offerings of the CCAs as of early 2019. Some of the more recently formed CCAs have not developed their own programs. However, the more established CCAs - including Sonoma Clean Power (SCP), Marin Clean Energy (MCE), Lancaster Choice Energy (LCE), Redwood Coast Energy Authority (RCEA), and Peninsula Clean Energy (PCE) - are all demonstrating leadership in transportation electrification and electric vehicle customer programs. Program types supported by the CCAs and SCE are identified in the tables below.

Table 2: CCA and Investor Owned Utility Electric Vehicle Incentives

Program Type	Participating Utility
Free Charger/ Smart Charger	SCP (with eMotorWerks)
Charger Rebate	MCE (workplace/multi-family)
Electric Vehicle Rebate Pilot	SCP (ended pilot) MCE (low income) PCE
Electric Vehicle TOU Rates	MCE, PCE (with 5 percent PG&E discount), Clean Power SF, RCEA
Ride & Drives Outreach	PCE SCP SCE and others

Table 3: CCA and Investor Owned Utility Electric Vehicle Incentives

INCENTIVE	MCE	SCP	PCE	PG&E	SCE
Fleet Charging Infrastructure Rebates	Up to $2,500 per port workplace & low income residential with 2-20 ports	No	No	FleetReady Program $236 Million for fleet charging at 700 sites	**ChargeReady:** 1250 Charging Infrastructure @ 60 sites **New Fleet Program** $356 Million for Charging Infrastructure **Pending with CPUC** $760 Million request for $48,000 Charging

					Infrastructure by 2023
Residential Charging Infrastructure Rebates	Up to $2,500/port MUD Program (market rate & low-income options for 2-20 ports)	Free charger program & $5 monthly credit for GridSavvy signup	No	No	$500-$1,500 toward out-of-pocket costs for installation
Residential Vehicle Incentives	$3,500 for CARE, FERA, or income qualified	Pilot program now at capacity	$1000 rebate plus up to $4000 discounts with local dealers	$800 Clean Fuel Rebate (CCA qualify)	$1,000 Clean Fuel Rebate (CCA qualify)

Ventura County Electric Vehicle Ready Blueprint

Chapter 7: Autonomous, Connected, and Shared Electric Vehicles

Introduction

Many transportation experts are predicting a future where autonomous, electric, and shared mobility technologies (ACES) will converge to transform our current transportation systems. The University of California, Davis Institute of Transportation Studies describes autonomous, shared, and electric vehicles as the "Three Revolutions" in transportation. The Three Revolutions have the potential in turn to advance the "Three Zeros" – a world with zero crashes, zero congestion, and zero emissions. This vision may seem far-fetched in the face of today's endemic pollution, congestion, and accidents. However, transportation researchers and technology companies are preparing for rapid advancements in shared, electric, and autonomous vehicles that could drive substantial progress toward the Three Zeros in the next decade.

Autonomous vehicles pilots are already being conducted in several U.S. cities and advanced autonomous driving capabilities could soon become commonplace. How soon is uncertain. A range of estimates -- from five to 15 years – is typically given as the timespan in which fully autonomous capabilities will become available across many vehicle types. However, new regulatory regimes will need to be developed to accommodate fully autonomous vehicles at federal, state, and even local levels. Many transportation experts agree that it is the pace of policy development – rather than technology development alone – that will determine how fast the Three Revolutions progress, and whether autonomous and shared vehicles help or hinder our societal goals for reducing emissions and congestion and increasing equitable access to mobility services.

The increasingly rapid introduction of new autonomous mobility demonstrations, technologies, and business models suggests that the Three Revolutions may arrive sooner than many local governments and transportation stakeholders anticipate. Today, advanced autonomous, shared, and electric vehicles are in commercial service in multiple local jurisdictions. One of the largest scale demonstrations is in the Phoenix area in an autonomous taxi project led by Waymo. In addition, tens of thousands of new Tesla models have advanced autonomous capability, which can be further enabled by software updates once regulators, engineers, and attorneys agree on key issues pertaining to safety, liability, and other concerns. Virtually all major vehicle OEMs are accelerating their research, development, and early deployment planning for shared, electric, and autonomous vehicles.

Much of the research and development in the autonomous vehicle world is occurring in California, especially in Silicon Valley, which is the birthplace of the Waymo self-driving technology. With this regional concentration of new technology development, there are important opportunities for local governments, universities, technology companies, and new mobility service providers to participate in pilot projects that will increase access to shared, autonomous, and electric mobility solutions.

It is important to underscore that the transformative potential of autonomous vehicles goes far beyond new technology features for automobiles and highly advanced cruise control, such as Tesla's autopilot feature. The stakes in the autonomous vehicle revolution are much higher -- and the potential shifts in transportation could economically transformative, according to some transportation experts. Emerging autonomous, shared, and electric vehicles present a wide range of future environmental and social outcomes, as highlighted by the University of California, Davis *Three Revolutions Future Mobility*

Program.[160] The most promising scenarios point to a sustainable transportation future that enhances equitable access, improves affordability, and drives significant emissions reductions. Other scenarios would move us toward more urban sprawl, increased energy use, and rising GHG emissions.
On the positive side, many analysts predict these potential benefits from autonomous vehicle deployment, given the right policy and regulatory frameworks:

- Dramatically decreased cost of mobility by enabling widespread "sharing mode" to make more efficient use of vehicles
- Reductions in individual car ownership by as much as two-thirds
- Reduced congestion through increased ride sharing and reduced "hunting" for parking spaces
- Reduced parking requirements and increased space for new urban amenities
- Reduction or elimination of accidents

On the other hand, some of the same experts have warned decision-makers about the potential pitfalls that autonomous vehicles could present without the right policies and regulations in place. These pitfalls would:

- Increase congestion by allowing vehicles to autonomously circle cities rather than pay expensive parking fees
- Increase vehicle miles traveled by enabling drivers to commute longer distances, since commute times may be freed up for sleeping, working, or other activities
- Significantly increase the cost of vehicles thereby increasing the mobility gap between rich and poor
- Decimate ridership on public transit as autonomous vehicles lower the cost of ride hailing services while increasing congestion that further increases travel times on fixed route buses
- Increase inequities related to transportation access, TNC affordability, and the problem of underserved routes and communities.

It will be crucial for decision-makers at national, state, and local levels to rise to the challenge of creating policies and regulations that will realize the promise of the Three Revolutions, while also expanding mobility options for under-served individuals and communities. It is already becoming clear that well-designed shared vehicle programs can fill public transit gaps, achieve lower costs than some traditional taxi and paratransit options, and provide air quality benefits through the combination of electrification and more efficient vehicle use. By contrast, an unplanned introduction of autonomous and shared technologies could increase congestion and reduce public transit options for those who cannot afford the new mobility services.

This chapter will investigate the shared and autonomous mobility options now emerging in the marketplace and explore key issues related to safety, equity, access, liability, and regulation. We will provide an overview of new technologies, service providers, and business models, and conclude with locally specific recommendations for advancing a positive vision of autonomous, shared, and connected mobility solutions in Ventura County.

---

[160] UC Davis Institute of Transportation Studies. *3 Revolutions Future Mobility Program*. Website access May 14, 2019. https://3rev.ucdavis.edu/

Innovative Mobility Options: Ridesharing, Carsharing, Electric Shuttles, and More

For decades, California has led the world in promoting individual car ownership as the dominant paradigm in modern mobility. In the last several years, however, the individual car ownership model is being increasingly disrupted by new shared mobility paradigms. Californians are gaining access to an increasingly broad array of new modalities to fulfill their transportation needs with the advent of TNCs such as Uber and Lyft, as well as the deployment of shared vehicles for fleet use from services like ZipCar and Green Commuter. The following program models and case studies provide a snapshot of the rapidly evolving shared and electric mobility offerings.

Vanpooling

Employer vanpooling programs have been in use for decades but are recently being electrified. With the advent of electrification other enhancements to vanpooling are being enabled through new vehicle sharing strategies, and more sophisticated routing and fleet management. For workforces, vanpooling enables commuters to get a ride from home or a convenient park and ride location that takes passengers to and from the workplace. Part of the value proposition is the freed-up time passengers have for relaxation or for a head start on the day's emails during their commute. Vanpools are managed either directly by employers, through third-party service providers working under contract to employers, or via a direct-to-consumer solution. Chariot, GreenCommuter, Van y Vienen, and emerging models from Volkswagen are some of the solutions reviewed in greater depth below.

Case Study: The Van y Vienen Farmworker Vanpool Service

Given the size and scale of agricultural operations in the Ventura County region, programs to expand access to electric vanpool services for farmworkers are especially important. The Van y Vienen program could serve as a model for these services.[161] The Van y Vienen program was launched in 2017 to provide electric vanpool services to farmworkers in the unincorporated communities of Cantua Creek and El Porvenir, which are located 35 miles north of Huron in Fresno County. The Cantua Creek community originated the idea for an electric farmworker vanpool in 2015, which they called Van y Vienen. In 2016-2017, the Leadership Council for Justice and Accountability (LCJA)responded to a request for proposals and received funding from 11th Hour's "Just Transit" program to implement the Van y Vienen electric vanpool.[162]

To provide electric vanpool service for Van y Vienen, LCJA staff contracted with GreenCommuter, an electric ridesharing and vanpool provider based in Los Angeles and a Los Angeles Cleantech Incubator portfolio company. GreenCommuter provided LCJA with a seven-seat Tesla Model X (along with maintenance services), which was used for the Van y Vienen electric vanpool vehicle. LCJA also contacted Fresno County Economic Opportunities Commission, who offered to include this program in their dispatch services and driver training, creating a direct nexus with local workforce development for Van y Vienen.

[161] StreetsBlog Cal. "Fresno to Get Rural Electric Ride Share Services." Mirena Perez. April 14, 2017. Accessed June 19, 2019. Available at: https://cal.streetsblog.org/2017/04/14/9797/

[162] Email correspondence with Amanda Monaco, J.D., Water Policy Coordinator, Leadership Council for Justice and Accountability. January 30, 2019.

The community was directly involved and collaborated with Green Commuter and Economic Opportunities Commission to design the Van y Vienen program, rates, and schedule.

Chariot

Launched in 2014, acquired by Ford for $65 million in 2016, and shut down in February 2019, Chariot is one of several start-ups in the dynamic "microtransit" space. Chariot attempted to integrate a fixed route employer shuttle model with on-demand services. The core Chariot service was a Chariot Pass costing between $3.80 and $5 for a one-way commute in 14-seat passenger vans along a route custom-devised for a specific group of employees of the client workplace. [163] Chariot established limited public routes in Austin, Chicago, Denver, Detroit, San Francisco, and London. Chariot also extended its service to the on-demand market – with the rider community able to vote for routes supported by the service. Chariot grew quickly to a workforce of 625 employees with unionized drivers, in contrast to the independent "gig economy" workforce powering most ride-hailing companies. Chariot was actively exploring fleet electrification before ending their operations. However, affordable electric alternatives to its internal combustion engine vans were not yet available on the market as of early 2019.

While Chariot attempted to offer a superior alternative to traditional fixed transit routes and a premium rider experience, its demise offers a number of lessons to mobility entrepreneurs and transit planners. In urban markets, would-be riders have an increasing number of mobility options. These include conventional transit, ride-hailing, as well as shared bike, e-bike, and e-scooter networks. Further, new market entrants must contend with uncertain and rapidly evolving regulatory structures. In October 2017, the state of California briefly shut down statewide Chariot operations after determining that some drivers did not have proper licensing. Moreover, Chariot was essentially running a hybrid fixed route bus and on-demand paratransit operation that was 100 percent dependent on fare revenue, which presented several business and revenue model challenges. Chariot's management stated in their final blog post that, "In today's mobility landscape, the wants and needs of customers and cities are changing rapidly. As those changes continue, it has become clear that the mobility services delivered by Chariot over the past five years will not be a sustainable solution going forward." [164]

[163] Associated Press. (May 17, 2015). In San Francisco, private transit that follows public routes – at a higher price). Retrieved from: https://www.omaha.com/money/in-san-francisco-private-transit-that-follows-public-routes-at/article_b6b51e66-2186-5a43-99de-5dd35ff93bc1.html

[164] Chariot. Important Update from Chariot. Retrieved from: https://blog.chariot.com/2019/01/10/important-update-from-chariot/

A Chariot Commuter Van [165]

GreenCommuter

GreenCommuter is a new business model that combines vanpooling, carsharing, and fleet replacement. It currently operates in greater Los Angeles, Columbus, Ohio, and Chattanooga, Tennessee. GreenCommuter has updated the traditional employer vanpool model by adding all-electric Tesla Model X vehicles; a carsharing program option during the middle of the work day and the weekend; and an opportunity for companies to replace their existing internal combustion engine fleets with electric vehicles. Formed in 2014, the company primarily utilizes the Tesla Model X, which has a seven-seat configuration that qualifies for federal and state vanpool funding in California. The company currently has programs deployed primarily in the Los Angeles area that utilize the Model X for carpooling during commuting hours and for car sharing during non-peak hours.

GreenCommuter generates most of its business from large employers with established vanpooling programs and provides their fleet of Tesla Model Xs through a pricing model based on a per mile charge paid by a combination of users, their employers, and government funds. The Model Xs are owned or leased by GreenCommuter but are driven in vanpool mode by regular employees of GreenCommuter client companies. The carsharing element of the program is open to the public at off-peak and weekend periods. GreenCommuter also offers fleet replacement of internal combustion engine for electric light duty vehicles to its employer partners, including universities. GreenCommuter provides insurance, registration, repairs, and maintenance, fleet management software, and a leasing structure.

GreenCommuter offers free charging for the vehicles and collects revenues from the Low Carbon Fuel Standard credit program to offset costs. When not in use as commuter vans, the company makes the vehicles available for weekend and off-peak use in its car sharing program accessed through a smartphone app. GreenCommuter is heavily dependent on government vanpool subsidies and is most viable in regions with a robust base of existing vanpool programs. In California, it receives substantial support from regional air districts to help recoup the higher upfront cost of the Tesla vehicles. GreenCommuter hopes to expand statewide and nationally by 2024.

Shared Electric Vehicles

Since the 1960's, the proportion of carless households have steadily decreased from 25 percent to less than 15 percent but has recently increased slightly statewide (by less than one percent) according to the 2015 U.S. Census. Within Southern California, however, the number of cars per household continues to

[165] Wikimedia, creative commons. Retrieved 2019.

increase as lower income households achieve higher levels of car ownership. Between 2000 and 2015, private car ownership in Southern California actually rose substantially -- from 1.7 to 2.4 vehicles per household -- according to a report from the Institute of Transportation Studies at the University of California, Los Angeles. This growth in the vehicle population has occurred at the expense of transit ridership. The state lost 62.2 million annual transit rides between 2012 and 2016 despite large investments in public transportation over the past 25 years, including more than 100 new miles of light and heavy rail in the Los Angeles area. [166]

For those city dwellers who are moving toward reduced car ownership, the ability to delay car purchases has much to do with the increasing availability of both ride-hailing services such as Uber and Lyft, and car sharing platforms such as ZipCar and Getaround. Ride-hailing and car share services provide both on-demand mobility and relatively low-cost vehicle access. When considering avoided costs from insurance, vehicle depreciation, parking fees, and car payments, the combination of ride-hailing and car sharing has the potential for continued rapid market growth. Many leading companies in both the ride-hailing and car sharing space are also incorporating electric vehicles into their fleets as vehicle prices are reduced and range improves. The brief case studies below illustrate the scale of this trend.

BlueCar and Blue Solutions
With headquarters in France, and a growing program in Los Angeles, the Bollore BlueCar is an electric car sharing program which utilizes electric vehicles co-developed with Renault that provide 160 miles of range in urban use and top speeds of 75 miles per hour. [167] The flagship Bollore Autolib program in Paris, which at one time numbered nearly 4,000 electric vehicles and 6,000 charging stations, was closed in July 2018 due to financial losses. However, other BlueCar programs are growing, including BlueIndy in Indianapolis, BlueLA in Los Angeles, and programs in Minneapolis, London, Singapore, and several European cities. BlueLA has developed self-service kiosks in East Hollywood, Rampart Village, Pico-Union, and Downtown LA's Fashion District. Launched in June 2018 as a test program in Westlake, the BlueCar service is now operating across much of Central Los Angeles, primarily in lower-income neighborhoods. In 2019, BlueLA plans to operate 100 vehicles and 200 charging docks at 40 different locations across Los Angeles. The system operates very much like a bikeshare system. To rent a car, users obtain a BlueLA or Metro TAP card and tap it to activate a charging station kiosk. The screen displays the user's account information and options to check out a vehicle or reserve a vehicle for later use. The system also features a mobile app that can be used to reserve a vehicle in advance.

Unlike many e-scooter programs, the BlueLA vehicle must be returned to a designated charging pod, rather than left anywhere in the City. A BlueLA membership costs $5 per month, and vehicle use is an additional $0.20 per minute. Thanks to significant government support, low income residents are eligible for a discounted monthly fee of just $1, and vehicle use cost is reduced to $0.15 per minute. To qualify for the discounts, users must submit income documentation or show enrollment in other low-income programs. For non-members in the BlueLA program, walk-up service is also available for $0.40 per minute.

---

[166] Ruxandra Guidi, "In Southern California, the Car Still Reigns," *High Country News,* July 5, 2018.
[167] Bluecar. La Citadine 100& electrique. Retrieved from: https://www.bluecar.fr/sites/bluecar/files/medias/PDF/2_bluecar_20_p.pdf. Translation provided by google translator.

All BlueLA vehicles have a call-button that connects the driver to a customer service representative who can provide guidance on the vehicles, charging kiosks, and program operations. On a full charge, the vehicles have a range of about 90 - 100 miles, depending on driving conditions. BlueLA is co-sponsored by the Los Angeles Department of Transportation with grant funding support from the California Air Resources Board.[168]

Envoy

Envoy offers on-demand shared electric vehicles, including e-scooters and e-bikes, located in dedicated parking spaces at apartment complexes, hotels, and workplaces, including WeWork. They also provide electric vehicles for drivers of Uber, Lyft, Postmates, and GrubHub. Envoy has initially focused on California. As of early 2019, Envoy has more than 20 locations in Southern California and more than 10 in Northern California. Most of these locations are higher-end apartment and condo complexes, with some Envoy vehicle deployments in low and moderate-income buildings that supported with grant funding from the California Energy Commission or from Electrify America Volkswagen settlement funds.

Envoy offers a turnkey solution that includes electric vehicle infrastructure, an app to access the vehicles, and maintenance and support for its all-electric fleet. The total cost of the program is estimated at $900 per month per vehicle, with per-minute use fees recouping the cost for market-rate properties. For programs operating on a non-subsidized basis, a revenue split is also provided for the property owner. The vehicles that Envoy deploys range from Tesla models for higher-end properties to the Chevrolet Bolt, Volkswagen e-Golf, Fiat 500e, and other lower cost options, including GenZe scooters and e-bikes. Envoy has an integrated smartphone app whereby drivers can select all available vehicle options.

The Envoy model has the potential to bring electric vehicle access to a wide variety of locations within Ventura County, and to help overcome the currently low adoption rate for electric vehicles in multi-unit residential developments including, with grant support, in lower-income communities.

Car2go

Car2go is a German car sharing company owned by Daimler AG. With markets in the U.S., Europe, and China, the company is currently the largest car sharing company in the world, with over 2.5 million registered members and a global fleet of 14,000 vehicles.[169] The company offers exclusively Smart and Mercedes-Benz vehicles (both gas and electric) and features one-way, point-to-point rentals. Users are charged by the minute, with hourly and daily rates available. Car2Go pioneered a large electric vehicle deployment in San Diego beginning in 2011. Car2go expected 1,000 charging stations to be deployed around the city, but only 400 were in place by early 2016. As a result, an average of 20 percent of the carsharing fleet was unavailable at any given time because the cars were either being charged or because they did not have enough charge to be driven. At the end of 2016, Car2Go left the San Diego market.

---

[168] https://www.bluela.com/about-bluela

[169] (June 15, 2017). Car2go brings new Mercedes-Benz Vehicles to Denver. Retrieved from: https://www.prnewswire.com/news-releases/car2go-brings-new-mercedes-benz-vehicles-to-denver-300474437.html

Car2G continues to offer car sharing services in seven other US cities and may return to the California market in the future. The company has a stated commitment to electrify their shared fleet as indicated in their 2018 white paper focused on the intersection of car sharing and electric mobility. Car2go already operates purely electric car sharing fleets in three locations (Stuttgart, Amsterdam, and Madrid) with a total of 1,400 vehicles in use by 365,000 customers.[170]

Gig Car Share
Gig Car Share manages a fleet of Prius plug-in hybrids in a shared rental platform. As of 2018, Gig Car Share is operating in Sacramento, Alameda County, Oakland, and Albany. The company offers plug-in electric vehicles and charges fees for use by the mile, hour, or day. The rental fee is inclusive of parking, insurance, and fueling costs. The model also enables one-way trips as long as the vehicle is parked within a specific zone. Trips can also be ended at the Oakland airport and at some lots in San Francisco. In Sacramento, Electrify America funding supported the rollout of 260 Gig Car Share electric vehicles in early 2019.[171]

Maven
Maven is the General Motors entry into the carsharing market, offering rental of both internal combustion engine and all-electric Chevy Bolt vehicles to customers through the Maven app. Having acquired Cruise Automation for nearly one billion dollars, General Motors is also committed to a rapid deployment of their autonomous vehicle program through Maven. Maven operates Chevy Bolts equipped for autonomy in New York and other cities. Maven has deployed vehicles in Los Angeles and has piloted a program in partnership with Many Mansions, a low-income multi-family development in the City of Thousand Oaks. *Many Mansions has a special focus on housing low-income families, the formerly homeless, seniors, veterans, and the disabled.* Residents at Many Mansions were able to rent the Maven vehicle for $8 per hour including e-fueling and insurance. Residents participating in the pilot responded positively to the program, which enables affordable access to a car when they need it.[172] In August 2017, Maven was announced as the exclusive carsharing partner for the University of Southern California in Los Angeles. The University of Southern California Maven program currently provides up to 18 vehicles on campus that can be rented for about $5 per hour using the mobile app, a discounted rate. The cars can be used for personal transportation, or for side work as ride-hailing drivers or for food delivery.[173]

Maven offers several different services as a part of their car sharing program, segmented into Maven City, Maven Gig, Maven Home, and Maven Reserve. Maven home is a car sharing service built for multifamily residential communities that provides members with 24/7 access to cars stationed at their building (similar to Envoy). Maven Gig is focused on gig economy workers, with the minimum reservation set at 35

---

[170]Car2go. Press Release. Retrieved from: https://www.car2go.com/media/data/na/press/releases/180410_press_release_car2go_publishes_white_paper_on_electric_mobility.pdf
[171] Kellen Browning. (June 13, 2018). Electrify America to spend $44 million on Sacramento-area electric vehicles. Retrieved from: https://www.sacbee.com/news/local/transportation/article213138339.html
[172] Tyler Hersko. VC Star. Car-sharing program offers a lift to Many mansion residents in Thousand Oaks. Retrieved from: https://www.vcstar.com/story/news/local/2017/08/31/car-sharing-program-offers-lift-many-mansion-residents-thousand-oaks/608522001/
[173] USC. Maven. Retrieved from: https://transnet.usc.edu/index.php/maven/

days in California. Maven Gig users can apply to drive for any rideshare, food, package, or grocery delivery platform using Maven vehicles. Maven Gig has arrangements with Grubhub, Instacart, Roadie, and HopSkipDrive, among others. Weekly rates include unlimited mileage, insurance (less the deductible), and maintenance. Available cars include the Chevrolet Cruze, Impala, Malibu, Trax, and Bolt electric vehicle. As of 2019, Maven Gig is available in San Diego, San Francisco, Los Angeles, Denver, Phoenix, Boston, Washington D.C., and in Australia. Maven is also experimenting with all electric deployments, having recently launched their first all-electric fleet with 20 Chevrolet Bolts in Austin, Texas. Maven Reserve is a car sharing program for customers who need a rental car from 7 to 28 days. This program is available in Los Angeles and San Francisco and other locations throughout the U.S. and Canada.

Peer-to-Peer Car Sharing

Peer-to-peer car sharing services -- including Getaround and Turo – provide a platform for car owners to earn money via short-term car rentals, similar to AirBnB for vehicles. Teslas in particular have proven popular on both platforms. Getaround also has a partnership with Uber that enables users to rent "ride-share ready" vehicles for use in the Uber network, based on per-hour rental fee. The program launched in the San Francisco Bay Area in May 2017 and is now coming to Los Angeles and San Diego, with plans to bring on Philadelphia and Washington, D.C., soon. Drivers pay $5 per hour for use of the vehicle. There are no upfront fees, commitments or subscriptions, and no limit to the booking duration. The cars are equipped with Uber decals, phone mounts and phone chargers, with insurance included. All Getaround vehicles are equipped with an app allowing users to book and unlock vehicles without need of a physical exchange of keys between owner and renter. The system enables those living car-free to rent a car and drive for Uber, while enabling car owners to earn extra income during times when they do not need access to their own vehicle.

As of 2018, Turo had four million registered users of the service and more than 170,000 privately owned cars available for rental. The company is based in San Francisco and operates in more than 5,500 cities in 56 countries. Car owners can register their cars online to be rented by other Turo members. The car owner states when and where the car will be available. A Turo member who wants to rent a car reserves a specific time slot. Turo takes 10 to 35 percent of rental income, depending on the insurance coverage it provides the car owner. The Turo service covers vehicles with up to $1 million of liability insurance to protect car owners against lawsuits for injuries and property damage. Cars listed must be 2006 or newer with few than 130,000 miles. Turo claims that users are screened for trust and safety purposes.

Peer-to-peer platforms like Turo and Getaround can reduce car ownership costs by enabling revenue generation for vehicles that are not needed for continuous use. They can also enable drivers to experience electric vehicles at low cost with a service that fills the gap between dealer test drives and long-term rental arrangements. Local programs that enable accelerated electrification of these gig economy and shared ride vehicles will clearly yield disproportionate emissions and electric vehicle awareness benefits relative to lower mileage, individually owned vehicles.

Ride-hailing and Shared Ride Apps

Ride-hailing and ride sharing services such as Uber and Lyft – sometimes called TNCs – have provided an alternative to both taxi and personal vehicle trips throughout California and globally. TNCs innovate on and disrupt the taxi model by introducing the ability to call a ride through a smart phone app that matches drivers and riders seamlessly and efficiently. In addition, the services provide an easy payment system, bypassing problems with in-car cash payments and credit card readers. As an urban mobility solution, TNCs have expanded travel options and reduced costs relative to taxis due in part to ride-sharing options, as well as subsidies provided by investors willing to sustain low prices as a means to gain market share and squeeze out competitors. In addition, the relatively low wages and lack of benefits provided to gig economy workers has been a powerful force in keeping fares low. As of late 2018, Uber had raised more than $16 billion in private equity and debt, while Lyft had raised nearly $5 billion, with much of these resources going to subsidize low prices.[174] As a result of attractive pricing and convenient service, Uber and Lyft increased their California trip miles more than 100 percent in 2016 and greater than 60 percent in 2017,[175] according to a 2018 report by the CPUC entitled "Electrifying the Ride Sourcing Sector in California: Assessing the Opportunity." As of 2017, Uber was operating in 172 cities in California and Lyft in more than 92. Statewide, the CPUC estimated that ride-hailing is only 2 percent of total vehicle miles traveled. However, in larger cities, that number goes up substantially. In San Francisco, for example, the San Francisco Municipal Transportation Agency estimates that 15 percent of in-town trips and 20 percent of total miles traveled during the week are in ride-hailing vehicles.[176]

Experience with the TNC model has produced varying environmental and congestion impacts. The diversity of impacts reflects differences in vehicle fuel type, operating mode (shared vs. single passenger), network efficiency ("ghost" miles without passengers vs. revenue passenger miles), and cannibalization from other modes of transport -- including induced demand for trips that might otherwise not have been made in the absence of TNC services. In a white paper entitled *The Future of Mobility*, the Transportation Sustainability Research Center at University of California, Berkeley found that in three out of four studies, more than a third of respondents would have taken public transit, walked, or biked, in place of ride-hailing.[177] Even when they displace personal car trips, ride-hailing trips can add more vehicle miles than the car trip they are displacing because of the phenomenon of ghost trips (also referred to as "dead-heading") – in which miles are travelled without any passengers between drop-offs and pick-ups. Ghost trips can account for an estimated 20 to 40 percent of all ride-hailing miles. San Francisco Municipal Transportation Agency reports that 20 percent of all VMT in San Francisco is in dead-head mode, while the CPUC reports that 40 percent of statewide TNC miles are in dead-head travel.

Finally, the unregulated entry of TNC vehicles into a city center can greatly increase the total number of vehicles on the roads at any one time, contributing to increased traffic congestion. For example, a 2018 report by the San Francisco Municipal Transportation Agency found that Uber and Lyft were responsible

---

174 Jason D. Rowley, "How Fierce Competition Shaped Uber And Lyft's Fundraising Strategy, Crunchbase, December 13, 2018, https://news.crunchbase.com/news/how-fierce-competition-shaped-uber-and-lyfts-fundraising-strategy/

175 Simi Rose George, "Electrifying the Ride Sourcing Sector in California: Assessing the Opportunity," April, 2018, California Public Utilities Commission. http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/Electrifying%20the%20Ride%20Sourcing%20Sector.pdf

176 Jimmy O'Dea, "How Many Rides Do Lyft and Uber Give Per Day? New Data Help Cities Plan for the Future," Union of Concerned Scientists (blog post), June 20, 2017.

177 Susan Shaheen and Hannah Totte, *The Future of Mobility,* University of California, Transportation Sustainability Research Center, 2018. http://www.dot.ca.gov/ctp/docs/FOM_White%20Paper.pdf

for 51 percent of the increase in daily vehicle delay hours between 2010 and 2016. During the same period, the companies accounted for 47 percent of the increase of vehicle miles traveled, and 55 percent of the average speed decline on roadways. Population and employment growth, plus changes in the road network, accounted for the balance of increased delays. Both Uber and Lyft criticized the study methodology, noting that it did not correct for the explosive growth in freight deliveries during the same time period.[178] However, there is little doubt that TNCs are increasing downtown congestion in cities with intensive use of ride-hailing services.

TNC management teams are sensitive to increasing congestion, and both Lyft and Uber have invested in new mobility strategies to address the issue. Uber purchased Jump – the e-bike company -- and is moving into e-scooters. Lyft purchased bikeshare company Motivate and has introduced e-scooters in Santa Monica and Denver. Moreover, in an effort to make amends in San Francisco, both Uber and Lyft agreed to a proposed 3.25 percent tax on net rider fares for each solo trip and a 1.5 percent tax on shared rides. These taxes are to be used to support public transit.

Uber and Lyft have both worked to strengthen the appeal of their shared ride option, which has the potential to reduce congestion and emissions. Lyft Line was released in 2014 and was followed quickly by the release of Uber's own ridesharing service, known as UberPool. Both services offer riders a reduced price in exchange for a shared ride with a modest detour to pick up or drop off additional customers. By 2016, 50 percent of the Lyft and Uber riders opted for shared rides.[179] In California, pooled rides represent more than 30 percent of the ride requests by Uber and Lyft passengers, according to the CPUC. However, the percent of these requested shared rides that end up transporting more than one passenger is not reported. The CPUC report concludes on an uncertain note with this statement: "finally, the overall impact of TNC operations on VMT in California remains ambiguous."[180]

In theory, a tightly controlled population of TNC vehicles in a dense urban area could greatly reduce congestion. A study from New York City found that just 3,400 passenger cars could serve 98 percent of New York's taxi demand, with a wait time of only 2.7 minutes per ride.[181] However, the unconstrained entry of gig drivers into New York and other cities, combined with ongoing competition from conventional taxis and private vehicles, makes it difficult to achieve the optimum fleet size for TNCs. Further, there is little doubt that TNCs have induced additional mobility demand, as well as a modal shift that draws from both owner-operated vehicles, taxis, transit ridership, and active transportation options such as biking and walking. A 2017 report from Schaller Consulting states that app-based services have generated a net

[178] Aarian Marshall, "Both Uber and Lyft Made Traffic Worse in San Francisco – But it's Complicated," *Wired Magazine,* October 2018. https://www.wired.com/story/uber-lyft-san-francisco-traffic-report/

[179] Sperling D. Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future.

[180] Gross, S. CPUC Policy and Planning Division. (April, 2019). Electriying the Ride-sharing Sector in California. Retrieved from: https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Policy_and_Planning/PPD_Work/PPD_Work_Products_(2014_forward)/Electrifying%20the%20Ride%20Sourcing%20Sector.pdf

[181] Alonso-Morea J. Et Al., (January, 2017). On-Demand High Capacity Ride Sharing via Dynamic Trip vehicle Assignment. Proceedings of the National Academy of Sciences 114; 462-67.

increase of 31 million trips to 52 million passengers since 2013 and increased vehicle travel by 600 million miles. [182]

Both Uber and Lyft are also seeking to expand the role of electric vehicles within their fleet by encouraging electric vehicle leasing programs available to "gig economy" drivers (see additional information in Chapter 6 of this report.) For example, Lyft recently deployed a program in Seattle called Green Mode, which enables riders to hail hybrid or electric vehicles. [183] In addition, both companies are investing heavily in autonomous technology as a way to further reduce operational costs and environmental impacts (insofar as the coming generation of autonomous vehicles is likely to be all-electric). The autonomous strategies of both companies are highlighted later in this chapter.

To date, most local regulation of ride-hailing and ridesharing has been focused on labor, safety, and congestion issues. [184] Some jurisdictions, such as Austin, Texas, have sought to require higher background check standards for drivers, including fingerprinting, that are consistent with standards for taxi drivers. New York City has sought to establish special minimum wage requirements to boost the income of higher-volume drivers to approximately $17 per hour after drivers' expenses, pointing out that high percentages of Uber and Lyft drivers are currently on public subsidies such as Medicaid and food stamps. A complex New York City wage formula seeks to reward drivers with higher utilization of the vehicles in order to create an incentive to reduce congestion caused by longer drive cycles between passengers. The City also provides a substantial bonus for drivers with wheelchair accessible vehicles. [185] As yet, there is no provision for rewarding electric vehicle adoption, but the scale of the City's intervention in ride-hailing operations indicates that they likely have the capability to address electrification with incentives or mandates.

In a "good news/bad news" scenario, the ongoing growth of ride-hailing has the potential to reduce total vehicle ownership and free up downtown parking but, as discussed earlier, ride-hailing is currently contributing to increased vehicle miles travelled and congestion. Key variables that will determine the degree of public benefits and burdens from TNC services include the percentage of trips that are shared, the degree of electrification of TNC fleets, and the utilization rate of the vehicles (percentage of ghost trip miles). Shared and autonomous vehicles could likewise have a positive or a negative influence on emissions depending on: 1) vehicle miles travelled; 2) the type(s) of fuel used in the vehicles (i.e. electricity, gasoline, diesel, and/or hydrogen); 3) the carbon intensity of the electricity and other fuel source; and 4) the degree to which other low-carbon travel modes are supplanted or supported (e.g. public transit, walking, biking, etc.).

Given the higher mileage travelled by a typical Uber and Lyft driver (estimated by CARB to be double the typical 12,000 miles per year of a regular car), the relative benefits of accelerated electrification of the

---

[182] Shaller B. Schaller Consulting. (27 February, 2017). Unsustainable? The Growth of App-Based Ride Services and Traffic, travel and the Future of New York City".

[183] Phil Dzikiy. (February 6, 2019). Electrik. Lyft's new 'Green Mode' let's riders request an EV. Retrieved from: https://electrek.co/2019/02/06/lyft-green-mode/

[184]Rudy Takala, "What's the Government's Role in Regulating Uber and Lyft," May 26, 2016, *Washington Examiner* https://www.washingtonexaminer.com/whats-the-governments-role-in-regulating-uber-and-lyft

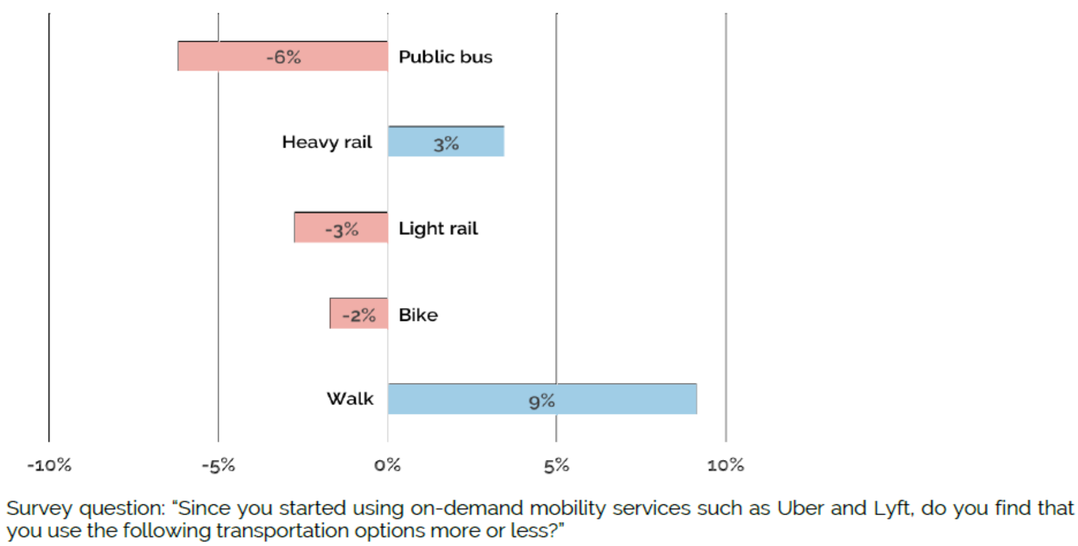
[185] Adam Smith, "New York City Imposes Pay Regulations for Uber and Lyft Drivers," The Street, December 5, 2018. https://www.thestreet.com/markets/regulation/new-york-city-imposes-pay-regulations-for-uber-and-lyft-drivers-14801670

ride-hailing segment is very high. In California, the emissions advantages of going electric continue to grow as the grid advances toward the state's 100 percent renewable target, so the carbon emission per mile of VMT is being reduced over time. However, the integration of ride-hailing with other low-carbon mobility options is a key issue for local transportation planning. With easily accessible ride-hailing offering an attractive first mile, last mile option, commuters may find some forms of mass transit more attractive, particularly commuter rail. A comprehensive report on ride-hailing impacts by the University of California, Davis generated these conclusions:

- Ride-hailing attracts users away from bus services (a 6 percent reduction) and light rail (a 3 percent reduction) but generates a 3 percent net increase in commuter rail use
- 49 percent to 61 percent of ride-hailing trips would have not been made at all, or would have been made by walking, biking, or transit
- Based on mode substitution and ride-hailing frequency, ride-hailing is likely to contribute to growth in VMT [186]

The University of California, Davis data is indicated below:

Figure 1: Ride Hailing Impact Analysis by the University of California, Davis. Changes in Transit use, biking, walking after adoption of ride-hailing services



Source: Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States*, October 2017 by Regina R. Clewlow and Gouri Shankar Mishra*

Clearly, ride-hailing could help improve mass transit, by filling routing gaps and making it more accessible and efficient than it is today. But it could also increase congestion, further slow buses in mixed traffic, undermine transit system economics, and degrade essential transportation services for the less affluent.

[186] Regina R. Clewlow and Gouri Shankar Mishra, *Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States*, October 2017, UC Davis Institution of Transportation Studies. https://steps.ucdavis.edu/new-research-ride-hailing-impacts-travel-behavior/

In an optimum scenario, transit operators would be motivated to increase the speed and convenience of core transit services, so that ride-hailing is used to fill in gaps in routing rather than to cover the same trip types. This is the approach favored by San Francisco, which is now collecting fees on ride-hailing service providers that can help fund investments in transit. Ultimately, ride-hailing services will make the biggest contributions to reducing climate pollution from transportation if they lead to more pooled rides, less overall VMT, more vehicle electrification, greater utilization of mass transit, and more biking, walking or scootering. But that outcome is far from guaranteed without public policies and regulations that steer ride-hailing and TNC service providers in toward the greatest societal and environmental benefits.

Senate Bill 1014 - the Electrify California Ride-Hailing Act (e-CAr)

The state of California has very recently passed important legislation to promote the electrification of ride-sharing via new legislation, known as the Electrify California Ride-hailing Act (e-CAr). The legislation was authored by Senator Nancy Skinner and signed into law by Governor Brown in late 2018. SB 1014 directs CARB to establish decreasing emissions targets for ride-hailing companies like Uber and Lyft. While the emissions regulations have not yet been written as of early 2019, they are expected to result in substantially increased rates of TNC electrification. As the legislation was debated, the following limits were considered: starting in 2023, 20 percent of miles traveled by ride-hailing services would be in ZEVs (battery electric vehicles or fuel cell electric vehicles), rising to 50 percent by 2026. By 2030, 100 percent of vehicles purchased, leased, or contracted by the services would have to be ZEVs. As Senator Skinner reported to Forbes, "it makes the most sense to focus on those cars that are going to be on the road the most. It doesn't necessarily make sense to have all of our electric vehicles be somebody's second or third vehicle that's mostly just parked in their garage." [187] Final regulatory requirements for TNCs under the e-CAr legislation will likely be in place by 2020.

Other Shared Mobility Services

The ride-hailing ecosystem also contains a growing array of services targeted to specific customer sub-segments. For example, BlaBlaCar connects drivers and passengers to share the costs of longer city to city journeys and road trips. [188] Informal carpooling solutions can also be observed at key pickup points in various locations in California. This practice is aided by high occupancy vehicle (HOV) lane access rules that provide a significant incentive for riders to take on fellow commuters to speed their journey. Known as slugging, this peer to peer practice typically has no central organization. In the Bay Area, 3,000 to 5,000 riders are estimated to participate, thanks in part to the significant speed advantage afforded to three-person carpools on the region's bridges and HOV lanes. [189] In the Ventura area, VCTC uses RideMatch to help people find carpooling partners or vanpools. [190] Ventura County residents that commute to and from

---

[187] Alan Ohnsman, "California May Push Uber And Lyft To Go Electric, With Far-Reaching Consequences," Forbes, May 16, 2018. https://www.forbes.com/sites/alanohnsman/2018/05/16/california-may-push-uber-and-lyft-to-go-electric-with-far-reaching-consequences/#2791361113fc

[188] https://www.blablacar.com/

[189] Bender, A. (March 10, 2016). A Practically Free Alternative to Uber and Lyft you are Missing Out on. Retrieved from: https://www.forbes.com/sites/andrewbender/2016/03/10/a-practically-free-alternative-to-uber-and-lyft-you-are-missing-out-on/#348c4e8181ad

[190] Ventura County Transportation Commission's Ride Sharing webpage. Access May 14, 2019. Available at: https://www.goventura.org/getting-around/rideshare/for-commuters/

Santa Barbara County for work can also find carpooling partners through the Santa Barbara County Association of Governments SmartRide service, which is based on the RideAmigos platform. [191]

Market, Technology, and Legal Context for Autonomous Vehicles

Autonomous driving technology is viewed by many TNC and fleet operators as a pathway to reduced cost, improved safety, and smarter utilization of fleet vehicles. For their part, vehicle OEMs are beginning to integrate autonomous vehicle features, to refine their capabilities, and to accustom consumers to the challenging role of "backup driver" when advanced autonomous features are engaged. While fully autonomous vehicles with no driver input are still years away from mass market deployment, high levels of automation are currently being incorporated into select vehicles (such as high-end Teslas).

Autonomous vehicle technology integrates a large array of sensors and processors to facilitate multiple levels of autonomous operation. Currently, the Society of Automotive Engineers classifies autonomous cars into five levels based of autonomous capability.

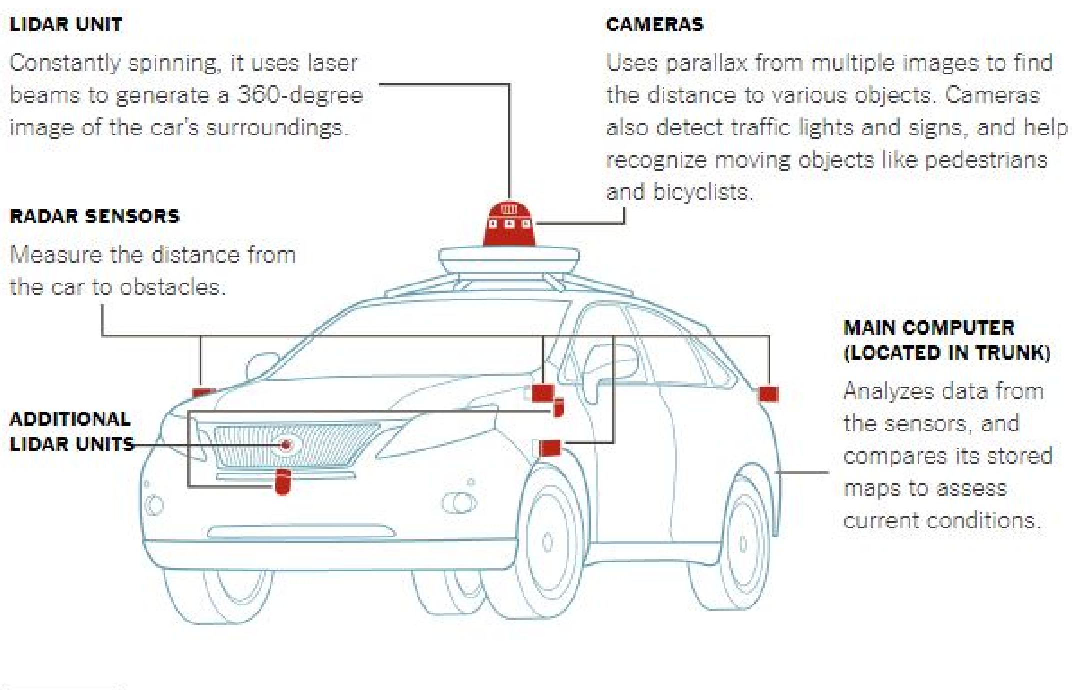
- **Level 0:** Automated system issues warnings and may momentarily intervene but has no sustained vehicle control.
- **Level 1 ("hands on"):** The driver and the automated system share control of the vehicle. Examples of Level 1 automation include: Adaptive Cruise Control, in which the driver controls steering while the automated system controls speed; and Parking Assistance, where steering is automated while speed is under manual control. The driver must be ready to retake full control at any time. Lane Keeping Assistance Type II is a further example of Level 1 self-driving.
- **Level 2 ("hands off"):** The automated system takes full control of the vehicle (accelerating, braking, and steering) under some circumstances. The driver must monitor the driving and be prepared to intervene immediately at any time if the automated system fails to respond properly. The shorthand "hands off" is not meant to be taken literally. In fact, contact between hand and wheel is often mandatory during Society of Automotive Engineers Level 2 driving, to confirm that the driver is ready to intervene. (The currently available Tesla Autopilot system is considered to be Society of Automotive Engineers Level 2.) At the current time, Level 2 automation systems are not able to handle all conditions – such as heavy snow, heavy rain at night, chaotic construction zones, etc.
- **Level 3 ("eyes off"):** The driver can safely turn their attention away from the driving tasks, e.g. the driver can text or watch a movie. The vehicle will handle situations that call for an immediate response, like emergency braking. The driver must still be prepared to intervene within some limited time, specified by the manufacturer, when called upon by the vehicle to do so.
- **Level 4 ("mind off"):** Similar in capability to Level 3, but no driver attention is ever required for safety, e.g. the driver may safely go to sleep or leave the driver's seat. Currently, self-driving in Level 4 is being demonstrated only in limited "geofenced" spatial areas or under special circumstances, like traffic jams. Outside of these areas or circumstances, the vehicle must be able to safely abort the trip, e.g. park the car, if the driver does not retake control.
- **Level 5 ("steering wheel optional"):** No human intervention is required at all. An example would be a robotic taxi that may not even have a steering wheel.

[191] Santa Barbara County Association of Governments' Traffic Solutions Division. SmartRide.org

Autonomous vehicles integrate multiple sensor systems to enable the three core functionalities of autonomous driving. These include:

- **Perception of the vehicle's surroundings** is facilitated by lidar, cameras, radar, Wi-Fi, cellular, and other near field communications with adjacent vehicles.
- **Central planning and sensor data interpretation** is facilitated by an onboard computer processor that plots next steps following analysis of sensor data and external data, including road signs, geospatial map data, and more.
- **Control of vehicles systems** where input to vehicle systems is provided via electronic links to steering, brakes, accelerator, gearing, signals, and other electrical systems.

Figure 2: How Driverless Cars See the World [192]



By Guilbert Gates | Source: Google | Note: Car is a Lexus model modified by Google.

Autonomous Vehicle Safety and Liability

In the United States, nearly 40,000 people were killed and 4.6 million were seriously injured in car, motorcycle, and truck accidents in 2016.[193] This is close to the same level of American casualties in the entire Vietnam War. Human error is a major contributing factor in 94 percent of these crashes. Many experts believe that removing the human element in driving can result in significant safety improvements. Advocates point out that commercial aircraft have been operating in a highly autonomous mode and

[192] Metz, Cade. The New York Times. *How Driverless Cars See the World Around Them.* Retrieved from: https://www.nytimes.com/2018/03/19/technology/how-driverless-cars-work.html
[193] NHTSA. USDOT Releases 2016 Fatal Traffic Crash Data. Retrieved from: https://www.nhtsa.gov/press-releases/usdot-releases-2016-fatal-traffic-crash-data

providing extremely high levels of safety for many years. Many high-tech factories and warehouses are also significantly autonomous in their operation. Autonomous vehicles operating in a mixed environment will of course be involved in accidents, and several fatal crashes have already been recorded involving semi-autonomous systems. However, it is certain that autonomous vehicles can significantly improve overall driving safety over time, even in mixed contexts. Connected autonomous vehicles will also be able to notify other cars of road hazards, and the combined data of millions of autonomous vehicles will progressively improve each individual car's safety and performance. [194]

Despite the legitimate promise of autonomous vehicles, regulators and technology developers will confront new risks. Many of these are greatest in the "grey zone" between partial and full automation. It is very difficult for humans to maintain high levels of situational awareness when, under normal circumstances of Level 3 automation, they will not be called upon to do much of anything other than periodically signal that they are awake. Other challenges include programming autonomous vehicle choices among accident scenarios that may inevitably arise. For example, should autonomous vehicles veer off the road to avoid pedestrians when this evasive maneuver might endanger the driver? Another challenge will be apportioning liability. How will liability be defined when humans fail to respond optimally when they are taking over for a failed autonomous system? Many of these questions do not have clear or satisfactory answers, and the job of system designers and regulators will become increasingly complex as autonomous vehicles become common on our roadways.

Liability, Cyber Security, and Data Privacy in the Autonomous Vehicle Ecosystem

In response to the evolving liability landscape, California and other state agencies have responded by requiring the approval of autonomous vehicle permits, which address some of the liability issues related to potential collision damages. Some manufacturers are also being proactive on the liability issue. Volvo plans to provide 100 customers with an autonomous XC90 SUV by 2021 in a pilot program planned to reach the U.S. and China. In this pilot context, Volvo will accept full liability for autonomous vehicle systems. [195]

Cyber security is another looming concern, as is data privacy. In 2015, researchers remotely accessed a Jeep Cherokee, turned on the air conditioner, and stopped the accelerator from working. [196] Given the growing sophistication of international cyber-conflict, this is a primary concern for regulators and OEMs. Data from on-board cameras, microphones, navigational systems, and communication devices have also raised questions about data ownership and rights. Most of these challenges will be addressed by state and federal regulation, and global industry standards setting. However, there are opportunities for capable local jurisdictions, especially counties or large cities, to play a proactive role by proactively defining the goals and parameters of local autonomous vehicle pilot projects.

---

[194] General Motors. 2018 Self-Driving Safety Report. Retrieved from: https://www.gm.com/content/dam/company/docs/us/en/gmcom/gmsafetyreport.pdf

[195] CBInsights. (September 4, 2018). 46 Corporations Working on Autonomous Vehicles. Retrieved from: https://www.cbinsights.com/research/autonomous-driverless-vehicles-corporations-list/

[196] Greenberg, A. (July 2015). Hackers Remotely Kill a Jeep on the Highway – with me in it. Wired.

Case Studies of Autonomous Vehicle Deployment

As of 2019, autonomous vehicle deployments (at Level 2 or Level 3) are under way by Uber, Lyft, Waymo, GM, Tesla, and other companies (many of which are operating in stealth mode.) A sample of relevant projects is provided below.

Tesla: Tesla released semi-autonomous driver assist technology in 2014. Since then, the company has updated customer software to enable autonomous lane changing, steering, and parking features. While Tesla leadership at one point boasted that they would initiate fully autonomous operations as early as 2018, fatal accidents involving autopilot systems have slowed progress. These accidents highlighted the danger of driver distraction while autonomous systems are deployed, as well as "blind spots" in the capability of autonomous systems to perceive particular road and traffic hazards. The company has not updated its schedule for deployment of fully autonomous capabilities, but it continues to lead the industry in accumulating on-the-road experience with autonomous vehicle systems.

Waymo: Owned by Alphabet, Google's parent company, Waymo currently is piloting their autonomous vehicle technology in commercial deployments. As of November 2017, they have completed over four million self-driven miles. Waymo has formed partnerships with Fiat Chrysler and Lyft, among others, to establish technology and commercial foundations for deploying their autonomous vehicle technologies. [197] In August 2018**,** the company launched a pilot program with Valley Metro Transportation Center to enable 400 residents of the Phoenix area to utilize a fleet of autonomous Chrysler Pacifica Minivans. [198] It is anticipated that additional pilot tests will follow in other cities soon.

Autonomous Trucking and Shipping: Otto, owned by Uber, demonstrated the first autonomous truck in 2016 [199] -- and pilot demonstrations of autonomous vehicle truck technology are now proceeding with Daimler, Volvo and Peloton, and others. New entrants such as Embark, Waymo, TuSimple, and Tesla are investing massive research and development resources into the technology in anticipation of safety improvements, and reduced labor and energy costs. Many analysts have predicted that autonomous vehicle truck technology will result in substantial job loss. [200] While this is likely to be a legitimate concern over the ten to twenty-year timescale, the current generation of Level 3 and Level 4 autonomy still requires a driver present in the cab.

Autonomous vehicle and Ride-hailing: Uber and Lyft are spearheading the development of autonomous vehicle technology for ride-hailing and shared mobility platforms. For both organizations, full autonomy is viewed as a pathway to significantly reduce labor costs. While full driverless operations are at least a

---

[197] Mike Isaac. (May 14, 2017). Lyft and Waymo Reach Deal to Collaborate on Self-Driving Cars. Retrieved from: https://www.nytimes.com/2017/05/14/technology/lyft-waymo-self-driving-cars.html

[198] Allssa Walker. Waymo's Self-driving Vans Will Take Passengers to Public Transit. Retrieved from: https://www.curbed.com/2018/8/1/17640116/waymo-driverless-transit-phoenix-uber-lyft

[199] Alex Davies. (October 25, 2016). Uber's Self Drivign Truck Makes Its First Delivery: 50,000 Beers. Retrieved from: https://www.wired.com/2016/10/ubers-self-driving-truck-makes-first-delivery-50000-beers/

[200] WSJ. Self-driving technology threatens nearly 300,000 trucking jobs, report says. Retrieved from: https://www.wsj.com/articles/self-driving-technology-threatens-nearly-300-000-trucking-jobs-report-says-1536053401

decade away according to Lyft's Co-founder John Zimmer 201, semi-autonomous Uber and Lyft vehicles equipped for Level 2 and Level 3 autonomy are already in testing on public roads today. In January 2018, Lyft and General Motors formed a partnership to offer an on-demand network of autonomous vehicles in Phoenix, Arizona and San Francisco, California.35 Another Lyft partnership with software and sensor company Aptive enabled new autonomous vehicles to provide Level 4 automated rides to 20+ destinations around the Las Vegas strip – completing a total of 5,000 autonomously-driven rides using the technology.

Uber has also invested significantly into the research and development of autonomous vehicle technology. However, the company has come under scrutiny after a fatal night time collision between an autonomous vehicle and a bicyclist in Tempe, Arizona. [202] Reports on the incident indicated that the driver of the vehicle may have been watching videos on their phone while the vehicle autopilot was engaged. [203] Following the crash, Uber suspended its self-driving trials and pulled its autonomous vehicles from public roadways. However, work on the technology continues. In August 2018, Uber announced a $500 million investment from Toyota and a plan to jointly work on autonomous vehicle development with the Japanese automaker. [204]

General Motors - Cruise: Cruise was acquired by General Motors in 2016 and is integrating autonomous vehicle technology with the Bolt electric vehicle platform. The company is currently refining their autonomous vehicle technology on the streets of San Francisco and has ambitions to be the first fully autonomous (fully driverless) ride-hailing service in the marketplace. [205] **The company is also developing joint ventures in the delivery segment with partners such as Door Dash.** [206]

Autonomous Micro-Mobility Solutions

Urban shuttle and other fixed route mobility applications have also attracted autonomous vehicle technology advancements. Innovative concept vehicles have appeared from major OEMs – many of which are akin to horizontal elevators or Personal Rapid Transit (which historically has relied on fixed guideways), rather than vehicles with traditional driver controls such as steering wheels. For example, Volkswagen

---

[201] John Zimmer. The Third Transportation Revolution: Lyft's vision for the next 10 years and beyond. Retrieved from: https://medium.com/@johnzimmer/the-third-transportation-revolution-27860f05fa91

[202] Daisuke Wakabayashi. (March 19, 2018). Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam. Retrieved from: https://www.nytimes.com/2018/03/19/technology/uber-driverless-fatality.html

[203] Kate Conger and Bryan Menegus. (June 22, 2018) Uber Driver in Fatal Tempe Crash May have Been Watching the Voice Behind the Wheel. Retrieved from: https://gizmodo.com/uber-driver-in-fatal-tempe-crash-may-have-been-watching-1827039127

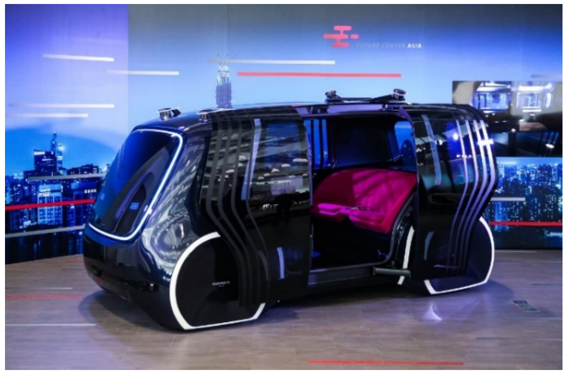
[204] Somerville, H. Reuters. Toyota to invest $500 million in Uber for self-driving cars. Retrieved from: https://www.reuters.com/article/us-uber-toyota/toyota-to-invest-500-million-in-uber-for-self-driving-cars-idUSKCN1LC203

[205] Jonathon Ramsey. (March 16th, 2018). GM begins mass-production of autonomous Cruise AV in 2019. Retrieved from: https://www.autoblog.com/2018/03/16/gm-autonomous-cruise-av-2019/

[206] Business Wire. Cruise's self-driving fleet will launch food delivery with DoorDash in early 2019 in San Francisco. Retrieved from: https://www.businesswire.com/news/home/20190103005514/en/Cruise-DoorDash-Announce-Partnership-Test-Autonomous-Deliveries

previewed a prototype self-driving shuttle concept car called Sedric that is intended to address low-speed urban circulation and last mile solutions.

Figure 3: Volkswagen Sedric Prototype Urban Autonomous Shuttle [207]



A similar new autonomous shuttle called Olli has been developed by Local Motors of Tempe Arizona. The Olli shuttle is designed for corporate and college campuses and has been deployed in a number of pilot demonstrations. [208]

Figure 4: The Olli Autonomous Shuttle Developed by Local Motors [209]

Vehicle to Vehicle (V2V) Connectivity, Platooning, and 5G Cellular Networks

A key enabling technology for the autonomous future is connected communications between vehicles. V2V connectivity can enhance safety by collecting and reporting data such as road hazards, traffic conditions, and managing headways between vehicles. For freight vehicles, headways can be minimized to enable platooning of vehicles to minimize air resistance. Automated platooning was piloted in 2016 in a partnership between DAF, Daimler, Iveco, MAN, Scania, and Volvo. These firms linked a dozen trucks

[207] Volkswagen Group. Volkswagen Group Opens Future Center Asia in Beijing to create mobility for beyond tomorrow. Retrieved from: https://www.discover-sedric.com/en/volkswagen-group-opens-future-center-asia-in-beijing-to-create-mobility-for-beyond-tomorrow/

[208] https://www.xcelerateauto.com/fleet-management/

[209] https://localmotors.com/meet-olli/

from their diverse brands to demonstrate the fuel savings and safety enhancing potential of the platooning concept. While the trucks had human drivers to back up automated systems, the vehicles demonstrated the potential to consolidate diverse autonomous vehicles into a single point of control. [210]

Standards for V2V communication are also advancing through a variety of standards-setting initiatives, with a goal of improving vehicle safety. The deployment of fifth generation (5G) Wi-Fi networks will enable the higher-volume, higher-speed, higher-security data flows required for operationalizing V2V in the context of autonomous vehicles. It is anticipated that V2V standards and technologies will co-evolve with autonomous systems and be ubiquitously deployed in the 2020s.

Local Regulation of Shared and Autonomous Vehicles

The long-term impact of autonomous vehicle technologies on both traffic congestion and emissions will be a function in part of local regulation. In a 2019 paper published in *Transport Policy,* policy analyst Dr. Millard-Ball posits that autonomous vehicles, which are estimated to have operating costs of approximately $.50 per hour inclusive of all costs, will have an economic incentive simply to circle city streets while not in use rather than pay for parking at a significantly higher per hour cost, thereby exacerbating congestion. [211] Because of this negative potential, many transport planners advocate that electric and shared autonomous vehicles should be advantaged in the licensing of mobility services. A University of California, Davis report on the energy and carbon impacts of autonomous vehicles estimates that driverless internal combustion engine cars with little or no sharing could increase GHG emissions by 50 percent by 2050, while increasing vehicle use by 15 to 20 percent. However, if electrified and pooled solutions are integrated into the autonomous vehicle system, total vehicle use would drop by 80 percent and overall mobility costs would drop by 40 percent – thereby saving an astonishing $5 trillion per year in global transportation costs. [212]

Given the speed and scale of emerging technologies for ACES vehicles, it is recommended that Ventura County stakeholders consider development of at least a rudimentary policy framework for ACES vehicles. A number of resources can support local and regional policy development in anticipation of ACES vehicles, including policy briefs from the University of California, Davis -- Three Revolutions Future Mobility Program [213], as well as the Los Angeles Department of Transportation's *Urban Mobility in the Digital Age* resources [214]. The Urban Mobility in the Digital Age is a technology strategy that proposes several policy approaches, near-term actions, and pilot projects for LADOT to consider as it prepares for autonomous vehicles. Ventura County's transportation planning, services, and demand management programs already

---

[210] CBInsights. Retrieved from: https://www.cbinsights.com/research/autonomous-driverless-vehicles-corporations-list/

[211] Millard-Ball, A. (March 2019). The Autonomous Vehicle Parking Problem. Transportation Policy, Volume 75 (pg. 99-108).

[212] Fulton, L., Mason, J., Meroux, D. (2017). Institute of Transportation Studies, UC Davis. Three Revolutions in Urban transportation. UCD-ITS-RR-1703.

[213] UC Davis Institute of Transportation Studies' 3 Revolutions Future Mobility Program. *Policy Briefs*. Accessed May 14, 2019. Available at: https://3rev.ucdavis.edu/policybriefs/

[214] Los Angeles Department of Transportation's Urban Mobility in the Digital Age. Accessed May 14, 2019. Available at: http://www.urbanmobilityla.com/

connect to the Los Angeles Department of Transportation planning context and the greater Los Angeles region – especially for the cities of Thousand Oaks, Moorpark, and Simi Valley. Therefore, integration with these larger Los Angeles basin ACES initiatives would be appropriate and timely.

Recommendations for Shared and Autonomous Vehicle Demonstration and Deployment

SB 1014 (the e-CAr Act) will provide an important framework for accelerated electrification by establishing basic goals for emissions reduction to be achieved by ZEVs in car-sharing applications. However, as in the case of electrification generally, local action will be critical to further accelerate progress toward statewide decarbonization goals, and to deliver additive benefits to local community members. In the case of TNCs and ride-hailing services, there is much to be done at the regional and local level. Specifically, there are three objectives that a balanced and effective TNC policy regime should seek to advance:

1. Accelerate electrification of vehicles used in TNC and ride-hailing applications
2. Optimize the total number of TNC vehicles so that negative congestion impacts, and ghost trip miles are minimized
3. Encourage use of pooled services

To advance these objectives it is recommended that Ventura County stakeholders consider the early development and deployment of ACES policies and demonstration projects, with an initial focus on ride hailing and shared mobility applications. The following recommendations will help position Ventura County stakeholders to participate in showcase initiatives and investments in the context the greater Los Angeles region.

Recommendations for Autonomous, Connected, and Shared Vehicles

- **Recommendation #1 - Create electrification objectives for TNCs and ride-hailing vehicles that accelerate accomplishment of SB 1014 goals**: Given the important role played by electrified TNC and ride-hailing services in boosting the percentage of passenger miles travelled that are all-electric, it is recommended that Ventura stakeholders set measurable goals for the electrification of TNC and ride-hailing vehicles. The baseline for such efforts could be set to accomplish SB 1014 (e-CAr Act) goals, while more aggressive goals could be defined in alignment with local potential for accelerating TNC utilization above the SB 1014 baseline.
- **Recommendation #2 - Develop an assessment of charging needs and a plan for priority charger deployment and charger access for TNC electric vehicles:** Following publication of CARB regulatory guidance aligned to SB 1014, Ventura stakeholders should outreach to Uber, Lyft, Getaround, and other ride-hailing or ridesharing service providers to assess expected growth in the local ride-hailing driver and vehicle population, and to project associated charging needs. A plan for deploying chargers to meet identified needs should be created and matched to available local, regional, state, and industry funding to ensure that vehicles that can provide the most electric passenger miles have priority access to charging infrastructure.
- **Recommendation #3 - Explore development of special incentives to encourage TNC electric vehicle procurement with state and regional agencies, auto OEMs, and TNCs:** In alignment with TNC electric vehicle growth goals and potential (outlined in Recommendation 2 above),

Ventura stakeholders should explore development of special incentives to encourage TNC electric vehicle purchase, lease, or rental by ride-hailing drivers and “gig economy” workers, including delivery service providers such as Door Dash. These incentives could include Ventura County APCD funds, special Energy Commission or CARB program funds, and potential industry matching resources from TNCs and related service providers.

- **Recommendation #4 - Create a plan for regulation of TNC density as needed to mitigate negative congestion or environmental impacts based on best practices in comparable jurisdictions**: Ventura County, local cities, and transportation agencies should annually assess congestion impacts of TNCs to determine if TNC operations are negatively affecting either public transportation service quality or road network congestion. If negative impacts are experienced, appropriate local authorities should consider a cap on TNC service providers in the County. In addition, variable local fees on TNC rider fares should be considered to promote ridesharing services and disincentive solo ride-hailing trips. These fees could be waived or reduced for rides in rural areas, low-income areas, and Disadvantaged Communities to further incentive affordable service to communities that currently lack reliable transit services and mobility access.

- **Recommendation #5 - Partner with TNCs, neighboring jurisdictions, and research institutions to test the impact of more robust price differentials between pooled and non-pooled services**: TNCs already feature dynamic pricing based on time of day and system congestion, as well as differentiated pricing based on pooled vs. individual rider services. Ventura County stakeholders could partner with TNCs, including Lyft, Uber, Maven, etc., and neighboring jurisdictions, including the City and County of Los Angeles, and research institutions such as the University of California, Berkeley Transportation Sustainability Research Center and the UCLA Luskin Center, to test the impact of more robust price differentials between pooled and non-pooled services. The goal of a Ventura County pricing pilot would be to increase the percentage of riders choosing pooled services.

- **Recommendation #6 - Partner with local employers with existing or potential electric vanpool services to prioritize development and deployment of vehicle and infrastructure incentives**: Larger employers in the County with existing or potential employer vanpool services should be prioritized for vehicle electrification and charging infrastructure initiatives based on their relative efficiency in providing electric passenger miles of service relative to other mobility service providers. Given the size and scale of agricultural operations in the Ventura County region, special emphasis should be placed on programs that will expand access to electric vanpool services for farmworkers, using programs such as Van y Vienen as models.

- **Recommendation #7: Explore partnership opportunities with TNCs, auto OEMs, and relevant entrepreneurial and research institutions in neighboring jurisdictions to develop a regionwide plan for optimizing deployment of autonomous, connected, electric and shared vehicles**: Given the enormous potential of ACES vehicles to enhance safety, reduce GHGs, and potentially deliver all-electric passenger miles at greatly reduced cost (particularly when operating in pooled modes), Ventura County stakeholders should outreach to relevant auto OEMs and service providers to explore the potential to prioritize Ventura County for early ACES deployment. The mixed urban, suburban, and rural geography of the County may provide an ideal proving ground for ACES vehicles, and proximity to Los Angeles area research institutions, companies, and incubators provide significant partnership opportunities.

Chapter 7 References

Aarian Marshall. (November 17, 2017). What Does Tesla's Automated Truck Mean for Truckers? Retrieved from: https://www.wired.com/story/what-does-teslas-truck-mean-for-truckers/

Alex Davies. (October 25, 2016). Uber's Self Driving Truck Makes Its First Delivery: 50,000 Beers. Retrieved from: https://www.wired.com/2016/10/ubers-self-driving-truck-makes-first-delivery-50000-beers/

Allssa Walker. Waymo's Self-driving Vans Will Take Passengers to Public Transit. Retrieved from: https://www.curbed.com/2018/8/1/17640116/waymo-driverless-transit-phoenix-uber-lyft

Alonso-Morea J. Et Al., (January, 2017). On-Demand High Capacity Ride Sharing via Dynamic Trip vehicle Assignment. Proceedings of the National Academy of Sciences 114; 462-67.

Andrew Hawkins. (Mar 9, 2018). Waymo's self-driving trucks will start delivering freight in Atlanta. Retrieved from: https://www.theverge.com/2018/3/9/17100518/waymo-self-driving-truck-google-atlanta

Andrew Hawkins. (October 23, 2018). Lyft unveils a new self-driving car and acquires an AR startup to help it build maps. Retrieved from: https://www.theverge.com/2018/10/23/18014200/lyft-self-driving-car-acquires-blue-vision-lab-ar

Associated Press. (May 17, 2015). In San Francisco, private transit that follows public routes – at a higher price). Retrieved from: https://www.omaha.com/money/in-san-francisco-private-transit-that-follows-public-routes-at/article_b6b51e66-2186-5a43-99de-5dd35ff93bc1.html

ATBS. (September 2018). Self-Driving Trucks: Are truck Drivers out of a Job? Retrieved from: https://www.atbs.com/knowledge-hub/self-driving-trucks-are-truck-drivers-out-of-a-jo

Bender, A. (March 10, 2016). A Practically Free Alternative to Uber and Lyft you are Missing Out on. Retrieved from: https://www.forbes.com/sites/andrewbender/2016/03/10/a-practically-free-alternative-to-uber-and-lyft-you-are-missing-out-on/#348c4e8181ad

Bluecar. La Citadine 100 & electrique. Retrieved from: https://www.bluecar.fr/sites/bluecar/files/medias/PDF/2_bluecar_20_p.pdf. Translation provided by google translator.

Business Wire. Cruise's self-driving fleet will launch food delivery with DoorDash in early 2019 in San Francisco. Retrieved from: https://www.businesswire.com/news/home/20190103005514/en/Cruise-DoorDash-Announce-Partnership-Test-Autonomous-Deliveries

Car2Go. (June 15, 2017). Car2go brings new Mercedes-Benz Vehicles to Denver. Retrieved from: https://www.prnewswire.com/news-releases/car2go-brings-new-mercedes-benz-vehicles-to-denver-300474437.html

Car2go. Press Release. Retrieved from: https://www.car2go.com/media/data/na/press/releases/180410_press_release_car2go_publishes_white_paper_on_electric_mobility.pdf

Casey. B., (2017). Amoral Machines or How Roboticists Can learn to Stop Worrying and Love the law. Northwestern University law Review 111, no. 5: N.P.

CBInsights. (September 4, 2018). 46 Corporations Working on Autonomous Vehicles. Retrieved from: https://www.cbinsights.com/research/autonomous-driverless-vehicles-corporations-list/

CBInsights. Retrieved from: https://www.cbinsights.com/research/autonomous-driverless-vehicles-corporations-list/

Chariot. Important Update from Chariot. Retrieved from: https://blog.chariot.com/2019/01/10/important-update-from-chariot/

Daisuke Wakabayashi. (March 19, 2018). Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam. Retrieved from: https://www.nytimes.com/2018/03/19/technology/uber-driverless-fatality.html

Deborah Lockridge. (April 27, 2015). Volvo Invests in Platooning Technology. Retrieved from: https://www.truckinginfo.com/129159/volvo-invests-in-platooning-technology

Fulton, L., Mason, J., Meroux, D. (2017). Institute of Transportation Studies, UC Davis. Three Revolutions in Urban transportation. UCD-ITS-RR-1703.

General Motors. 2018 Self-Driving Safety Report. Retrieved from: https://www.gm.com/content/dam/company/docs/us/en/gmcom/gmsafetyreport.pdf

Greenberg, A. (July 2015). Hackers Remotely Kill a Jeep on the Highway – with me in it. Wired.

Greenblatt, J., Saxena. S. (2015). Autonomous Taxis Could Greatly Reduce Greenhouse Gas Emissions of U.S. Light-Duty vehicles. Nature Climate Change 5. 860-63.

Houser, K. Futurism. Expert: Self-Driving Cars will Clog Streets to Avoid Parking Fees. Retrieved from: https://futurism.com/the-byte/self-driving-cars-avoid-parking-fees

https://comma.ai/

https://embarktrucks.com/

https://localmotors.com/meet-olli/

https://www.blablacar.com/

https://www.bluela.com/about-bluela

https://www.kangoapp.co/index.html

https://www.xcelerateauto.com/fleet-management/

John Zimmer. The Third Transportation Revolution: Lyft's vision for the next 10 years and beyond. Retrieved from: https://medium.com/@johnzimmer/the-third-transportation-revolution-27860f05fa91

Jonathon Ramsey. (March 16th, 2018). GM begins mass-production of autonomous Cruise AV in 2019. Retrieved from: https://www.autoblog.com/2018/03/16/gm-autonomous-cruise-av-2019/

Josh Lowensohn. (May 19, 2015). Uber gutted Carnegie Mellon's top robotics lab to build self-driving cars. Retrieved from: https://www.theverge.com/transportation/2015/5/19/8622831/uber-self-driving-cars-carnegie-mellon-poached

Karbhari, V. (February 7, 2018). Uber Case Study – The State of Autonomous Transport. Retrieved from: https://medium.com/acing-ai/uber-case-study-the-state-of-autonomous-transport-42bf2da90fb3

Kate Conger and Bryan Menegus. (June 22, 2018) Uber Driver in Fatal Tempe Crash May have Been Watching the Voice Behind the Wheel. Retrieved from: https://gizmodo.com/uber-driver-in-fatal-tempe-crash-may-have-been-watching-1827039127

Kellen Browning. (June 13, 2018). Electrify America to spend $44 million on Sacramento-area electric vehicles. Retrieved from: https://www.sacbee.com/news/local/transportation/article213138339.html

Metz, Cade. The New York Times. *How Driverless Cars See the World Around Them.* Retrieved from: https://www.nytimes.com/2018/03/19/technology/how-driverless-cars-work.html

Mike Isaac. (May 14, 2017). Lyft and Waymo Reach Deal to Collaborate on Self-Driving Cars. Retrieved from: https://www.nytimes.com/2017/05/14/technology/lyft-waymo-self-driving-cars.html

Millard-Ball, A. (March 2019). The Autonomous Vehicle Parking Problem. Transportation Policy, Volume 75 (pg. 99-108).

NHTSA. USDOT Releases 2016 Fatal Traffic Crash Data. Retrieved from: https://www.nhtsa.gov/press-releases/usdot-releases-2016-fatal-traffic-crash-data

nuTonomy. Press Release. Retrieved from: https://www.nutonomy.com/press-release/grab-partnership-launch/

Shaller B. Schaller Consulting. (27 February, 2017). Unsustainable? The Growth of App-Based Ride Services and Traffic, travel and the Future of New York City".

Sperling D. Three Revolutions: Steering Automated, Shared, and Electric Vehicles to a Better Future.

tomorrow. Retrieved from: https://www.discover-sedric.com/en/volkswagen-group-opens-future-center-asia-in-beijing-to-create-mobility-for-beyond-tomorrow/

Volkswagen Group. Volkswagen Group Opens Future Center Asia in Beijing to create mobility for beyond

WSJ. (May 6, 2015). Daimler's Autonomous Trucks to be Tested in Nevada. Retrieved from: https://www.wsj.com/video/daimlers-autonomous-trucks-to-be-tested-in-nevada/26B3B8AD-1C32-44D5-A30C-EC34F605208A.html

WSJ. Self-driving technology threatens nearly 300,000 trucking jobs, report says. Retrieved from: https://www.wsj.com/articles/self-driving-technology-threatens-nearly-300-000-trucking-jobs-report-says-1536053401

Zia Wadud, Don Mackenzie, Paul N. Leiby. April 2016. Help or Hinderance? The travel, Energy, and carbon Impacts of Highly Automated vehicles," Transportation Research part A 86. 1-18

Ventura County Electric Vehicle Ready Blueprint

Chapter 8: Public Electric Vehicle Siting, Permitting, and Installation

Public Charging Siting, Permitting, and Installation Guidelines

The development of a convenient and ubiquitous charging network in Ventura County will depend on several key factors. These include funding levels, siting decisions, and a streamlined approach to permitting and installation. Decisions about electric vehicle charging station siting, payments, and installation in turn can have a significant impact on station users' experience. This chapter addresses key issues, challenges, best practices, and recommendations to enhance siting, permitting, and installations for electric vehicle charging stations. It also provides guidance that can help the site host or station manager improve user experiences and address challenges related to charging station congestion, payment, cost recovery, and utilization.

Siting Electric Vehicle Service Equipment

The process of selecting a site for the deployment of new electric vehicle charging infrastructure must consider infrastructure gaps, cost factors, site host needs, and funding availability. Key factors to consider for the siting of electric vehicle charging infrastructure include:

- **Site host willingness:** Interest from the site owner is the single most important consideration in EV charger siting. Typically, a site owner needs to have a compelling financial offer from a third-party electric vehicle service equipment company, or significant demand from customers, employees, or tenants to move forward with a new EVSE project.
- **Availability of electrical capacity:** The availability of electrical capacity at a site directly impacts the number of chargers and rate of charging possible at the site. Larger deployments of Level 2 and DC Fast Charging with large peaks in energy usage can quickly surpass available electrical capacity on a site. Panel and conduit capacity within existing structures, and the physical distance between electrical service panels and the proposed electric vehicle service equipment, are also critical factors.
- **Proximity to existing charging or other geospatial considerations:** Siting new electric vehicle service equipment based on gaps in the charging ecosystem can alleviate driver range anxiety by providing options for on-route or destination charging.
- **Ease of permitting and site approval:** Local permitting processes that impose high fees or create projects delays can significantly impede charging station deployment. EVSE developers that have experienced permit delays in a particular jurisdiction may choose to locate potential sites elsewhere. AB 1236 sets forth requirements for local governments to streamline electric vehicle permitting processes. However, there is currently limited state enforcement of these requirements and the extent of implementation for AB 1236 appears to vary significantly from one jurisdiction to another. It is recommended that local permitting authorities consult the newly published electric vehicle permit streamlining guidance document from the Governor's Office of Policy and Research to identify and update best practices in local permitting. (See the EVSE guidance document and local government "scorecard" at: http://www.business.ca.gov/ZEVReadiness.
- **Property ownership arrangements:** Tenant/landlord relationships, building ownership, and management structures for MUDs and leased commercial properties present unique challenges and barriers to EVSE installation. To be successful, innovative business models and approaches are needed for the MUD and leased workplace segments.

- **Americans with Disabilities Act requirements, accessibility, and security:** Developers must carefully consider ADA requirements, where local interpretation of high-level guidance often determines how a project must proceed. For example, difference in ADA requirements for new buildings and remodels often exist within different local contexts. Other key factors include ensuring a safe path of travel from the EVSE, parking lot security, and access schedules. All three factors can greatly affect charger utilization and accessibility.
- **Local government zoning and minimum parking space requirements:** Local government zoning ordinances for MUDs and workplace destinations often include minimum parking space requirements. In some cases, these zoning codes stipulate that a minimum number of parking spaces be specifically dedicated to tenants or workplace employees. In some cases, parking spaces for public charging stations may not be counted towards the required minimum spaces for tenants or workplace employees – even when charging stations are intended for mixed use by the public and tenants or employees. It is recommended that local planners and permitting authorities work closely with electric vehicle stakeholders to resolve these barriers to electric vehicle access.

Zoning and Permitting

California cities and counties have authority over land use decisions within their communities. Land use decisions are guided by each municipality's General Plan, building codes, local ordinances, and the zoning requirements. For California cities, including language that clarifies the zoning status of electric vehicle infrastructure and ability to be permitted has helped to streamline and accelerate EVSE deployment. All residential and nonresidential land uses should allow Level 1 and 2 charging, and DC Fast Charging where feasible based on local electric grid capacity**.**

Many counties across California have adopted tailored policies for electric vehicle charging infrastructure; for example, Ventura County is working to adopt a new policy through their General Plan update. Section 8176-9 of the Ventura County Coastal Land Use Ordinance has established this comprehensive policy for EVSE and approves the following:

- Residential Level 1 and Level 2 charging is approved in all land use types
- Non-residential Level 1 and Level 2 Charging is approved in the Coastal Agricultural, Coastal Open Space, Coastal Commercial, and Coastal Industrial zones

The Coastal Land Use policy further states, "No person shall place, erect, or install a new electric vehicle charging station or modify, alter, or incorporate electrical or mechanical upgrades to a legally permitted electric vehicle charging station without first obtaining zoning clearance per Sec. 8176-9.4.1 and/or a Planned Development Permit per Sec. 8176-9.4.2 in accordance with the provisions of the electric vehicle Application Procedures in Sec. 8176-9.4.3." Additional details on permit application requirements are outlined on pages 196-200 of the ordinance at: https://docs.vcrma.org/images/pdf/planning/zoning/coastal_zone_ord.pdf.

Ventura municipalities currently require developers to obtain approval for EVSE installation through the permitting process. This is the primary mechanism through which government agencies ensure that increased charging demand does not cause adverse impacts on building electrical systems and the larger distribution grid. Should new load from charging occur without government or utility awareness, there are operational risks to the electric system. These could include substation overloads, electrical outages, and equipment damage that will decrease the reliability of the electrical grid. Permitting processes enacted by government agencies around the state also provide mechanisms to help inform local grid operators about new charging station development, so they can provide the additional augmented power or new interconnections needed to meet increased demand from charging.

Assembly Bill 1236: In 2015, AB 1236 established requirements for cities and counties to streamline their permitting systems for residential and nonresidential electric vehicle charging stations. Under this legislation, all California cities and counties were required to adopt an ordinance that establishes an expedited, streamlined permitting process for electric vehicle charging stations no later than September 30, 2017. [215] The legislative intent of AB 1236 is to: 1) encourage the installation of electric vehicle charging stations by removing obstacles and minimizing costs for charging station permitting, so long as the action does not supersede the building official's authority to identify and address higher priority life-safety situations, and 2) streamline local government permitting processes for electric vehicle charging stations. Key requirements in AB 1236 state that cities and counties shall:

- Adopt an ordinance that creates an expedited, streamlined permitting process for residential (including multi-family residential) and non-residential electric vehicle charging stations, in consultation with the local fire department or district and the utility director (if the city, county, or city and county operates a utility)
- Adopt of a checklist of all requirements with which residential and non-residential electric vehicle charging stations shall comply to be eligible for expedited review
- Publish the checklist and required permitting documentation on a publicly accessible internet web site
- Provide a means of electronic submittal (via email, fax, or the internet) of a permit application and associated documentation
- Authorize the electronic signature on all forms, applications, and other documentation in lieu of a wet signature by an applicant. If unable to authorize the acceptance of an electronic signature on all forms, applications, and other documents in lieu of a wet signature by an applicant, the city, county, or city and county shall state, in the ordinance required under AB 1236, the reasons for its inability to accept electronic signatures and acceptance of an electronic signature shall not be required.

The Community Environmental Council conducted outreach from December 2017 to October 2018 to assess local government implementation of AB 1236 in the counties of San Luis Obispo, Santa Barbara, and Ventura. This work was scoped under California Energy Commission grant agreement ARV-16-015 for regional ZEVs Readiness Implementation. Building and permitting officials for a total of 12 local governments from all three counties were contacted and asked about the status of AB 1246 implementation. Of these, four of the local governments were cities in the Ventura County region: cities of Thousand Oaks, Ventura, Oxnard, and Moorpark. Although the September 2017 deadline for all local governments to implement AB 1236 had already passed, only three of the 12 local governments contacted from the three counties had fully implemented AB 1236 requirements. In Ventura County, two of the four contacted cities had had streamlined permitting process for both residential and non-residential electric

[215] Assembly Bill 1236 Local Ordinances: electric vehicle charging stations (Chiu, 2015). Signed into law October 8, 2015. Full text available at: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1236

vehicle charging station installations, including ordinances, online checklists, and electronic submittal options. The other two cities in Ventura County had completed streamlining permitting for residential electric vehicle charging stations but still need to implement streamlined permitting processes for multifamily residential and non-residential installations. Guidance for local government implementation of AB 1236, including model ordinances and permitting check lists, are included in the Appendix of this Blueprint.

Based on Community Environmental Council's engagement with local governments, the main factors contributing to incomplete implementation of streamlined permitting requirements set forth in AB 1236 include:

- **No enforcement:** There is currently no state agency mandated to track, support, or enforce local government implementation of AB 1236, so many cities and counties have not prioritized implementation of streamlined permitting
- **Limited awareness:** In some cases, local government staff indicated that they were not aware AB 1236 requirements, highlight the need for improved information sharing between state authorities and local government building officials.
- **Lack of local government capacity:** Many local governments were open about staff capacity limitations and budget constraints that prevented them from devoting time and resources to AB 1236 implementation.

Future outreach and engagement with local government building officials should be conducted to ensure that the fees and approval processes for electric vehicle charging station permitting are affordable and do not present barriers to electric vehicle infrastructure development or investment in the region.

Preparing for the Permitting Process

Site hosts should be prepared for permit requirements and expectations. Permitting processes vary across jurisdictions and depend on property type. The table below summarizes some of the property traits and their impact on permit processes.

Table 1: Permit Processes by Property Type

Property Type	Unique Permit Process Considerations
Single Family Residential	▪ Older buildings may require electrical system upgrades and technical review as part of permitting requirements ▪ Installing a dedicated TOU meter for electric vehicle chargers is often required to qualify customer for specialized electric vehicle rate classes and demand response programs
MUDs	▪ Involves multiple stakeholders including electric vehicle owner, homeowner's association, and building owner. Including tenant and landlord complications where there is tenant demand for charging but lack of action from the landlord or building owner

	▪ SB 880 establishes rules for multi-unit residential electric vehicles charging including apartment projects, condominium projects, planned developments, and cooperatives.[216] ▪ Long distances from parking to central circuits can require extensive trenching, potentially triggering **California Environmental Quality Act** (CEQA) review ▪ Limited space for individual metering ▪ Often limited electrical capacity and California code requires a 25 percent buffer above the electric vehicle's capacity ▪ Variable installation costs on a building by building basis
Commercial Properties including Workplaces	▪ Multiple commercial tenants can complicate internal approval processes and should be factored into timelines ▪ Site specific electrical infrastructure needs ▪ Oversubscription to existing charging and demand that outpaces charger availability ▪ Public access and or dual usage of chargers for work fleets and the public

Corridor and Fast Charging Permitting: DC Fast Charging has its own unique characteristics that can affect the permitting process. Defined by its ability to deliver more than 20 kW of charging in less than a one-hour period, DC Fast Charging can result in large power requirements that can place additional stress on electrical distribution systems. Some of the larger DC Fast Charging installations in Ventura County, such as Tesla's East Thousand Oaks Superchargers, host 24 superchargers, with each pair capable of drawing up to 120 kW. The resulting 1 MW+ peak demand is like the energy needs of a hospital, a shopping center, or a residential development of several hundred homes. Typically, 440-480 Volt, 3-phase alternating current (AC) or 208-volt (AC) is required to accommodate DC Fast Charging infrastructure. Given these characteristics, longer permitting processes, additional siting review, and technical assistance should be expected for the installation of new DC Fast Charging infrastructure.[217]

Recommendations for Electric Vehicle-Friendly Permit Streamlining, Building Codes, and Public Charger Deployment

Streamlined permitting policies and electric vehicle-friendly building codes can accelerate the EVSE siting and installation process, reduce costs, and ensure that chargers operate safely. Recommended initiatives are described below:

- **Recommendation #1 - Streamline EVSE permitting processes** by 1) approving all zoning and land use classifications for electric vehicle charging in local ordinance; 2) providing digital and online permit submission options; 3) establishing and communicating standard permit approval times by building type; 4) identifying a point of contact for the EVSE permitting process; 5) clearly defining required materials for permit application; 6) including permit process language in local ordinance; 7) maintaining reasonable – and flat – charger permit fees; 8) waiving plan requirements for simple

[216]Bill text: http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201120120SB880

[217] Governor's Office of Business and Economic Development (GO-Biz). Electric Vehicle Charging Station Permitting Guidebook. Pre-Publication Copy. (April 8, 2019).

installations such as single-family residential charging; and 9) establishing phone and online inspection request systems.

- **Recommendation #2 - Integrate CALGreen language in local ordinance** to bring local communities into compliance with AB 1236, so that all municipalities in Ventura County will see increased deployment of electric vehicle charging stations in new construction.
- **Recommendation #3 - Develop a countywide initiative to implement Reach codes that increase EVSE requirements** for new buildings and major remodels. Ventura County can build on the multi-county Reach Code effort ongoing in Alameda, Santa Clara, and San Mateo Counties, coordinated by TRC.
- **Recommendation #4 - Develop an interactive, map-based Electric Vehicle Planning tool** that will assist in public and private EVSE development and that can be used to locate existing electric vehicle charging infrastructure, largest MUDs and workplaces, major public destinations, and Disadvantaged and Low-income Communities.
- **Recommendation #5 - Track private and public sector funding opportunities** to bring electric vehicle charging infrastructure to areas where it is needed most. Utilize the Electric Drive 805 website to present up to date funding information for stakeholders to consider in their EVSE planning.
- **Recommendation #6 - Prioritize public charging development strategically** to increase overall electric vehicle adoption and serve communities throughout the Ventura County region. EVSE siting should focus on 1) locations with heavy vehicle turnover, including grocery stores and shopping centers; 2) locations with longer vehicle dwell time such as multi-unit apartments, workplaces, airports, and transit hubs; 3) site proximity to disadvantaged community or low-income area as identified by CARB for AB 1550; and 4) site distance from existing electric vehicle charging stations.

State Building Code (CALGreen) and Local Reach Code

CARB projects that the number of electric vehicles on California roads will triple between 2025 and 2030.[218] Accordingly, the need for increased charging capacity to meet fueling needs is rapidly increasing. CARB reports suggest that increased capacity can be reached in part through the inclusion of electric vehicle charging requirements within building codes and standards. The California Green Building Standards Code (Title 24, Part 11) is known as CALGreen. CALGreen has been steadily increasing its requirements for accommodating electric vehicle charging infrastructure across all building types. In addition to meeting the requirements of CALGreen, local governments are encouraged to develop ordinances that are more rigorous than standard CALGreen code requirements. These "reach codes" are a powerful tool in increasing local electric vehicle readiness. Making a higher percentage of parking electric vehicle-ready at the time of construction of a new building is far more cost efficient than retrofits. Additional reach code opportunities also exist for requiring EVSE "make ready" infrastructure at the time of major remodels.

California's cities and counties are required to enforce Title 24 standards. Beginning in 2020, CALGreen will enforce new requirements for electric vehicle readiness at MUDs, single-family residents, duplexes, townhouses, and provide two new voluntary reach codes. The CALGreen standards are defined below:

---

[218] CARB. Electric Vehicle Charging Infrastructure: Multifamily Building Standards. (April 13, 2018). Retrieved from: https://arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf

- **MUDs:** Starting January 1, 2020 new construction of MUDs are required to include electric vehicle-capable infrastructure in at least ten percent of parking spaces, rounded up. Voluntary reach codes have also been defined to set electric vehicle make-ready requirements at 15 percent and 20 percent of total parking spaces.
- **Residential buildings with private garages:** New construction on single-family residences, duplexes, and townhouses with private garages must have raceway and panel capacity to support future installation of Level 2 charging stations. Under CALGreen voluntary reach codes a dedicated circuit including wiring must be installed. These codes align with AB 2565 (Statutes of 2014, Chapter 529) and AB 1796 (Statutes of 2018, Chapter 163), which empower renters to deploy electric vehicles at the properties where they reside. [219]
- **Nonresidential buildings:** CALGreen requires that approximately six percent of parking spaces in new nonresidential buildings must be electric vehicle capable. Two tiers of voluntary CALGreen reach codes increase these levels to about eight percent and ten percent of total parking.[9]

Accessibility Standards

Accessibility requirements for electric vehicle service equipment are established at a federal level in Section 508 of the U.S. Rehabilitation Act. The act requires that any entity receiving federal, state, or local government funding for EVSE must ensure that persons with visual, auditory, cognitive, or physical disability can operate charging stations easily and independently. In addition, the ADA also establishes requirements for EVSE to accommodate individuals with mobility and physical disability.

The California Building Standards Commission adopted the accessibility standards for electric vehicle charging stations as part of the 2016 California Building Code (Title 24), which became effective on January 1, 2017 [220] and made California the first state to adopt specific accessibility standards beyond ADA requirements. California Building Code Chapters 11b-238.3.2.1 highlights the sections of code which address accessibility requirements of EVSE - as summarized in the table from the California Department of Housing and Community Development below and in the Appendix of this report.

[219] Governor's Office of Business and Economic Development (GO-Biz). Electric Vehicle Charging Station Permitting Guidebook. Pre-Publication Copy. (April 8, 2019). & AB 1796 (Statutes of 2018, Chapter 163).

[220] Division of the State Architect, Department of General Services. Summary of 2016 California Building Code Changes for Electric Vehicle Charging Station Accessibility. Retrieved from: https://www.documents.dgs.ca.gov/dsa/access/2016CaliforniaCodes-electric vehicle charging stations_FactSheet_accessible.pdf

Table 2: California Building Code electric vehicle service equipment Accessibility Requirements, Chapter 11B

SECTION	TITLE	NOTES
11B-228.3	**Electric vehicle charging stations**	Provides scoping for electric vehicle charging stations installed in new and existing facilities with Table 11B-228.3.2.1 to determine the number of accessible EVCS required. Provides reference to 11B-812 for technical requirements for EVCS.
11B-812	**Electric vehicle charging stations**	Provides new section with technical provisions for EVCS.
11B-812.1	**General.**	General requirements for the dimensions and marking of EV charging spaces and access aisles.
11B-812.2	**Operable parts.**	Technical requirements for operable parts of the EVCS.
11B-812.3	**Floor or ground surfaces.**	Technical requirements for floor and ground surfaces of the EVCS.
11B-812.4	**Vertical clearance.**	Provisions for vertical clearance requirements at EVCS.
11B-812.5	**Accessible routes**	Provides requirements for accessible routes to electric vehicle chargers and to a building entrance.
11B-812.6	**Vehicle spaces.**	Provides dimensions for length of van accessible, standard accessible, ambulatory and drive-up EVCS.
11B-812.7	**Access aisle.**	Provides requirements for the access aisle adjacent to the electric vehicle charging space.
11B-812.8	**Identification signs.**	Provides general scoping for the technical sections for identification signs for accessible EVCS.
11B-812.9	**Surface marking.**	Provides requirements for the surface markings at EVCS.
11B-812.10	**Electric vehicle chargers.**	Technical requirements for electric vehicle chargers, which includes the requirements for operable parts, point-of-sale devices and location of the chargers in relation to the EV space.

Importantly, California Building Code Chapter 11B assigns the requirement for accessible electric vehicle charging based on a proportion of total deployed charging as highlighted below:

Table 3: Table 11B-228.3.2.1 From the 2016 California Building Code, Chapter 11B, Section 11B-228.3 [221]

Total Number of EVCS at a Facility[1]	Minimum Number (by type of EVCS Required to Comply with Section 11B-812:[1] Van Accessible	Minimum Number (by type of EVCS Required to Comply with Section 11B-812:[1] Standard Accessible	Minimum Number (by type of EVCS Required to Comply with Section 11B-812:[1] Ambulatory
1 to 4	1	0	0
5 to 25	1	1	0
26 to 50	1	1	1
51 to 75	1	2	2
76 to 100	1	3	3
101 and over	1, plus 1 for each 200, or fraction thereof, over 100	3, plus 1 for each 60, or fraction thereof, over 100	3, plus 1 for each 50, or fraction thereof, over 100

1. Where an EV charger can simultaneously charge more than one vehicle, the number of EVCS provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

There are four types of accessible spaces defined in California Building Code, including van accessible spaces, standard accessible spaces, ambulatory spaces, and drive up spaces. Each space type varies based on width, the presence of an access isle, and ability for the space to be identified with appropriate accessibility signage. Governor's Office of Business and Economic Development (GO-Biz) summarized accessibility requirements in their 2019 draft report as shown below:

Table 4: Summary of Accessible Electric Vehicle Charging Space Types, GO-Biz 2019. [222]

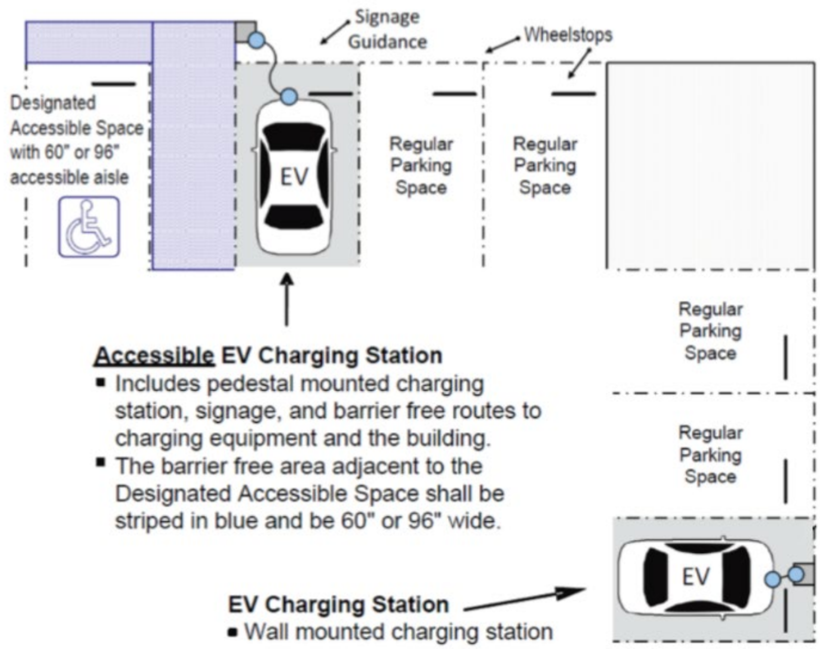
	Van accessible	Standard accessible	Ambulatory	Drive-up
Purpose	Wider charging space with access aisle to accommodate van with ramp or lift	Charging space with access aisle	Slightly wider charging space	Similar to a gas station - drive in and drive out, moving forward
Width	12 feet (144 inches)	9 feet (108 inches)	10 feet (120 inches)	17 feet (204 inches)
Access aisle	Yes, on passenger side, markings required	Yes, on either side, markings required	No	Yes, but not marked
Identify with the ISA sign?	When 5-25 charging stations, identify one; when 26+, identify all	When 26+ charging stations, identify all	No	No

[221] An electric vehicle charger that has two ports and can simultaneously charge two vehicles (and therefore offering a charging space available for each), is counted as two charging spaces.

[222] Governor's Office of Business and Economic Development. (April 8, 2019). Electric Vehicle Charging Station Guidebook – Pre-publication/pre-design copy.

ADA compliant electric vehicle charging parking can be designed in many arrangements, and site-specific considerations often impact charging layout. The drawing below provides a sample from the U.S. Department of Energy of typical ADA-compliant electric vehicle charging spaces. Other examples of ADA-Compliant design can be found in the 2019 GO-Biz report.

Figure 1: Typical ADA-Compliant Electric Vehicle Charging Parking Space[13]



As California Building Code continues to evolve, it is recommended that Ventura County jurisdictions continue to track the best practices and resources provided by GO-Biz and the Governor's Office of Planning and Research, which are providing voluntary guidelines to address accessibility and electric vehicle charging in 2019.[223] One strategy to meet ADA accessibility requirements without reducing the total number of parking spaces at a site is to install electric vehicle charging stations at existing van accessible, standard accessible, ambulatory, and drive up parking spaces when feasible.

Existing and Proposed EVSE Requirements in City and County Building Code

In response to AB 1236, municipalities within Ventura County have begun to adopt their own ordinances to promote electric vehicle service equipment as outlined in the table below. Ventura County jurisdictions have a significant opportunity to adopt building specific code language into local zoning ordinances. There are multiple examples of best practice language currently in place throughout the state, as reviewed below. According to GO-Biz, over 20 California jurisdictions have exercised their authority to exceed state minimum code requirements by adopting higher electric vehicle infrastructure requirements to align with California's EV adoption goals.[7] Pertinent code examples that could be adopted by jurisdictions in Ventura County are summarized below.

[223] Progress on the GOPR can be followed at: http://opr.ca.gov/docs/Pelectric vehicle_Access_Guidelines.pdf

San Francisco, CA - In February 2017, San Francisco introduced an ordinance requiring all new residential and commercial buildings to enable ten percent of available parking as electric vehicle service equipment ready (with conduit and wiring in place), and the remaining 90 percent of parking must be "electric vehicle capable" ensuring conduit is run to the spaces and sufficient electrical panel capacity is present. [224]

Boulder, CO: The City of Boulder, Colorado is the first to require EVSE installation at the time of building construction for both residential and commercial new construction, rather than just being "electric vehicle ready." MUDs are required to have a Level 2 dual port electric vehicle charging station. Commercial structures with more than 25 parking spaces must have a Level 2 dual port charging station. Buildings serving a Group R-1 or R-2 occupancy shall have Level 2 parts in one percent of, but no less than two, parking spaces. [225]

Fremont, CA**:** Fremont, CA also has adopted an electric vehicle-ready parking ordinance requiring that raceway, wiring and circuits are included in all residential and nonresidential new construction projects. Single family requirements in the city include provision for one electric vehicle-ready parking space for each new unit. Multi-family projects of three or more units and non-residential projects require eight percent of new parking spaces to be electric vehicle ready. [226]

Other Programs Impacting Electric Vehicle Siting and Installation

California Environmental Quality Act

On an individual basis, electric vehicle charging installations are subject to environmental review under CEQA. Many local governments ultimately determine that EVSE is exempt from CEQA review. In some cases, electric vehicle charging may trigger a negative declaration or an environmental impact report. Electric vehicle charging can also be a mitigation measure under CEQA, by lowering GHG emissions associated with a development. [227]

Leadership in Energy and Environmental Design

The LEED certification process provides a voluntary incentive for EVSE installation in the form of LEED points for buildings with electric vehicle-ready infrastructure installation. According to the Governor's Office of Planning and Research, the following LEED points are available for commercial and residential buildings with electric vehicle service equipment infrastructure:

- Multifamily residences over four stories and commercial buildings can earn up to three LEED points under the New Construction Sustainable Sites Credit 4.3 -- Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles.

---

[224]City of San Francisco. Municipal Code. Retrieved from: http://www.amlegal.com/codes/client/san-francisco_ca/
[225] City of Boulder. Boulder Municipal Code. Retrieved from: https://library.municode.com/co/boulder/codes/municipal_code
[226] City of Fremont. Municipal Code. Retrieved from: https://fremont.gov/2815/California-Building-Standards-Codes
[227] Governor's Office of Planning and Research. Zero-Emission Vehicles in California: Community Readiness Guidebook. Retrieved from: http://opr.ca.gov/docs/Zelectric vehicle_Guidebook.pdf

- Multifamily residences can earn three to 15 LEED points under the Existing Building Sustainable Sites Credit 4 -- Alternative Commuting Transportation -- for installing one or more electric vehicle chargers.
- Multifamily residences under four stories and new or majorly renovated single-family residences may earn one credit under LEED for Homes Credit 3 -- Innovative Design -- for installing one or more electric vehicle chargers.

In addition, buildings designed to encourage the adoption of low emission vehicles can earn points by providing preferred parking for low emission vehicles for employees, tenants or paid parking customers; providing fleet vehicles or shared vehicles to employees or tenants; and instituting vehicle sharing programs for at least two-year period along with preferred parking for those vehicles.[228] Additional information on the LEED program can be found at the website of the U.S. Green Building Council.

---

[228] Governor's Office of Planning and Research. Zero-Emission Vehicles in California. Community Readiness Guidebook: Towards 1.5 Million Zero-Emission Vehicles on California Roadways by 2025. Fall 2013, First Edition. Retrieved from: http://opr.ca.gov/docs/ZEV_Guidebook.pdf

Chapter 8 References

CA, Assembly Bill No. 1236. Retrieved from:
https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1236

LA Department of Building and Safety. *Online permit System.* Retrieved from:
http://ladbs.org/LADBSWeb/LADBS_Forms/InformationBulletins/IB-P-GI2011-003ExpressPermits.pdf

Governor's Office of Planning and Research – State of California. Zero-Emission vehicles in California: Community Readiness Guidebook.

California Department of Housing and Community Development. (September, 2018). 2018 Report to the Legislature, Status of the California green Building Standards Code: Cal Green.

California Air Resources Board's Electric Vehicle (electric vehicle) Charging Infrastructure: Multifamily Building Standards. Retrieved from: https://arb.ca.gov/cc/greenbuildings/pdf/tcac2018.pdf

Energy Solutions. (May, 2013). Title 24 Building Standards and Plug in Electric Vehicles. Retrieved from:
https://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-diego/SD%20Pelectric vehicleCC%20Title%2024%20Overview%20May%2016%202013.pdf

Division of the State Architect – Department of General Services. Access California: New Accessibility Regulations for electric vehicle charging stations. Retrieved from: https://www.documents.dgs.ca.gov/dsa/access/electric vehicle charging stationsPresentation_04-07-17.pdf

Governor's Office of Business and Economic Development. (April 8, 2019). *Electric Vehicle Charging Station Guidebook – Pre-publication/pre-design copy.*

Division of the State Architect, Department of General Services. Summary of 2016 California Building Code Changes for Electric Vehicle Charging Station Accessibility. Retrieved from:
https://www.documents.dgs.ca.gov/dsa/access/2016CaliforniaCodes-electric vehicle charging stations_FactSheet_accessible.pdf

US Department of Energy. Plug-In Electric Vehicle Handbook for Workplace Charging Hosts. Retrieved from:
https://afdc.energy.gov/files/u/publication/pev_workplace_charging_hosts.pdf

US Department of Energy. Workplace Charging Challenge. ADA Requirements for Workplace Charging Installation.
ttps://afdc.energy.gov/files/u/publication/WPCC_complyingwithADArequirements_1114.pdf

City of Santa Monica. (November 14, 2017). Santa Monica Electric Vehicle Action Plan. Retrieved from:
https://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Energy/electric vehicleAP_Final_Draft_WEB.pdf

Santa Monica Municipal Code. Section 8.106.100 Electric Vehicle Charging. Retrieved from:
http://www.qcode.us/codes/santamonica/view.php?topic=8-8_106-8_106_100&frames=on

Governor's Office of Planning and Research. *Zero-Emission Vehicles in California: Community Readiness Guidebook*. Retrieved from: http://opr.ca.gov/docs/Zelectric vehicle_Guidebook.pdf

Chapter 8 Appendix

Permit Streamlining Resources for local Governments

- **Streamlined electric vehicle Charging Station Permitting Guidance**
- California Building Officials (CALBO) **AB 1236 Tool Kit – Small Jurisdiction (2016)**
- Center for Sustainable Energy – Electric Vehicle Charging Station Toolkit Guidance (2017):
- **Checklist for Residential and Nonresidential Permit Application**
- **Plan Review and Permit Correction Sheet for Residential and Nonresidential**
- **Installation Checklist for Residential and Nonresidential**
- California Governor's Office of Planning & Research – "ZEVs in California: Community Readiness Guidebook" (2013) **Plug-In Electric Vehicle Infrastructure Permitting Checklist**
- Central Coast electric vehicle Readiness Plan Guidance (2014) **Appendices A – C**

AB 1236 Implementation Guidance & Resources

California Building Officials (CALBO) Resources and AB 1236 Tool Kits (2016)

- Small Jurisdictions (population of less than 200,000) Toolkit PDF
- Large Jurisdictions (population of 200,000 or more) Toolkit PDF

Center for Sustainable Energy – Electric Vehicle Charging Station Toolkit Guidance (2017)

- Checklist for Residential and Nonresidential Permit Application
- Plan Review and Permit Correction Sheet for Residential and Nonresidential
- Installation Checklist for Residential and Nonresidential

Model Permitting Checklists

- California Governor's OPR - "ZEVs in California: Community Readiness Guidebook" Plug-In Electric Vehicle Infrastructure Permitting Checklist (2013)
- City of Oxnard Model Permitting Forms & Checklists

Central Coast electric vehicle Readiness Plan Guidance (2014)

- Appendices A – C

Need AB 1236 Implementation Support?

Contact Cameron Gray, the regional zero electric vehicle Ombudsman for Electric Drive 805 and Transportation & Climate Program Manager at Community Environmental Council.

Cameron Gray

Electric Drive 805 zero electric vehicle Ombudsman | Transportation & Climate Program Manager

Community Environmental Council

cgray@cecmail.org | 805-963-0583 x111

Full Legislative Text for AB 1236 is available at:

https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1236

Stated Legislative Intent of AB 1236

- Encourage the installation of electric vehicle charging stations by removing obstacles and minimizing costs for charging station permitting, so long as the action does not supersede the building official's authority to identify and address higher priority life-safety situations.
- Streamline local government permitting processes for electric vehicle charging stations

AB 1236 Requirements

A city, county, or city and county:

- Shall administratively approve an application to install electric vehicle charging stations through the issuance of a building permit or similar nondiscretionary permit.
- Shall limit the review of applications for electric vehicle charging station installs to the building official's determination of whether the station does or does not meet all health and safety requirements of local, state, and federal law.
- Shall limit the requirements of local law to those standards and regulations necessary to ensure that the electric vehicle charging station will not have a specific, adverse impact upon the public health or safety. Local government staff can require the applicant to apply for a use permit if their building official makes a finding, based on substantial evidence, that the electric vehicle charging station could have a specific, adverse impact upon the public health or safety,
- May deny an application for a use permit to install an electric vehicle charging station only if it makes written findings based upon substantial evidence in the record that the proposed installation would have a specific, adverse impact upon the public health or safety, *and* there is no feasible method to satisfactorily mitigate or avoid the specific, adverse impact.
- Shall include the basis for the rejection of potential feasible alternatives of preventing the adverse impact in written, evidence-based findings.
- Shall adopt an ordinance that creates an expedited, streamlined permitting process for electric vehicle charging stations, in consultation with the local fire department or district and the utility director (if the city, county, or city and county operates a utility). The ordinance shall be adopted **on or before September 30, 2016**, for every city, county, or city and county with a population of 200,000 or more residents, and, **on or before September 30, 2017**, for every city, county, or city and county with a population of less than 200,000 residents. The ordinance shall be consistent with the goals and intent of AB 1236.
- Shall adopt a checklist of all requirements with which electric vehicle charging stations shall comply to be eligible for expedited review.
- Shall deem an application complete if it satisfies the information requirements in the checklist, as determined by the city, county, or city and county.
- Shall approve the application and issue all required permits or authorizations upon confirmation by the city, county, or city and county of the application and supporting documents being complete and meeting the requirements of the checklist, and consistent with the ordinance, a city, county, or city and county.
- Shall issue a written correction notice detailing all deficiencies in the application and any additional information required to be eligible for expedited permit issuance upon receipt of an incomplete application.
- An application submitted to a city, county, or city and county that owns and operates an electric utility shall demonstrate compliance with the utility's interconnection policies prior to approval.

- Shall publish the checklist and required permitting documentation on a publicly accessible Internet Web site if the city, county, or city and county has an Internet Web site
- Shall allow for electronic submittal of a permit application and associated documentation
- Shall authorize the electronic signature on all forms, applications, and other documentation in lieu of a wet signature by an applicant. If unable to authorize the acceptance of an electronic signature on all forms, applications, and other documents in lieu of a wet signature by an applicant, the city, county, or city and county shall state, in the ordinance required under AB 1236, the reasons for its inability to accept electronic signatures and acceptance of an electronic signature shall not be required.
- Shall not condition approval for any electric vehicle charging station permit on the approval of an electric vehicle charging station by an association, as that term is defined in Section 4080 of the Civil Code.

AB 1236 Definitions

"A feasible method to satisfactorily mitigate or avoid the specific, adverse impact" includes, but is not limited to, any cost-effective method, condition, or mitigation imposed by a city, county, or city and county on another similarly situated application in a prior successful application for a permit.

"Electronic submittal" means the utilization of one or more of the following:

- Email
- The Internet
- Facsimile

"Electric vehicle charging station" or "charging station" means any level of EVSE station that is designed and built in compliance with Article 625 of the California Electrical Code, as it reads on the effective date of this section and delivers electricity from a source outside an electric vehicle into a plug-in electric vehicle.

"Specific, adverse impact" means a significant, quantifiable, direct, and unavoidable impact, based on objective, identified, and written public health or safety standards, policies, or conditions as they existed on the date the application was deemed complete.

Other Relevant Legislation

Existing law, the Electric Vehicle Charging Stations Open Access Act, prohibits the charging of a subscription fee on persons desiring to use an electric vehicle charging station, as defined, and prohibits a requirement for persons to obtain membership in any club, association, or organization as a condition of using the station, except as specified.

2016 California Building Code Accessibility Requirements for Electric Vehicle Charging Station

This document includes excerpts from the 2016 California Building Code (CBC) updates that pertain to accessibility regulations for electric vehicle charging station installations. The information was compiled from the guidance document released for Federal Resources, which covers applicable codes for public buildings, public accommodations, commercial buildings (including workplaces), and public housing.

The excerpts in this document are not comprehensive. We strongly encourage reviewing the full CBC guidelines for accessibility requirements related to electric vehicle charging stations installations and designs. Some of the codes in in this document reference broader ADA requirements that are not included in the excerpts. We therefore recommend referring to **Chapter 11B** of the 2016 CBC as well since it is the authoritative source of information about electric vehicle charging stations accessibility requirements.

The full text from Chapter 11B is available here:
https://codes.iccsafe.org/content/chapter/1780/?site_type=public

2016 CBC Excerpts for Electric Vehicle Charging Stations Accessibility Requirements & Designs

***11B*-207.1 General.** Means of egress shall comply with *Chapter 10, Section 1009*.
Exceptions:

1. Where means of egress are permitted by local building or life safety codes to share a common path of egress travel, accessible means of egress shall be permitted to share a common path of egress travel.
2. Areas of refuge shall not be required in detention and correctional facilities.

***11B*-207.2 Platform lifts.** Standby power shall be provided for platform lifts permitted by *Chapter 10, Section 1009.5* to serve as a part of an accessible means of egress. *To ensure continued operation in case of primary power loss, platform lifts shall be provided with standby power or with self-rechargeable battery power that provides sufficient power to operate all platform lift functions for a minimum of five upward and downward trips.*

***11B*-208.1 General.** Where parking spaces are provided, parking spaces shall be provided in accordance with *Section 11B*-208. *For the purposes of this section, electric vehicle charging stations are not parking spaces; see Section 11B-228.*

***11B*-208.2.3 Residential facilities.** Parking spaces provided to serve residential facilities shall comply with *Section 11B*-208.2.3.
***11B*-208.2.3.1 Parking for residents.** Where at least one parking space is provided for each residential dwelling unit, at least one parking space complying with *Section 11B*-502 shall be provided for each residential dwelling unit required to provide mobility features complying with *Sections 11B*-809.2 through *11B*
809.4. *Where fewer than one parking space is provided for each residential dwelling unit, parking spaces complying with Section 11B-502 shall be provided in accordance with Table 11B-208.2.*

***11B*-203.9 Employee *workstations*.** *Employee workstations shall be on an accessible route complying with Division 4. Spaces and elements within employee workstations shall only be required to comply with Sections 11B-207.1, 11B-215.3*

***11B*-208.2.3.3 Parking for guests, employees, and other non-residents.** Where parking spaces are provided for persons other than residents, parking shall be provided in accordance with Table *11B*-208.2.
Note: *When assigned parking is provided, Chapter 11A indicates designated accessible parking for the adaptable residential dwelling units shall be provided on requests of residents with disabilities on the same terms and with the full range of choices (e.g., off-street parking, carport or garage) that are available to other residents*

TABLE *11B*-208.2 PARKING SPACES

TOTAL NUMBER OF PARKING SPACES PROVIDED IN PARKING FACILITY	MINIMUM NUMBER OF REQUIRED ACCESSIBLE PARKING SPACES
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000

11B*-228 Depositories, vending machines, change machines, mail boxes, fuel dispensers*, and electric vehicle charging stations.

***11B*-228.1 General.** Where provided, at least one of each type of depository, vending machine, change machine, and fuel dispenser shall comply with *Section 11B*-309. *Electric vehicle charging stations shall comply with Section 11B-228.3.*

11B-228.3 Electric vehicle charging stations

11B-228.3.1 General. *Where electric vehicle charging stations (electric vehicle charging stations) are provided, electric vehicle charging stations shall be provided in accordance with Section 11B-228.3.*

11B-228.3.1.1 Existing facilities. *Where new electric vehicle charging stations are added to a facility with existing electric vehicle charging stations, the requirements of Section 11B-812 shall apply only to the new electric vehicle charging stations installed. Alterations to existing electric vehicle charging stations shall comply with Section 11B-228.3.*

11B-228.3.1.2 Operable parts. *Where electric vehicle chargers are provided, operable parts on all electric vehicle chargers shall comply with Section 11B-309.4.*

11B-228.3.2 Minimum number. *Electric vehicle charging stations complying with Section 11B-812 shall be provided in accordance with Section 11B-228.3.2. Where electric vehicle charging stations are provided in more than one facility on a site, the number of electric vehicle charging stations complying with Section 11B-228.3.2 provided on the site shall be calculated according to the number required for each facility. Where an electric vehicle charger can simultaneously charge more than one vehicle, the number of electric vehicle chargers provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.*

Exceptions:

1. *Electric vehicle charging stations not available to the general public and intended for use by a designated vehicle or driver shall not be required to comply with Section 11B-228.3.2. Examples include, but are not limited to, electric vehicle charging stations serving public or private fleet vehicles and electric vehicle charging stations assigned to an employee.*

2. *In public housing facilities, electric vehicle charging stations intended for use by an electric vehicle owner or operator at their residence shall not be required to comply with Section 11B-228.3.2.*

11B-228.3.2.1 Public use or common use electric vehicle charging stations.
Where electric vehicle charging stations are provided for public use or common use, electric vehicle charging stations complying with Section 11B-812 shall be provided in accordance with Table 11B-228.3.2.1. Where new electric vehicle charging stations are installed in facilities with existing electric vehicle charging stations, the "Total Number of electric vehicle charging stations at a Facility" in Table 11B-228.3.2.1 shall include both existing and new electric vehicle charging stations.
Exception: *All drive-up electric vehicle charging stations shall comply with Section 11B-812.*

TABLE 11B-228.3.2.1 ELECTRIC VEHICLE CHARGING STATIONS FOR PUBLIC USE AND COMMON USE

TOTAL NUMBER OF electric vehicle charging stations AT A FACILITY *(1)*	***MINIMUM NUMBER (by type) OF vehicle charging stations REQUIRED TO COMPLY WITH SECTION 11B-8121***		
	Van Accessible	***Standard Accessible***	***Ambulatory***
1 to 4	*1*	*0*	*0*
5 to 25	*1*	*1*	*0*
26 to 50	*1*	*1*	*1*
51 to 75	*1*	*2*	*2*
76 to 100	*1*	*3*	*3*
101 and over	*1, plus 1 for each 300, or fraction thereof, over 100*	*3, plus 1 for each 60, or fraction thereof, over 100*	*3, plus 1 for each 50, or fraction thereof, over 100*

(1) Where an electric vehicle charger can simultaneously charge more than one vehicle, the number of electric vehicle charging stations provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

11B-812 Electric vehicle charging stations
11B-812.1 General. *Electric vehicle charging stations (electric vehicle charging stations) shall comply with Section 11B-812 as required by Section 11B-228.3. Where vehicle spaces and access aisles are marked with lines, measurements shall be made from the centerline of the markings.*
Exception: *Where vehicle spaces or access aisles are not adjacent to another vehicle space, access aisle, or parking space, measurements shall be permitted to include the full width of the line defining the vehicle space or access aisle.*
11B-812.2 Operable parts. *Operable parts shall comply with Section 11B-309.*

11B-812.3 Floor or ground surfaces. *Vehicle spaces and access aisles serving them shall comply with Section 11B-302. Access aisles shall be at the same level as the vehicle space they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted in vehicle spaces and access aisles.*

11B-812.4 Vertical clearance. *Vehicle spaces, access aisles serving them, and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum. Where provided, overhead cable management systems shall not obstruct required vertical clearance.*

11B-812.5 Accessible routes

11B-812.5.1 Accessible route to building or facility.
electric vehicle charging stations complying with Section 11B-812 that serve a particular building or facility shall be located on an accessible route to an entrance complying with Section 11B-206.4. Where electric vehicle charging stations do not serve a particular building or facility, electric vehicle charging stations complying with Section 11B-812 shall be located on an accessible route to an accessible pedestrian entrance of the electric vehicle charging facility.

Exception: *electric vehicle charging stations complying with Section 11B-812 shall be permitted to be located in different electric vehicle charging facilities if substantially equivalent or greater accessibility is provided in terms of distance from an accessible entrance or entrances, charging fee, and user convenience.*

11B-812.5.2 Accessible route to electric vehicle charger. *An accessible route complying with Section 11B-402 shall be provided between the vehicle space and the electric vehicle charger which serves it.*

11B-812.5.3 Relationship to accessible routes. *Vehicle spaces and access aisles shall be designed so that when the vehicle space is occupied the required clear width of adjacent accessible routes is not obstructed. A curb, wheel stop, bollards, or other barrier shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.*

11B-812.5.4 Arrangement. *Vehicle spaces and access aisles shall be designed so that persons using them are not required to travel behind vehicle spaces or parking spaces other than the vehicle space in which their vehicle has been left to charge.*

Exceptions:

1. *Ambulatory electric vehicle charging stations shall not be required to comply with Section 11B-812.5.4.*
2. *Vehicle spaces installed in existing facilities shall comply with Section 11B-812.5.4 to the maximum extent feasible.*

11B-812.5.5 Obstructions. *electric vehicle charging stations shall be designed so accessible routes are not obstructed by cables or other elements.*

11B-812.6 Vehicle spaces. *Vehicle spaces serving van accessible, standard accessible, ambulatory and drive-up electric vehicle charging stations shall be 216 inches (5486 mm) long minimum and shall com ply with Sections 11B-812.6.1 through 11B-812.6.4 as applicable. All vehicle spaces shall be marked to define their width.*

Exceptions:

1. *Where the long dimension of vehicle spaces is parallel to the traffic flow in the adjacent vehicular way, the length of vehicle spaces shall be 240 inches (6096 mm) minimum.*
2. *Vehicle spaces at drive-up electric vehicle charging stations shall be 240 inches (6096 mm) long minimum and shall not be required to be marked to define their width.*

11B-812.6.1 Van accessible. *Vehicle spaces serving van accessible electric vehicle charging stations shall be 144 inches (3658 mm) wide minimum and shall have an adjacent access aisle complying with Section 11B-812.7.*

11B-812.6.2 Standard accessible. *Vehicle spaces serving standard accessible electric vehicle charging stations shall be 108 inches (2743 mm) wide minimum and shall have an adjacent access aisle complying with Section 11B-812.7.*

11B-812.6.3 Ambulatory. *Vehicle spaces serving ambulatory electric vehicle charging stations shall be 120 inches (3048 mm) wide minimum and shall not be required to have an adjacent access aisle.*

11B-812.6.4 Drive-up. *Vehicle spaces serving drive-up electric vehicle charging stations shall be 204 inches (5182 mm) wide minimum and shall not be required to have an adjacent access aisle.*

11B-812.7 Access aisle. *Access aisles shall adjoin an accessible route. Two vehicle spaces shall be permitted to share a common access aisle. Access aisles shall be 60 inches (1524 mm) wide minimum and shall extend the full required length of the vehicle spaces they serve.*

11B-812.7.1 Location. *Access aisles at vehicle spaces shall not overlap the vehicular way and may be placed on either side of the vehicle space they serve except for van accessible spaces which shall have access aisles located on the passenger side of the vehicle spaces.*

11B-812.7.2 Marking. *Access aisles at vehicle spaces shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36 inches (914 mm) on center. The color of the borderlines, hatched lines, and letters shall contrast with that of the surface of the access aisle. The blue color required for identification of access aisles for accessible parking shall not be used. Access aisle markings may extend beyond the minimum required length.*

11B-812.7.3 Lettering. *The words "NO PARKING" shall be painted on the surface within each access aisle in letters a minimum of 12 inches (305 mm) in height and located to be visible from the adjacent vehicular way.*

11B-812.8 Identification signs. *Electric vehicle charging stations identification signs shall be provided in compliance with Section 11B-812.8.*

11B-812.8.1 Four or fewer. *Where four or fewer total electric vehicle charging stations are provided, identification with an International Symbol of Accessibility (ISA) shall not be required* ***11B-812.8.2 Five to twenty-five.*** *Where five to twenty-five total electric vehicle charging stations are provided, one van accessible electric vehicle charging stations shall be identified by an ISA complying with Section 11B 703.7.2.1. The required standard accessible electric vehicle charging stations shall not be required to be identified with an ISA.*

11B-812.8.3 Twenty-six or more. *Where twenty-six or more total electric vehicle charging stations are provided, all required van accessible and all required standard accessible electric vehicle charging stations shall be identified by an ISA complying with Section 11B-703.7.2.1.*

11B-812.8.4 Ambulatory. *Ambulatory electric vehicle charging stations shall not be required to be identified by an ISA.*

11B-812.8.5 Drive-up. *Drive-up electric vehicle charging stations shall not be required to be identified by an ISA.*

11B-812.8.6 Finish and size. *Identification signs shall be reflectorized with a minimum area of 70 square inches (45 161 mm^2).*

11B-812.8.7 Location. *Required identification signs shall be visible from the electric vehicle charging stations it serves. Signs shall be permanently posted either immediately adjacent to the vehicle space or within the projected vehicle space width at the head end of the vehicle space. Signs identifying van accessible vehicle spaces shall contain the designation "van accessible." Signs shall be 60 inches (1525 mm) minimum above the finish floor or ground surface measured to the bottom of the sign. Signs located within an accessible route shall be 80 inches (2032 mm) minimum above the finish floor or ground surface measured to the bottom of the sign. Signs may also be permanently posted on a wall at the interior end of the vehicle space.*

11B-812.9 Surface marking. *electric vehicle charging stations vehicle spaces shall provide surface marking stating "Electric vehicle CHARGING ONLY" in letters 12 inches (305 mm) high minimum. The centerline of the text shall be a maximum of 6 inches (152 mm) from the centerline of the vehicle space and its lower corner at, or lower side aligned with, the end of the parking space length.*

11B-812.10 Electric vehicle chargers

11B-812.10.1 General. *Electric vehicle chargers shall comply with Section 11B-812.10.*

11B-812.10.2 Operable parts. *Operable parts and charging cord storage shall comply with Section 11B-309.*

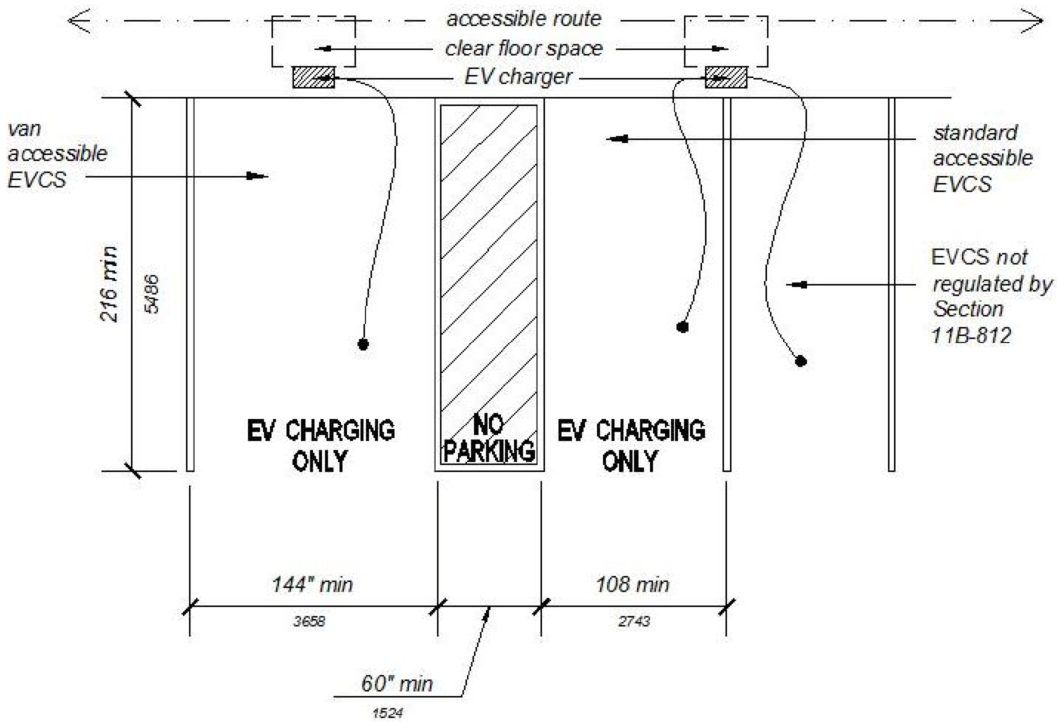
11B-812.10.3 Point-of-sale devices. *Where provided, point of-sale devices shall comply with Sections 11B-707.2, 11B707.3, 11B-707.7.2, and 11B-707.9.*

11B-812.10.4 Location. *Electric vehicle chargers shall be adjacent to, and within the projected width of, the vehicle space being served.*

Exceptions:

1. *Electric vehicle chargers serving more than one electric vehicle charging stations shall be adjacent to, and within the combined projected width of, the vehicle spaces being served.*
2. *For alterations at existing facilities where an accessible route or general circulation path is not provided adjacent to the head end of the vehicle space or access aisle, the electric vehicle charger may be located within the projected width of the access aisle 36 inches (914 mm) maximum from the head end of the space.*
3. *Where the long dimension of a vehicle space is parallel to the vehicular way, the electric vehicle charger shall be adjacent to, and 48 inches (1219 mm) maximum from the head end or foot end of the vehicle space or access aisle being served.*

FIGURE 11B-812.9. SURFACE MARKING



City of Santa Monica Green Building Standards Code Language Section 8.106.100

(a) **Multi-Family Dwellings.** For new electrical services in multi-family dwellings, the following shall apply:

(1) The total load calculations shall include a load for future electrical vehicle charging. This load shall be calculated at 10 kilowatts per 5 percent of the parking spaces provided.

(2) The minimum rating of the main service panel and the ampacity of the service entrance conductors shall be based on the total calculated load and the requirements of Chapter 2 of the California Electrical Code.

(3) A separate multi-meter distribution section shall be provided for electrical vehicle charging only. The minimum number of meters in this multi-meter section shall be based on 5 percent of the parking spaces provided. The minimum rating of this multi-meter distribution section shall be calculated at 10 kilowatts per 5 percent of the parking spaces provided.

Each meter shall have a space for a two-pole 208/240-volt circuit breaker where the space is identified as “Electric Vehicle Charging” or “Future Electric Vehicle Charging,” as applicable. This distribution panel section shall be permanently and conspicuously marked “Electric Vehicle Charging Only.”

(4) If the continuous rating of Level 2 and/or Level 3 electric vehicle service equipment is known at the time of installation then these ratings shall be applied to the load calculations in subsection (a), but in no case shall less than 10 kilowatts per 5 percent of the parking spaces be provided.

(5) Where the calculated number of parking spaces results in a fraction of 0.5 or greater, the calculated number shall be rounded to the next higher whole number.

(b) **Buildings of Mixed-Use Occupancies.** For new electrical services in buildings of mixed-use occupancies, the following shall apply:

(1) The requirements in subsection (a) shall be applicable to the residential portion of the building. The residential distribution system shall supply the charging source for electric vehicles.

(c) **Non-Residential Buildings.** For new electrical services in non-residential buildings, the following shall apply:

(1) The total load calculations shall include a load for future electric vehicle charging. This load shall be a calculated at 10 kilowatts per 5 percent of the parking spaces provided.

The minimum load for future electrical vehicle charging shall not be less than 10 kilowatts; however, if the continuous rating of Level 2 and/or Level 3 electric vehicle service equipment is known at the time of installation then these ratings shall be applied to the load calculations, but in no cases less than 10 kilowatts per 5 percent of the parking spaces provided.

The minimum rating of the main service panel and the ampacity of the service entrance conductors shall be based on the total calculated load and the requirements of Chapter 2 of the California Electrical Code.

(2) The electrical distribution system shall include spaces for two-pole, 208/240-volt circuit breakers for future electric vehicle charging. The minimum number of circuit breaker spaces shall be equal to five percent of the provided parking spaces. These circuit spaces shall be dedicated and identified as "Future Electric Vehicle Charging."

(3) For new non-residential buildings, 5 percent of the parking spaces provided shall be dedicated to electric vehicles. Each parking space shall have a raceway installed from the service or distribution panel and stubbed-up at the midline of each parking space. The minimum size of the raceway shall be one-inch nominal.

Where the parking accommodations include more than one floor or level, the parking spaces dedicated to electric vehicles, to the extent practicable, shall be provided at the first floor or level of parking access.

(4) Where the calculated number of 5 percent of the parking spaces provided results in a fraction of 0.5 or greater, the calculated number shall be rounded to the next higher whole number.

(d) **Exceptions.** The requirements of this Section shall not apply under the following conditions:

(1) New electrical service is installed in a building where there is no attached or dedicated parking facility;

(2) New electrical service is not associated with a building or structure;

(3) Compliance is technically infeasible due to the distance between a dedicated parking facility and the structure containing residential occupancies, or similar conditions. (Added by Ord. No. 2445CCS § 55, adopted 11/12/13; amended by Ord. No. 2527CCS § 11, adopted

Ventura County Electric Vehicle Ready Blueprint

Chapter 9: Innovative Electric Mobility and "First Mile, Last Mile" Solutions

Introduction and Summary of Micromobility and "First Mile, Last Mile" Solutions

Urban transportation technology is changing faster today than at any time since the internal combustion engine vehicle replaced the horse and carriage -- and micromobility solutions are in the forefront of the new wave of innovative transportation options. Micromobiity encompasses a broad and rapidly growing range of transportation technologies and modes, including NEVs, various kinds of "people movers" (some of which are autonomously operated), electric and shared bikes, e-scooters and trikes, electric skateboards, Segways, and other novel personal transportation devices. Micromobility solutions are highly complementary to public transit, with particular relevance to the so-called "first mile, last mile" radius around fixed route transit systems, both at the urban core and the suburban edge of our metropolitan areas. The potential of micromobility is vast, considering that half of the trips Americans make each day are less than three miles in length, yet 72 percent of those are made by car. Micromobility has the potential to replace a large proportion of those trips, especially in favorable climates like California. What is needed to enable this shift is a coherent vision for the deployment of micromobility solutions, and relatively modest investments in the bike/ped infrastructure that is friendly to multiple modes of micromobility.

Because of the broad applicability of micromobility solutions, the global consulting firm McKinsey and Company notes that micromobility start-ups have attracted extraordinary private investment capital. A total of $5.7 billion in venture funding has been invested in micromobility since 2015, with multiple "unicorns" – or startups valued at more than one billion dollars – appearing in the e-scooter and e-bike space alone. McKinsey believes that the shared micromobility market could reach $300-$500 billion worldwide by 2030, with the U.S. being more than half of this market. [229]

Micromobility solutions have a huge addressable market and could provide affordable and convenient medium-range commuting solutions as well as "first mile, last mile" options for transit riders. Lightweight micromobility solutions, including e-bikes and e-scooters, are also extremely efficient, producing only one to ten percent of the carbon per mile compared to a gasoline car, with electric bikes achieving over 1,000 miles per gallon equivalent. Micromobility solutions are also exciting from an urban planning point of view insofar as they can be overlaid on existing streets and (in some cases) existing sidewalks.

However, most two-wheeled and three-wheeled micromobility solutions are safer and more effective when their users can access traffic-buffered or traffic segregated bike lanes, or mixed bike/pedestrian paths. As these bicycle and pedestrian networks take shape across many California cities -- and enable appropriate access for low-speed e-mobility technologies -- improved bike/pedestrian infrastructure will earn an even greater return on investment. Improved bike/ped paths that can accommodate a variety of micromobility devices will enable:

- Higher passenger throughput per lane-mile
- New climate-friendly travel options for intra-city trips

[229] McKinsey and Company. "Micromobility's 15,000 Mile Check-up". January 2019. Accessed April 7 2019. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/micromobilitys-15000-mile-checkup

- Affordable mobility solutions for lower-income communities
- First and last mile solutions that improve transit access and usability
- Improved safety
- Improved public health
- Reduced noise and emissions levels.

The "First Mile, Last Mile" Challenge at Key Transit Hubs

The "First Mile, Last Mile" challenge in transportation planning identifies access to key transportation hubs (at either the beginning or end of a transit ride) as a significant barrier to increased use of public transportation. The transit hub in question may be a bus stop or bus depot, railway station, park and ride, or any other transit facility. As California cities are building out higher density transit-oriented developments along transit lines, there is a need for better access to these hubs for both central city residents and commuters in the suburban fringe. Innovative electric mobility technologies can connect transit riders with their transit hubs and destinations, both with personally owned e-mobility options as well as shared mobility services. Many of the proliferating micromobility solutions, such as smaller e-bikes, lightweight e-scooters, and electric skateboards, hoverboards, and unicycles, are also mall enough to bring on board transit, ensuring users have both a first and last mile solution. The diversity of the emerging micromobility technologies and use cases are described below.

Bike Sharing and Scooter Sharing Programs

Electric bike sharing and scooter sharing programs are innovative strategies for increasing low-carbon mobility in cities. Bike share programs have existed since the 1960's but many were unsuccessful due to theft and vandalism. However, with new high-tech systems, utilizing in-frame locks, GPS, and apps, bike and scooter networks have seen rapid growth. In these shared systems, bikes and e-scooters are auto-locked, and users access smartphone apps with automated electronic payment features to rent the devices, often paying $1 to $2 for 15 to 30 minutes. In the U.S., there are now at least 119 urban bike sharing programs sponsored by the likes of Ford, Citibank, and Uber -- and many more are being added every year. [230] Docked systems have the advantage of limiting bikes and scooters to a managed space when not in use. Dockless systems have the advantage of being more readily usable for one-way trips, with potentially broader distribution throughout the city. However, some cities have experienced significant problems with inappropriately parked bicycles and scooters blocking rights-of-way, as well as damaged, vandalized, and stolen bikes and scooters littering cities.

In Southern California, dockless e-scooter sharing systems were introduced by Bird Rides in Santa Monica in 2017 and have proliferated very quickly since the scooters are inexpensive, take up less space than bicycles, and provide a fun-to-drive and low carbon solution. While e-scooters are well liked by many riders, they have been controversial. Many cities have banned them, due to concerns about their legality in the public right-of-way, disorderly parking of e-scooters, riders flaunting traffic laws, and safety concerns. These controversies and challenges are addressed further below.

---

[230] Malouff, Dan. "All 119 US Bikeshare Systems Ranked By Size." *Greater Washington.* January 26th, 2017. Accessed April 5th, 2019. https://ggwash.org/view/62137/all-119-us-bikeshare-systems-ranked-by-size

Technology, Regulatory, and Market Outlook for NEVs, E-Bikes, and E-scooters

Neighborhood Electric Vehicles

NEVs are small battery electric vehicles that are designated by the U.S. Department of Transportation as "Low Speed Vehicles", with a gross vehicle weight under 3,000 pounds and a top speed of 25 miles per hour. Until recently, NEVs typically have had a range of 20-30 miles and used lead acid batteries. Newer models utilize lithium-ion batteries and can have a range of up to 100 miles. Many NEVs resemble golf carts; however, they are legally allowed on streets with posted speed limits up to 35 miles per hour. They come in various configurations with seating options up to six, as well as in the form of small flatbed trucks. Many NEV's are available at prices under $10,000, so they can offer an inexpensive zero emission solution with low fueling and maintenance costs.

Due to their small size, low speed, and efficient electric motors, NEVs can achieve 200 to 350 miles per gallon equivalent.[231] Many NEVs offer open air designs with great visibility and a fun overall driving experience. They also require smaller amounts of road and parking space than full size automobiles.

Polaris GEM Neighborhood Electric Vehicle https://gem.polaris.com/en-us/why-gem/

NEVs have been most popular in China, where hundreds of small companies sold 1.4 million low cost NEVs in 2018. In the U.S., NEVs have been a niche product used primarily in resorts, retirement communities, and college and corporate campuses, rather than in urban settings (as is common throughout Asia). NEV use has grown in retirement communities have been designed to incorporate NEVs as a principal means of transportation. For example, Peach Tree City in Georgia has over 100 miles of paths that are open to NEVs, allowing residents to travel from residential neighborhoods to shopping, parks, and schools.[232]
Polaris claims their GEM NEVs are the market leader in low speed electric vehicles, with 45,000 sold worldwide since 1998. The outlook for expanded NEV use in urban and suburban setting rests on constructing and opening up more bike lanes (and wider lanes) to enable NEV access that co-exists with bikes and other micromobility modes.

[231] Eli Electric Vehicles. Accessed April 12th, 2019 https://www.eli.world/vision

[232] Peach Tree City, accessed April 12th, 2019 https://www.peachtree-city.org/216/Paths-Golf-Carts

Electric Bicycles

An e-bike is a bicycle with an integrated electric motor. The motor can provide an electric assist to the rider's own pedaling power, making it possible to arrive at work without breaking a serious sweat, even over longer distances or hilly terrain. Most recent e-bikes use rechargeable lithium-ion batteries and can travel up to 20 to 28 miles per hour, with a typical range of 20 to 30 miles for e-bikes in the $1,000 to $2,500 range. However, ranges and speeds can be greater (e.g. 35+ MPH and 50+ miles of all-electric range) with higher-cost models. Top of the line e-bikes can cost as much as $4,000 to $7,000. In the U.S., models in the $3,500 to $4,500 range are most popular, though this may reflect the more expensive tastes of early adopters.[233] Most e-bikes require pedaling, but some have throttles that can operate without pedaling, similar to an electric moped. Due to the lightweight design of e-bikes, they are the most efficient electric vehicle commonly used, with a fuel economy of 300 to 1,000 miles per gallon equivalent depending on the amount of human pedal assist, the weight of the bike and rider, and the terrain.[234]

E-bikes are classified by the level of electric motor assist. "Pedelec" e-bikes are legally classified as bicycles and have relatively low powered electric motors of less than 250 watts. The motorized assistance only engages while the rider is actively pedaling and is particularly helpful when a rider climbs a hill or is facing headwinds. Pedelecs can help riders expand their range of destinations, speed up trip times, and help riders with physical limitations confidently ride longer or hillier routes. More powerful e-bikes are known as "S-Pedelecs" or Power-on-demand e-bikes. These have motors more powerful than 250 watts and typically can travel at speeds of more than 20 miles per hour. These e-bikes are often legally classified as mopeds and have different registration, insurance, and legal status on various roadways.

Conversion of conventional non-motorized bikes to e-bikes is now possible at a reasonable cost thanks to electric hub motors. A hub motor, battery, and other components are sold in kits that allow do-it-yourselfers to inexpensively convert a regular bike to an e-bike for as little as $300. By contrast, purpose-built e-bikes offer a smoother, better integrated ride and look, while costing $1,000 and up.

E-bike in a Sport Format

[233] Velorsurance, "E-Bikes Are Wooing Americans," accessed May, 2019, https://velosurance.com/information-center/ebikes-wooing-americans/

[234] Behar, Jason. "The American e-bike Blog: How eco-friendly are electric bikes." Prodecotech. May 18, 2017. Retrieved April 12th, 2019 https://prodecotech.com/american-e-bike-blog-eco-electric-bikes/

E-bikes are an established technology that have seen high levels of growth in Asia and Europe and are now quickly catching on in the United States. China is the undisputed leader in e-bike adoption, with 50 percent of all bikes currently sold being electric, a total of 210 million in daily use, and roughly 30 million new e-bikes sold per year.[235] An order of magnitude behind is Europe, with roughly 2 million e-bikes sold each year, but with many countries experiencing 20 percent or more annual growth.[236] In Germany, e-bikes have a 20 percent overall market share with experts predicting that e-bikes will gain 35 to 50 percent of the European bicycle market. In Europe, e-bikes are much higher performance and higher cost, with an average price point of $2,000 versus $450 in China.[237]

The U.S. e-bike market is lagging well behind both Europe and China, with approximately 150,000 e-bikes sold in 2016, or about a one percent market share vs. the 16 million regular bicycles sold in the U.S. each year. At this point, the U.S. is about ten years behind Europe in e-bike adoption. However, many factors are driving significant U.S. market growth, including maturing technology, a rapid decline in lithium-ion battery prices, a general increase in bicycling, new bike infrastructure, an aging population, and an increase in distribution for quality E-bike products. Finally, there is significant growth in electric bike sharing programs that will introduce many new customers to the virtues of e-bikes. Shared e-bikes can also provide critical last-mile connectivity for transit riders who are not able to bring their bikes on board the bus or train.

Electric Bike Sharing

Electric bike sharing is still a small niche but is growing rapidly. Roughly 150 cities worldwide have launched programs that include electric bikes, with about 50,000 e-bikes in bike share fleets globally.[238] In the U.S., 4,000 e-bikes are in bike share fleets, with Jump launching the first dockless electric bike sharing program in San Francisco in 2017.

A docked electric bike in New York City[239] -- one of 150+ electric bike sharing networks in major cities globally

[235] ElectricBikeReport.com. "The State of the Electric Bike Market." September 19, 2016. Accessed April 5th, 2019. https://electricbikereport.com/the-state-of-the-electric-bicycle-market/

[236] Citron, Ryan. "E-bike Sales Climbing in Major European Markets, US Lags Behind." *Navigant Research*. June 26th, 2018. Accessed April 6th 2019. https://www.navigantresearch.com/news-and-views/e-bike-sales-climbing-in-major-european-markets-us-lags-behind

[237] ElectricBikeReport.com. "The State of the Electric Bike Market." September 19, 2016. Accessed April 5th, 2019. https://electricbikereport.com/the-state-of-the-electric-bicycle-market/

[238] Sisson, Patrick. "Why Electric Bikes Can Provide a Big Jolt to Bikeshare Systems. *Curbed.* June 28, 2018. Accessed April 6th, 2019. https://www.curbed.com/2018/6/28/17515758/electric-bike-share-cycling-city-transportation

[239] https://www.westsiderag.com/wp-content/uploads/2018/08/citibike-e-bike.jpg

E-bikes enhance existing bike share programs by enabling longer rides and increased usage on hilly terrain. These programs also bring biking within reach of individuals with limited physical capabilities. In New York City, 150,000 bike sharing program members are now sharing 12,000 bikes and e-bikes -- making 17.5 million trips in 2018.[240] With Lyft's recent purchase of Motivate (the New York bike sharing provider), $100 million will be invested over five years to triple the number of bikes to nearly 40,000, including an unspecified number of e-bikes. Currently, 200 of New York City's 12,000 bike sharing fleet are e-bikes, and they are extremely popular, averaging 14 trips per day compared to just seven for regular bikes. Motivate expects to increase the e-bike fleet to 1,000 in 2019, with an intention to provide alternatives to commuters displaced by subway routes closed for construction.[241]

Closer to Ventura County, Los Angeles has just launched a new electric bike sharing system, with leading e-bike companies Jump and Wheels authorized to distribute a combined 4,000 dockless e-bikes on city streets. City officials hope the e-bikes will be more popular than previous bike sharing programs with regular bikes. In 2017, Lime, Spin, and OjO all launched dockless bike sharing programs but since have left the market or switched to e-scooters. While e-bikes may prove more attractive than regular bikes, city officials stressed that the long-term success of any shared mobility program depends on continually improving the city's bike infrastructure. Creating traffic-buffered or fully segregated bike lanes is critical to improving safety both for e-bikes as well as for lightweight e-scooters and pedestrians.

Electric Scooters

There are two very different types of electric vehicles which are both referred to as e-scooters. The smaller of the two is a stand-on device with handlebars, which looks like a heavier-duty electric version of the children's scooter first popularized under the trade name Razr. An entirely different vehicle also sometimes referred to as an e-scooter is more properly considered an electric moped or electric motorbike. This vehicle is like the gas-powered mopeds that have dominated many Asian cities for decades. The electric version of the moped is now being popularized by companies such as Scoot and the Ventura based company OjO[242]. In this report, we will refer only to the smaller devices as e-scooters, while labeling the larger devices electric mopeds (e-mopeds) or electric motorbikes.

Smaller, simpler, and less expensive than e-bikes, the e-scooter has seen explosive growth since 2017, largely driven by the shared dockless e-scooter programs pioneered by the companies Bird and Lime. IBird Rides reached a $1 billion valuation in just eight months, the fastest timeline of any start-up company. In just 14 months, the company launched in 120 cities, accumulating over 10 million rides.[243] In the last two years, at least ten other e-scooter companies have launched, including some owned by ridesharing

---

[240] Motivate. Accessed April 7, 2019. https://www.motivateco.com/

[241] Furfaro, Daniel. "Good Luck Grabbing These Snazzy Citibikes." *New York Post*. November 25, 2018. Accessed April 7th, 2019. https://nypost.com/2018/11/25/good-luck-grabbing-these-snazzy-citi-bikes/

[242] Ojo Scooters. Retrieved from: https://www.ojoelectric.com/contact/

[243] Yacowicz, Will. "14 Months, 120 Cities, $2 Billion: There's Never Been a Company Like Bird. Is the World Ready?" *Inc.* Winter 2018/2019. Accessed April 6th, 2019 https://www.inc.com/magazine/201902/will-yakowicz/bird-electric-scooter-travis-vanderzanden-2018-company-of-the-year.html

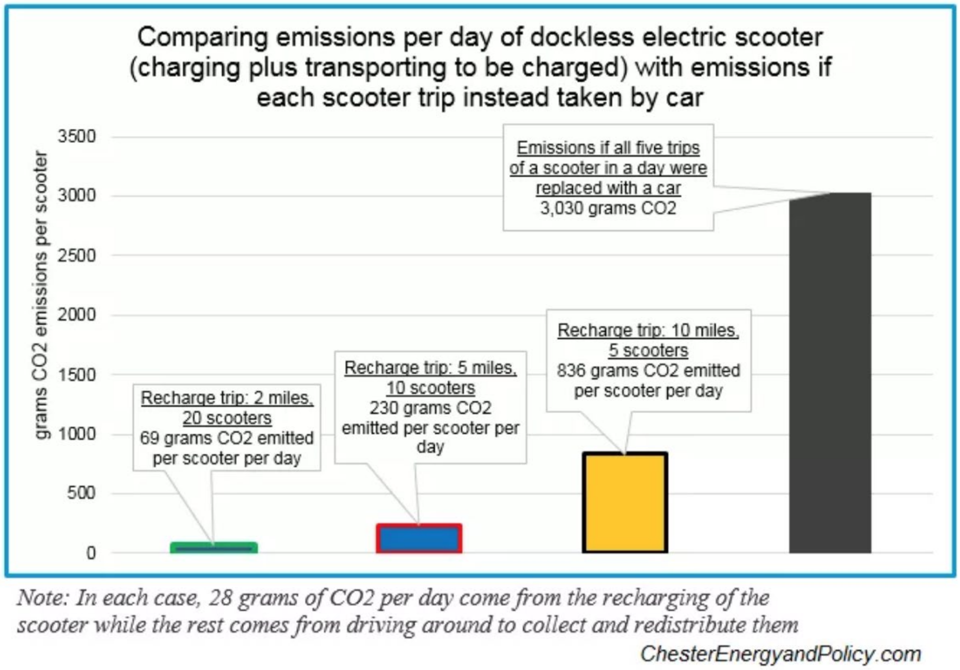
heavyweights Uber and Lyft, which have placed hundreds of thousands of scooters onto city streets, generating significant backlash and controversy in the process.

Scootersharing and bikesharing networks co-exist along with new bike lanes in Santa Monica

Commonly used e-scooters are lightweight, usually under 30 pounds, with a metal frame and two small wheels. They are ridden standing up, with typical models utilizing an approximately 335 watt-hour lithium-ion battery to travel up to 15 miles per hour, for a total range of approximately 18 miles. These e-scooters have a minicomputer with GPS that allows the device to connect to a company's software platform, so the company can see where each e-scooter is located, lock and unlock the wheels and motor, and control speed remotely. Riders use an app to locate the e-scooters and unlock them, usually paying $1 to start a ride plus $0.15 to $0.20 per minute of use. When finished with a ride, the user typically leaves the e-scooter wherever they end their ride. However, some cities are designating official e-scooter parking areas or requesting they be left near bike parking installations.

Emissions Impacts of E-scooters: Like all electric vehicles, e-scooter emission factors vary depending on the carbon intensity of electricity used for charging. In California cities served by an energy provider with a 100-percent renewable option, emission factors are very low. However, nearly all scooter services must reposition some of the vehicles daily, a practice that is sometimes referred to as rebalancing. The vehicles used for re-distributing shared e-scooters are often internal combustion engine vans or trucks. Therefore, the emissions of scooters must consider both the scooters themselves and the service vehicles, as indicated in the chart below.

Figure 1: Emissions Impact of E-Scooter vs. Car Trips



E-scooter companies rightfully claim that their products are a very green way to move around a city, with a 30-pound e-scooter emitting as little as one percent of the GHGs as a 4,000-pound car. However, it is also true that many of the rides that e-scooters replace may have previously been made by even lower carbon forms of transportation, such as walking or biking. Or they would not have been made at all – a phenomenon known as "induced demand." According to recent data from the City of Portland's Department of Transportation,[244] only 34 percent of Portland residents' e-scooter rides replaced a car trip or ride-hailing trip. The comparable number for Portland visitors was 48 percent. Thus, for both residents and visitors, most e-scooter rides have been replacing a lower carbon form of transportation, such as walking, biking, or transit. In Santa Monica users report that shared scooters were more likely to displace a car trip than a walking trip, and that there was an overall increase in both walking and rail transit use for respondents who took up regular use of the shared e-scooter and bike networks. The City of Santa Monica's 2019 shared mobility survey found that: [245]

- Work and recreation trips (31 percent and 23 percent respectively) were the most commonly reported trips.
- 50 percent of shared mobility trips displaced a car trip (including driving alone, ride share services, taxi, etc.) and 38 percent of shared mobility trips displaced a walking trip.

---

[244] Portland Bureau of Transportation. "2018 Electric scooter Pilot User Survey Results." 2018. Accessed April 7th, 2019. https://www.portlandoregon.gov/transportation/article/700916

[245] City of Santa Monica. "Shared Mobility Device Pilot Program User Survey Results: 2019. Accessed June 17, 2019. https://www.smgov.net/uploadedFiles/Departments/PCD/Transportation/SharedMobility_UserSurveySummary_20190509_FINAL.PDF

- Respondents reported a notable increase in walking and rail transit use (18 percent and 16 percent respectively) since taking up shared scooters/bikes.

One of the most significant challenges that local governments encounter with shared e-scooters is ensuring both user safety and managing user behavior to reduce right-of-way conflicts or threats to public safety. According to the City of Santa Monica survey results, 67 percent of respondents report rarely or never wearing helmets while they ride; and 77 percent of respondents' report riding on streets with bike lanes, while nearly half (48 percent) report riding on streets without bike lanes, and 20 percent report riding on sidewalks. In response to safety concerns, the City of Santa Monica has implemented a set of enforceable rules for shared e-scooter use, described below:

Table 1: City of Santa Monica Rules for Riding Shared Mobility Devices (as of June 2019) [246]

Rules for Riding	*E-scooters*	*BikeShare Bikes: Human powered or electric*
Required valid driver's license or instruction permit	Yes	No
Age to ride	16 yrs.	16 yrs.
Age for required helmet	All Ages	18 yrs.
One person per device	Yes	Yes
Riding on the Sidewalk	Prohibited	Prohibited
Riding on 3rd Street Promenade, Pier Bridge, Ocean Front Walk, and Beach Bike Path	Prohibited	Prohibited
Must be ridden in bike lanes	Yes	Yes
Must obey traffic laws and yield to pedestrians	Yes	Yes

The City of Santa Monica has devoted significant staff time and resources to launch public information campaigns that are intended to create broad awareness of the rules for using shared mobility devices. Based on the City's 2019 survey results, it appears public information campaigns have been most effective at influencing user behavior among city residents. It has been more difficult to ensure that users from outside of the City are aware of and follow the rules for shared mobility devices. The City also requires that operators ensure scooters are parked safely out of the right of way. Devices that are left in the public right of way (e.g. sidewalk, crosswalk, street, curb) in a manner that presents an immediate hazard are subject to impound. If a device is impounded, a fee of $95 per device will be assessed to the operator to retrieve the device.

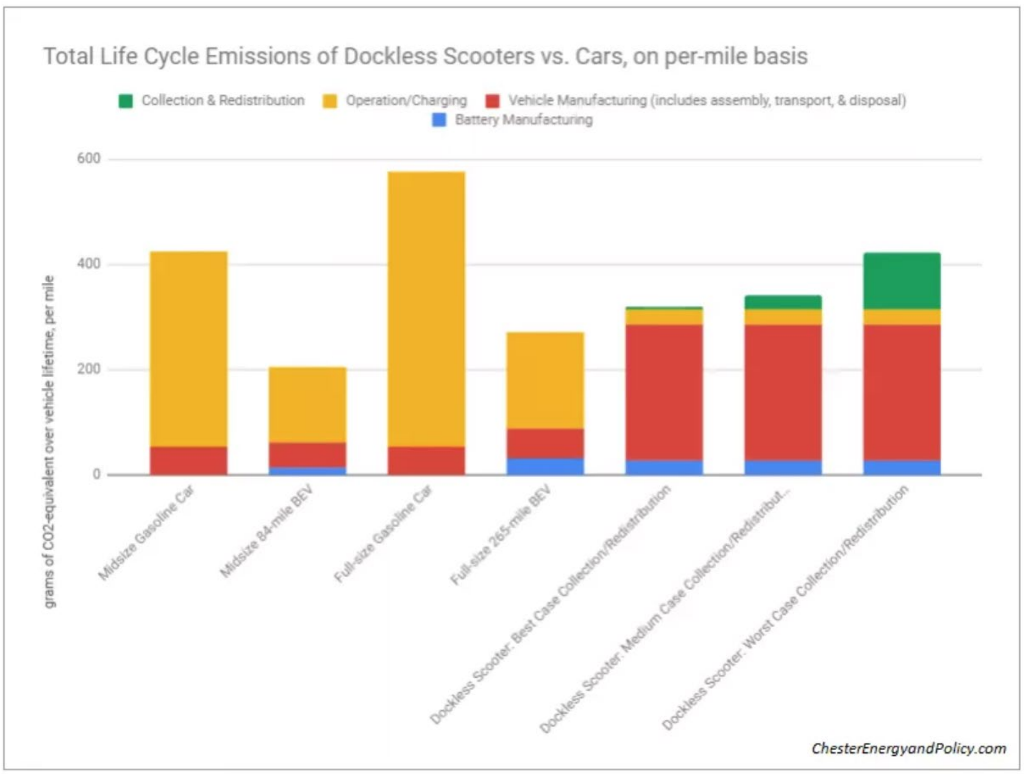
Another challenge facing early e-scooter deployments is that many existing models have low durability and high incidence of vandalism and theft. Thus, the embedded carbon in the manufacturing of the scooter and its batteries must be amortized over a relatively short lifespan. In fact, the average e-scooter in deployments to date has had a lifetime of only 45 days, or as little as 23 days in challenging urban

[246] City of Santa Monica. "Scooter and Bike Share Services." Access June 17, 2019. Availabe at: https://www.smgov.net/Departments/PCD/Transportation/Shared-Mobility-Services/

markets.[247] With this lifespan, the average lifetime mileage of an e-scooter may be less than 1,000 miles, compared to over 100,000 miles for an average car. Accordingly, the lifecycle emissions per mile from an e-scooter (counting CO_2e in the manufacturing as well as the operations) are extremely high. According to a Life Cycle Analysis published in *Chester Energy and Policy,* the per-mile carbon emissions of an e-scooter with a short lifespan are nearly as high as a mid-size gasoline car, and twice as high as an electric vehicle.

Fortunately, some e-scooter companies are responding with next generation designs that improve durability. Analysts such as Matt Chester[229] suggest that manufacturers must develop more robust models that can last for at least a year in order for e-scooters to significantly reduce their manufacturing environmental footprint per mile of utilization. The chart below indicates the degree to which scooter lifespan impacts CO_2e per mile.

Figure 2: Total Life Cycle Emissions of Dockless Scooters vs. Cars



Improving the life-cycle emissions profile of dockless e-scooters requires extending vehicle lifespans and reducing the emissions associated with collection and redistribution.

A new company called CLEVR Mobility has developed an e-scooter model that attempts to address the sustainability challenges associated with first generation e-scooters. Their ruggedized e-scooter for

[247] Chester, Matt. "It's a Bird…It's a Lime…It's Dockless Scooters! But Can These Electric-Powered Mobility Options Be Considered Sustainable Using Life-Cycle Analysis?" *Chester Energy and Policy*. January 28, 2019. Accessed April 7th, 2019. http://chesterenergyandpolicy.com/2019/01/28/its-a-bird-its-a-lime-its-dockless-scooters-but-can-these-electric-powered-mobility-options-be-considered-sustainable-using-life-cycle-analysis/

commercial fleet use is expected to last ten times longer than the current consumer grade disposable scooters. It has a swappable battery that reduces the environmental impact of scooter charging. Rather than utilizing internal combustion engine vehicles for e-scooter collection, central charging, and redistribution, CLEVR Mobility utilizes e-bikes and trailers to swap batteries in the field. The CLEVR e-scooter has three larger wheels, rather than just two, leading to a safer and smoother ride with less concerns about riders tipping over. (Most scooter injuries have occurred due to operator error, not crashes with pedestrians, bikes, or cars). They also have an improved GPS onboard, which enables precision monitoring to a three-foot radius. This capability enables more sophisticated geo-fencing – which, for example, can be utilized to determine if scooters are on sidewalks and thereby limit speeds. Data showing when users prefer sidewalks can also be used to inform city officials regarding street conditions where drivers feel unsafe.

Electric Mopeds

Shared e-mopeds are also beginning to be deployed in California cities, although market penetration is lower than stand-up e-scooters. Oxnard-based OjO Electric recently launched shared e-moped services in the cities of Austin and Dallas, Texas, and Hoboken, New Jersey. The e-moped company Scoot now offers 500 e-mopeds in San Francisco, charging $4 for the first 15 minutes and $0.10 per minute thereafter. Scoot claims that their e-mopeds achieve 600 miles per gallon equivalent, while emitting only two percent of the emissions of an average gasoline-powered car per mile. Further, nearly all components of their mopeds are recyclable, including the frame and battery.[248] The e-mopeds have a range of 20 miles, a top speed of 30 miles per hour, and come with helmets and USB charging ports. Scoot claims their mopeds have been ridden 6.8 million miles since their launch in 2012. E-mopeds must be driven in regular lanes of traffic.

While use in California and other U.S. cities has not been large enough to impact urban travel patterns significantly yet, it is possible that electric mopeds will gain a loyal following as more urban residents are exposed to their many advantages, including convenience, ease of parking, clean and quiet ride, versatility, and fun factor. As with e-bikes and other two-wheeled vehicles, safety is a concern, and cities with high densities of scooters will be advised to take traffic "calming" measures and to consider establishment of lower speed limits or emissions-free zones that favor NEVs and new electric micro-mobility vehicles.

A Scoot electric moped of the type currently deployed in San Francisco.
https://scoot.co/san-francisco/

[248] Scoot. Accessed April 12, 2019. https://scoot.co/san-francisco/faq/#main-76

Overview of Electric Skateboards, Hoverboards, and Unicycles

Electric skateboards, hoverboards, and unicycles are emerging micromobility solutions that are small enough to be carried onto transit for a first mile, last mile solution, and they have sufficient range to make multiple urban trips before needing a recharge. Most of these devices weigh 10 to 30 pounds, cost from $200 to $1000, travel 10 to 20 miles per hour, and have ranges of 10 to 20 miles. In traffic plagued large cities, where autos can average less than ten miles per hour, these devices can help users get around as fast as a car without the parking hassles, and usually with a smile.

Electric Skateboards

Electric skateboards are becoming more sophisticated, with swappable battery systems, Bluetooth connectivity, and regenerative braking. Some are as inexpensive as $300, are easily carried at just eight pounds, and offer approximately five miles range.

Electric skateboards can provide significant range, speed, and even hill climbing capability

More sophisticated skateboard models are also available that are somewhat heavier, cost as much as $1,700, and have larger capacity batteries and motors that can travel at 23 miles per hour, climb hills as steep as 30 percent, and travel up to 22 miles before recharging. Given the high-performance potential of the new e-skateboards, investors are responding by supporting companies such as Inboard Technology (which recently raised $8 million in early stage funding). [249] While electric scooters have made strong inroads in select college and urban environments, they are not yet being mass-deployed in sharing program configurations.

Electric Hoverboards

Electric Hoverboards, or self-balancing scooters, are very affordable, with inexpensive models selling for under $150, providing a 400-watt motor that can propel a rider to seven miles per hour, for up to three miles. More advanced hoverboards can cost approximately $600, and travel up to ten miles per hour, with

---

[249] Schieber, Jonathan, Inboard Technology raises $8 million to be the Tesla of electric skateboards. Techcrunch. November 11th, 2017. Accessed April 7th, 2019.
https://techcrunch.com/2017/11/16/inboard-technology-raises-8-million-to-be-the-tesla-of-electric-skateboards/

a range of ten miles and capability of up to 220 pounds. Their low cost and portability make them a perfect first mile, last mile solution for transit riders. Many riders find them easier to navigate than skateboards. Electric hoverboards have not yet been the subject of large-scale sharing experiments, and because of theft and safety issues, they may not be suitable for large-scale fleet sharing.

Electric hoverboards can travel at up to 20 miles per hour and achieve 30-mile range

Electric Unicycles

Electric unicycles (e-unicycles) are self-balancing, personal transportation devices with a single wheel, and can be considered a one-wheel scooter. The wheel is typically 12 to 18 inches in diameter and features a self-balancing mechanism that uses gyroscopes and accelerometers to enable to the rider to balance, accelerate, and decelerate in a manner similar to a Segway.

Electric unicycles can achieve 20 miles per hour and travel up to 30 miles on a charge.

The e-unicycle can speed along at 10 to 20 miles per hour and travel 15 to 30 miles on a charge. The devices are available at prices that range from approximately $500 to $1,000. There is a learning curve for new riders, so some unicycles come with apps that instruct the rider on proper technique, while limiting initial speed until mastery is gained.

Overview of Bike Infrastructure and Opportunities for E-Bike and Micromobility Utilization

The latest Ventura Countywide Bicycle Masterplan was adopted by the Ventura Transportation Commission in 2007. Seven of Ventura's ten incorporated cities also have their own Bicycle Masterplans. The 2007 Ventura County Plan enables all cities and the unincorporated County to qualify for State of California bicycle infrastructure funding opportunities. The purpose of the planning was to prepare Ventura County for an expected influx of new state funding aimed at improving bike safety and making biking a legitimate commute alternative to the car for shorter trips. The Countywide Plan found that Ventura County had 56.3 miles of Class 1 off-street bike paths, 250.8 miles of Class 2 bike lanes, and 55.6 miles of Class 3 bike routes. [250] The classes of bike paths are indicated below:

- **Bike Paths (Class 1)** are paved rights-of-way completely separated from streets. These paths are often located along waterfronts, creeks, railroad rights-of-way or freeways with a limited number of cross streets and driveways. Class 1 paths are typically shared with pedestrians and often called mixed-use paths.
- **Bike Lanes (Class 2)** are on-street facilities designated for bicyclists using stripes and stencils. Bike lanes may include buffer striping to provide greater separation between bicyclists and vehicles.
- **Bike Routes (Class 3)** are streets designated for bicycle travel and shared with motor vehicles. While the only required treatment is signage, streets are designated as bike routes because they are relatively well-suited for sharing with motor vehicles and provide better connectivity than other streets.
- **Protected Bike Lanes (Class 4**) also known as cycle tracks, provide space exclusively for bicyclists and separated from vehicle travel lanes, parking lanes, and sidewalks. Parked cars, curbs, bollards, or planter boxes provide physical separation between bicyclists and moving cars. Where on-street parking is allowed, it is placed between the bikeway and the travel lanes (rather than between the bikeway and the sidewalk, as is typical for Class 2 bike lanes).

The Bicycle Masterplan found -- according to Census data – that 0.7 percent of Ventura County residents commute by bicycle to work, compared to 0.4 percent nationally and 0.8 percent in California. As this data only included work commute bicycling, the Plan estimated that cumulative bicycling rates for school, college, and transit commuters (who use bikes for a portion of their trip) was 2.4 percent. This rate of bike utilization is equivalent to an estimated 12,926 total bicycle commuters and utilitarian riders in the County -- not including recreational riding. Total daily bicycle trips in Ventura County were estimated at 25,853. The Plan also included a trip reduction potential analysis. It found that 99,996 Ventura County commuters had a commute trip of 15 minutes or less, and that after existing bicyclist and walkers were subtracted, 15 percent of these short vehicle trips could potentially be converted to bicycle trips, creating 13,554 potential additional bike commuters. If this increase was achieved, the commute bike rate would increase from 2.4 percent to 8.1 percent. The potential increases in cycling are based on actual increases in cycling achieved in San Francisco, Portland, and Seattle, thanks in part to newly developed bike infrastructure. Notably, all these cities have more challenging weather and hillier topography than Ventura County.

---

[250] Alta Planning+Design. "Ventura Countywide Bicycle Masterplan." *Prepared for Ventura County Transportation Commission,* October 2007. Accessed April 7th, 2019.
http://pwaportal.ventura.org/TD/Residents/Streets_and_Transportation/Reports_and_Programs/AP_VenturaCountyBikePlanFinal2008.pdf

Since 2007, significant investments have been made in Ventura County's bicycle infrastructure, which will lead to safer bikeways and likely attract at least some of the estimated 13,554 potential new bike commuters (with or without electrically assisted bikes). These improvements are also creating safer corridors and increased opportunities for more usage of e-bikes, e-scooters, and other micromobility devices. In 2017, an additional $14 million was approved for Ventura County bicycle and pedestrian infrastructure, a historic high.[251] This influx of new funding is due to the recently passed SB 1 gas tax, which authorized unprecedented new funding for bicycle and pedestrian infrastructure. This funding increase also coincides with new state Department of Transportation goals to double walking and triple biking rates by 2020, while cutting bicycle and pedestrian fatalities by ten percent per year.

To lay the foundations for safer micromobility solutions, the County of Ventura and municipal governments in the region should seek to accelerate the development of safe multimodal transportation infrastructure benefiting all road users. According to data analysis from University of California, Berkeley, Ventura County has a high rate of bicycle and pedestrian collisions and fatalities in California relative to other counties. From 2013 to 2017, Ventura County had:

- 969 pedestrian collisions (13th highest out of 58 counties) and 48 pedestrian fatalities (18th out of 58 counties)
- 1,154 bicycle collisions (11th out of 58 counties) and 14 bicycle fatalities (15th out of 58 counties)

To improve bike/ped and road safety generally, the County of Ventura and municipal governments could adopt Vision Zero policies. Vision Zero is a globally recognized approach to eliminating all traffic fatalities and severe injuries, while increasing safe, healthy, and equitable mobility for all. First implemented in Sweden in the 1990s, Vision Zero has proved successful across Europe and is now gaining momentum in major American cities. More than 40 cities in the U.S. have adopted Vision Zero policies. Eleven of these 44 cities are in California, including Fremont, La Mesa, Los Angeles, Monterey, Sacramento, San Diego, San Francisco, San Jose, San Luis Obispo, Santa Barbara, and Watsonville.[252]

Vision Zero focuses on the "Four E's" of Evaluation, Engineering, Enforcement, and Education. Evaluation of data is used to identify intersections with the highest rates of traffic accidents. Engineering is used to create physical infrastructure solutions that reduce the frequency of accidents. Enforcement of traffic laws is used to reinforce safe driving behavior, with increased resources for traffic law enforcement provided to local police departments, County sheriffs, and the California Highway Patrol. Education is used to make sure that all road users are aware of traffic laws and to cultivate a "safety-first" mentality.

The most effective Vision Zero efforts bring together transportation engineers, police officers, advocates, and policymakers to work together towards creating safer streets. Special emphasis should be placed on Vision Zero policies, programs, and projects that will protect the region's most vulnerable road users,

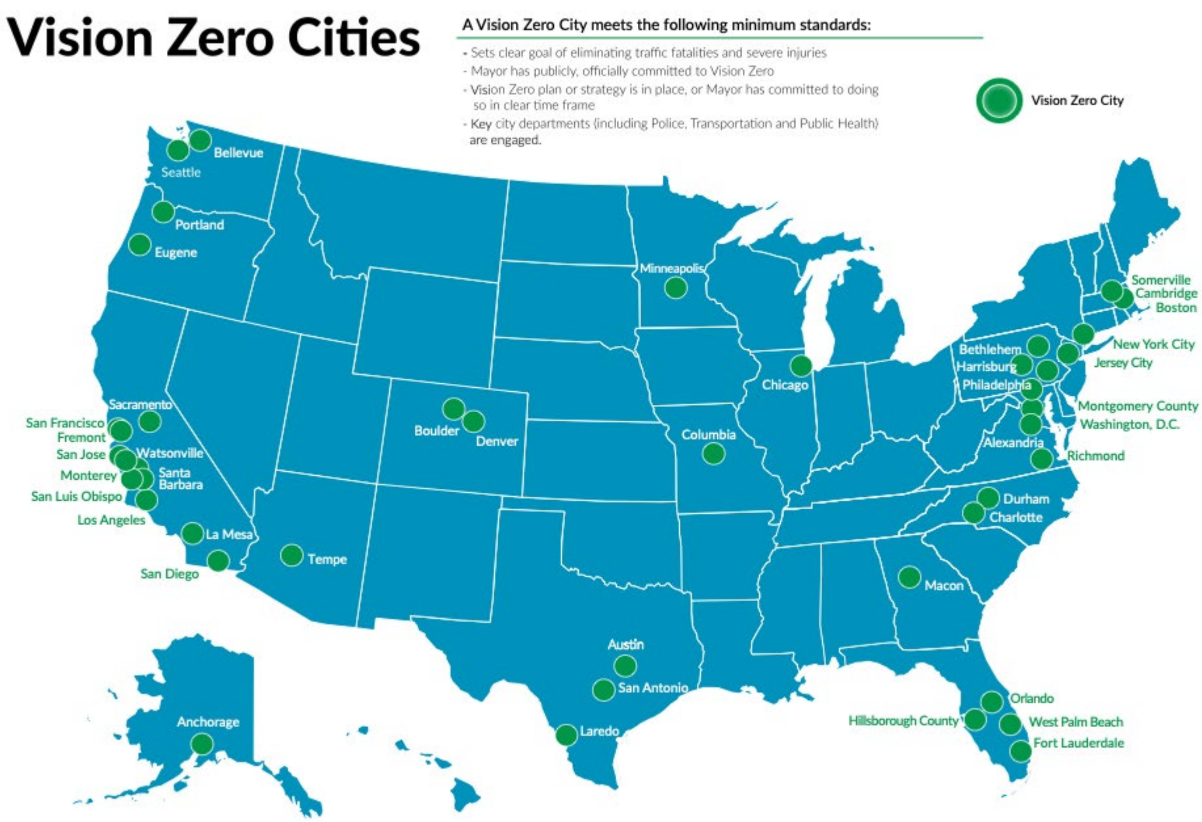
---

[251] Wilson, Kathleen. "Ventura County Puts Funding Muscle Behind Bicycle and Pedestrian Paths." *Ventura County Star.* November 11th, 2017. Accessed April 7th, 2019. https://www.vcstar.com/story/news/2017/11/09/ventura-county-puts-funding-muscle-behind-bicycle-and-pedestrian-paths/785511001/

[252] Vision Zero Network. "Vision Zero Cities Map." Accessed June 17, 2019. Available at: https://visionzeronetwork.org/resources/vision-zero-cities/

including children, older adults, and people walking and bicycling to support safe infrastructure development for all road users. The extent of the Vision Zero movement is illustrated in the map below.

Figure 3: Vision Zero Standards and Vision Zero Cities



As new bicycle and pedestrian infrastructure is developed to close key infrastructure gaps and make Ventura County safer for bicyclist and pedestrians, it is likely that new electric micromobility technology usage will also grow. It is also possible that e-scooter sharing and bike sharing (including e-bikes) may come to Ventura County. The City of Ventura is the most obvious candidate for the first shared micromobility program in the County. The City of Ventura has a 25 percent higher commute bike rate than the County as a whole (0.88 percent versus 0.70 percent) and has the most Class 1 Bike Paths and other bicycle infrastructure, including heavily used bike paths along the Pacific Ocean and the Ventura River. As the oldest city in the County, it has relatively bike friendly streets as well as the largest tourism sector in the County, with 2.7 million visitors in 2017. However, there are currently no plans to bring bike sharing to Ventura. In October 2018, the Ventura City Council also put a temporary ban on e-scooters after observing the challenges that the Cities of Santa Barbara and Goleta have experienced with Lime and Bird Rides deploying hundreds of e-scooters, some of which were left strewn on sidewalks.

The City of Thousand Oaks was the first city in Ventura County to allow e-scooters and negotiated an agreement in November 2018 for Bird to deploy e-scooters, along with additional e-scooters at nearby California Lutheran University. In March 2019, however, Bird Rides issued a statement that they had no current plans to launch in Thousand Oaks, with City staff suggesting this decision had been made due to profitability concerns, with other cities also being scaled back. [253] It is not clear as of this writing when other shared mobility service providers might enter the Ventura market.

Strategies for Micromobility Programs to Effectively Serve Low-Income Residents

While shared bike and e-scooter programs have been very popular, their track record of helping low-income residents has been mixed. Some operators have – in concert with city sponsors – tried to proactively distribute mobility devices to lower-income communities, and in some cases to provide discounted program fees. For example, Skip operates scooters in San Francisco and provides discounts of 50 percent to low-income riders who demonstrate eligibility for other low-income programs such as CalFresh and PG&E Cares. The program has not been successful to date, registering just 22 riders out of 39,000 overall users. [254] In Portland Oregon's four month 2018 e-scooter pilot program, only 43 residents were enrolled in discounted low-income plans, out of 2,043 e-scooters making more than 700,000 trips. [255] However, the company failed to abide by a city requirement to place at least 100 e-scooters each in predominantly low-income communities, so the evidence of uptake is not conclusive.

Portland's study also found that while 62 percent of Portlanders viewed e-scooters positively, support was even higher amongst people of color (74 percent) and those with incomes under $30,000 (66 percent). Scooter companies and the City are also considering additional program strategies for low-income Portlanders, such as free e-scooter rides to those who charge a scooter at their house, and rewards for homeless Portlanders who return scooters to charging centers with money and/or a hot meal. Other strategies to improve participation by low-income residents include offering pay stations that accept cash rather than needing a smartphone or credit card, and pro-actively recruiting riders from underserved neighborhoods. [256]

Despite some positive outreach programs, many low-income communities have viewed bike sharing as a symbol of gentrification. In San Francisco, bike sharing was met with opposition from community activists, who blocked bike sharing stations in the City's Mission District, a mostly Latino neighborhood. They believed that bike sharing fueled gentrification without offering commensurate benefits for their community. Bike sharing at $149 for an annual membership was seen as an expensive alternative to

---

[253] Harris, Mike. "Bird Scooter Plan Grounded in Thousand Oaks; City Was First to Allow Electric Scooters." *Ventura County Star.* March 15th, 2019. Accessed April 6th, 2019. https://www.vcstar.com/story/news/local/communities/conejo-valley/2019/03/15/electric-scooters-not-coming-thousand-oaks-after-all/3173990002/

[254] Fitzgerald-Rodriguez, Joe. "Scoot, Skip Fail to Deliver on Promises in First Electric scooter Accountability Report. *San Francisco Examiner.* February 2nd, 2019. Accessed April 12, 2019. https://www.sfexaminer.com/news/scoot-skip-fail-to-deliver-on-promises-in-first-electric scooter-accountability-report/

[255] Portland Bureau of Transportation. "2018 Electric scooter Pilot User Survey Results." 2018. Accessed April 12th, 2019. https://www.portlandoregon.gov/transportation/78431

[256] Wiltz, Teresa. "How (and Why) Cities are Marketing Bikes to Poor People." Governing.com. February 16th, 2018. Accessed April 12, 2019. https://www.governing.com/topics/urban/sl-bike-lane-equity-equality-income.html

buying an inexpensive used bike. In response, San Francisco's program now offers low-income residents a first year's pass for $5, also payable in cash, followed by a $5 per month fee in following years.

Other programs have incorporated low-income communities with more success, including in Philadelphia, which was the first U.S. city to add bike equity into startup program planning. Upon launch, Philadelphia's Indego bike sharing system installed 20 stations in underserved communities, and a year later added a discounted pass for low-income residents, as well as a digital literacy and safe biking class. Since its launch, Indego has logged nearly 2 million rides, and ten percent of rides have been taken by the 1,000 low-income users who have accessed a reduced-price pass.

Data Policies, Specifications, and Tools for Shared e-Mobility Management and Regulation

The rapid emergence and market growth of micromobility solutions have prompted many local governments to re-examine the management and regulation of transportation services. As part of this response, many local governments have developed and implemented detailed data requirements for shared mobility operators. The Los Angeles Department of Transportation created the Mobility Data Specification, a new data sharing standard intended for use in and beyond Los Angeles.[257] Mobility Data Specification prescribes a data format for trip data, fleet status, and communication expectations between city regulators and shared mobility service providers including Bird and Lime. Specifically, the Mobility Data Specification provides:

- Historical timestamped data on shared mobility services
- Data insights into constituent transportation behavior
- Monitoring and regulation for the operations of mobility-as-a-service providers, including upholding standards for equitable clean mobility access.

Mobility Data Specification is being developed on Github – a platform that enables open source, collaborative software development -- with participation from cities and shared mobility service providers.[258] Mobility Data Specification updates can be provided via an API. Shared mobility service providers can be required to share data via the API as part of the terms of their mobility services agreement with a local government. For example, Nashville adopted a real-time API requirement, which obligates shared mobility operators to provide real-time information on the entire fleet through a documented API.[259]

Moving forward, local governments in the Ventura County region should implement a set of policies, data specifications, and tools (such as APIs) that will allow local governments to obtain important mobility-as-a-service data in real time or at regular intervals throughout the day. The County and local governments

[257] LADOT. "Mobility Data Specification." Accessed June 17, 2019. More information available at: https://www.arcgis.com/apps/Cascade/index.html?appid=9b39f195da0e457c944ae4fc7333f32f

[258] GitHub. "City of Los Angeles/Mobility Data Specification". Access June 17, 2019. Available at: https://github.com/CityOfLosAngeles/mobility-data-specification

[259] Metropolitan Government of Nashville and Davidson County, Tennessee. "Second Substitute Bill BL2018-1202 (as amended)". August 29, 2018. Access June 17, 2019. https://www.nashville.gov/Metro-Clerk/Legislative/Ordinances/Details/7d2cf076-b12c-4645-a118-b530577c5ee8/2015-2019/BL2018-1202.aspx

should consider using the Los Angeles Department of Transportation's open source Mobility Data Specification given the important transportation linkages between Ventura County and the Los Angeles metropolitan region. Using the Los Angeles Mobility Data Specification will help ensure that data can be easily shared across jurisdictional boundaries.

Additional map-based data may be needed to manage curb space more effectively in the future. A traditional metered parking space typically serves just 15 vehicles per day, according to the National Association of City Transportation Officials, while curbside micromobility hubs can serve hundreds of people a day, and a bus stop can serve 1,000 passengers. Freeing up curb space for bikeshares and scooters will help provide a compelling alternative to jumping in a motor vehicle for short-haul trips. [260]

Local governments have detailed maps about land use but have little to no map-based data on curb uses. The emergence of transportation network companies, new micromobility services, and an increasingly multimodal transportation network is generating new demand for curb space from uses including but not limited to:

- Pickup and drop-off zones for ride-hailing services
- Goods delivery
- Vehicle stations for carshare
- Curbside electric vehicle charging stations
- Dockless bikes and scooters

These competing uses are creating a compelling need for new curb management approaches. Integrating curb use data into a map-based GIS interface can help facilitate future decision-making on curb uses. Several companies such as Coord, Sidewalk Labs, and Allvision, are offering digital tools to quickly collect curb data for GIS applications that could support future curb management. Moving forward, local governments in the Ventura County region should develop curb-use data and explore demand-based approaches to manage curb uses that will help create healthier, more "complete" streets, which will better accommodate emerging micromobility solutions as well as electric vehicles and TNCs.

Recommendations for Deploying Micromobility and First/Last Mile Solutions

- **Recommendation #1: Accelerate build out of safe biking and pedestrian infrastructure**, prioritizing infrastructure needed to improve safety and reduce conflicting uses of sidewalk right of ways.
- **Recommendation #2: Adopt a Vision Zero policy** that brings together transportation engineers, police, advocates, and policymakers to work together to create safer streets. Focus on policies, programs, and projects that will protect the region's most vulnerable road users, including children, older adults, pedestrians, and bicyclists.

[260] American Planning Association. "Curb Control." *Planning June 2019*. Access June 17, 2019. Available at: https://www.planning.org/planning/2019/jun/curbcontrol/

- **Recommendation #3: Include robust funding for new bike and pedestrian infrastructure in a future transportation sales tax** being considered by the VCTC.
- **Recommendation #4: Collaboratively develop a shared bike/e-bike/e-scooter program** using best practices for sustainability, safety, equity, and high utilization. Ensure that pilot projects help local agencies collect community input and improve programs before full scale launch.
- **Recommendation #5: Develop shared micromobility programs that enhance First Mile, Last Mile transit access** for Ventura County residents, and include micromobility depots at key transit locations.
- **Recommendation #6: Implement a set of data policies, specifications, and tools (such as APIs) that will allow local governments to obtain key mobility-as-a-service data** in real time or at regular intervals throughout the day.
- **Recommendation #7: The County of Ventura and local governments should engage the Los Angeles Department of Transportation** to explore use of their Mobility Data Specification to further strengthen transportation links between Ventura County and the Los Angeles metropolitan region.
- **Recommendation #8: Local governments should develop curb-use data and explore demand-based approaches for curb use management** that will help create safer, more "complete" streets and better accommodate emerging micromobility solutions, as well as electric vehicles and TNCs.

Chapter 9 References

Alta Planning+Design. "Ventura Countywide Bicycle Masterplan." *Prepared for Ventura County Transportation Commission,* October 2007. Accessed April 7th, 2019. http://pwaportal.ventura.org/TD/Residents/Streets_and_Transportation/Reports_and_Programs/AP_VenturaCountyBikePlanFinal2008.pdf

American Planning Association. "Curb Control." *Planning June 2019*. Access June 17, 2019. Available at: https://www.planning.org/planning/2019/jun/curbcontrol/

Behar, Jason. "The American e-bike Blog: How eco-friendly are electric bikes." Prodecotech. May 18, 2017. Retrieved April 12th, 2019 https://prodecotech.com/american-e-bike-blog-eco-electric-bikes/

Chester, Matt. "It's a Bird…It's a Lime…It's Dockless Scooters! But Can These Electric-Powered Mobility Options Be Considered Sustainable Using Life-Cycle Analysis?" *Chester Energy and Policy*. January 28, 2019. Accessed April 7th, 2019. http://chesterenergyandpolicy.com/2019/01/28/its-a-bird-its-a-lime-its-dockless-scooters-but-can-these-electric-powered-mobility-options-be-considered-sustainable-using-life-cycle-analysis/

Citron, Ryan. "E-bike Sales Climbing in Major European Markets, US Lags Behind." *Navigant Research*. June 26th, 2018. Accessed April 6th 2019. https://www.navigantresearch.com/news-and-views/e-bike-sales-climbing-in-major-european-markets-us-lags-behind

City of Santa Monica. "Scooter and Bike Share Services." Access June 17, 2019. Availabe at: https://www.smgov.net/Departments/PCD/Transportation/Shared-Mobility-Services/

City of Santa Monica. "Shared Mobility Device Pilot Program User Survey Results: 2019. Accessed June 17, 2019. https://www.smgov.net/uploadedFiles/Departments/PCD/Transportation/SharedMobility_UserSurveySummary_20190509_FINAL.PDF

ElectricBikeReport.com. "The State of the Electric Bike Market." September 19, 2016. Accessed April 5th, 2019. https://electricbikereport.com/the-state-of-the-electric-bicycle-market/

ElectricBikeReport.com. "The State of the Electric Bike Market." September 19, 2016. Accessed April 5th, 2019. https://electricbikereport.com/the-state-of-the-electric-bicycle-market/

Eli Electric Vehicles. Accessed April 12th, 2019 https://www.eli.world/vision

Fitzgerald-Rodriguez, Joe. "Scoot, Skip Fail to Deliver on Promises in First Electric scooter Accountability Report. *San Francisco Examiner.* February 2nd, 2019. Accessed April 12, 2019. https://www.sfexaminer.com/news/scoot-skip-fail-to-deliver-on-promises-in-first-electric scooter-accountability-report/

Furfaro, Daniel. "Good Luck Grabbing These Snazzy Citibikes." *New York Post*. November 25, 2018. Accessed April 7th, 2019. https://nypost.com/2018/11/25/good-luck-grabbing-these-snazzy-citi-bikes/

GitHub. "City of Los Angeles/Mobility Data Specification". Access June 17, 2019. Available at: https://github.com/CityOfLosAngeles/mobility-data-specification

Harris, Mike. "Bird Scooter Plan Grounded in Thousand Oaks; City Was First to Allow Electric Scooters." *Ventura County Star.* March 15th, 2019. Accessed April 6th, 2019. https://www.vcstar.com/story/news/local/communities/conejo-valley/2019/03/15/electric-scooters-not-coming-thousand-oaks-after-all/3173990002/

https://www.westsiderag.com/wp-content/uploads/2018/08/citibike-e-bike.jpg

LADOT. "Mobility Data Specification." Accessed June 17, 2019. More information available at: https://www.arcgis.com/apps/Cascade/index.html?appid=9b39f195da0e457c944ae4fc7333f32f

Malouff, Dan. "All 119 US Bikeshare Systems Ranked By Size." *Greater Washington.* January 26th, 2017. Accessed April 5th, 2019. https://ggwash.org/view/62137/all-119-us-bikeshare-systems-ranked-by-size

McKinsey and Company. "Micromobility's 15,000 Mile Check-up". January 2019. Accessed April 7 2019. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/micromobilitys-15000-mile-checkup

Metropolitan Government of Nashville and Davidson County, Tennessee. "Second Substitute Bill BL2018-1202 (as amended)". August 29, 2018. Access June 17, 2019. https://www.nashville.gov/Metro-Clerk/Legislative/Ordinances/Details/7d2cf076-b12c-4645-a118-b530577c5ee8/2015-2019/BL2018-1202.aspx

Motivate. Accessed April 7, 2019. https://www.motivateco.com/

Ojo Scooters. Retrieved from: https://www.ojoelectric.com/contact/

Peach Tree City, accessed April 12th, 2019 https://www.peachtree-city.org/216/Paths-Golf-Carts

Portland Bureau of Transportation. "2018 Electric scooter Pilot User Survey Results." 2018. Accessed April 7th, 2019. https://www.portlandoregon.gov/transportation/article/700916

Portland Bureau of Transportation. "2018 Electric scooter Pilot User Survey Results." 2018. Accessed April 12th, 2019. https://www.portlandoregon.gov/transportation/78431

Schieber, Jonathan, Inboard Technology raises $8 million to be the Tesla of electric skateboards. TechCrunch. November 11th, 2017. Accessed April 7th, 2019. Retrieved from: https://techcrunch.com/2017/11/16/inboard-technology-raises-8-million-to-be-the-tesla-of-electric-skateboards/

Scoot. Accessed April 12, 2019. https://scoot.co/san-francisco/faq/#main-76

Sisson, Patrick. "Why Electric Bikes Can Provide a Big Jolt to Bikeshare Systems. *Curbed.* June 28, 2018. Accessed April 6th, 2019. https://www.curbed.com/2018/6/28/17515758/electric-bike-share-cycling-city-transportation

Velorsurance, "E-Bikes Are Wooing Americans," accessed May, 2019, https://velosurance.com/information-center/ebikes-wooing-americans/

Vision Zero Network. "Vision Zero Cities Map." Accessed June 17, 2019. Available at: https://visionzeronetwork.org/resources/vision-zero-cities/

Wilson, Kathleen. “Ventura County Puts Funding Muscle Behind Bicycle and Pedestrian Paths.” *Ventura County Star.* November 11th, 2017. Accessed April 7th, 2019. https://www.vcstar.com/story/news/2017/11/09/ventura-county-puts-funding-muscle-behind-bicycle-and-pedestrian-paths/785511001/

Wiltz, Teresa. “How (and Why) Cities are Marketing Bikes to Poor People.” Governing.com. February 16th, 2018. Accessed April 12, 2019. https://www.governing.com/topics/urban/sl-bike-lane-equity-equality-income.html

Yacowicz, Will. “14 Months, 120 Cities, $2 Billion: There’s Never Been a Company Like Bird. Is the World Ready?” *Inc.* Winter 2018/2019. Accessed April 6th, 2019 https://www.inc.com/magazine/201902/will-yakowicz/bird-electric-scooter-travis-vanderzanden-2018-company-of-the-year.html

Ventura County Electric Vehicle Ready Blueprint

Chapter 10: Electric Vehicle Workforce Development

Introduction to Electric Vehicle-Related Workforce Development

This assessment of electric vehicle-related workforce issues will provide an overview of:

- Electric vehicle-related employment impacts and trends
- Workforce opportunities and needs
- EV-related training programs
- Key recommendations to enhance electric vehicle workforce development.

Growth in Electric Vehicle Related Employment Opportunities and Skill Requirements: With electric vehicle sales on a steep increase – along with charging infrastructure deployment – employment opportunities related to transportation electrification are growing rapidly. However, the new jobs available in the electric vehicle ecosystem will increasingly require more specialized skills. Manufacturers will be producing an increasing variety of electric vehicles and charging stations, while incorporating advanced new features such as ultra-fast charging; autonomous, shared, and connected vehicle operations; and new modes of e-mobility. Utilities will be integrating electric vehicles and charging stations into the grid in increasingly sophisticated ways. Infrastructure will need to be upgraded to accommodate a substantial increase in demand for electric vehicle charging. In summary, the entire electric vehicle supply chain – including manufacturing, service, and infrastructure – will be experiencing dramatic growth in both the numbers of workers needed and the skills required to support the transition to electric transportation.

EV-Related Employment Growth in the Ventura Area: Some electric vehicle related jobs – particularly in dealerships, service centers, and infrastructure – are widely distributed across all areas of California where electric vehicles are found. However, localized opportunities are also emerging in and around Ventura County. For example, transportation electrification at the Port of Hueneme and associated freight operations in the Ventura County region present a significant opportunity for electric vehicle-related employment and workforce development. The Port of Hueneme is already the fourth largest employer in the County and has spurred 13,633 direct, indirect, induced, and related jobs associated with goods movement. Port operations move an estimated $9 billion per year in goods and support $1.5 billion per year in regional economic activity. Port of Hueneme operations are also a significant source of tax revenue, providing an estimated $93 million in state and local taxes each year.

The Port is one of the largest importers of automobiles in California. It is estimated that the Port of Hueneme imports 300,000 cars annually, with an increasing number of electric vehicles. BMW imports cars into the Western U.S. exclusively with the Port of Hueneme, including a large volume of BMW's plug-in electric models. Growth of the electric vehicle market could also generate new employment opportunities related to OEMs with manufacturing currently based outside of the U.S., but which are looking to shift production into California.

On the engineering side of the electric vehicle industry, BMW is working with the California Energy Commission on smart charging software that will pool electrical power demand for their electric vehicles to targeted times when electricity has the lowest carbon intensity and can reduce renewables curtailment.

Regionally focused smart charging development at the BMW research center in Ventura County could provide additional employment opportunities.

The Naval Base Point Mugu in Ventura County is another major employer that may have an increased interest in smart charging, solar generation, and electric vehicles to support the resilience of their base operations. Increased adoption and use of EVs at Naval Base Point Mugu could provide additional electric vehicle-related workforce opportunities related to auto technicians, electricians, contractors, and smart charging network development. In 2017, the US Naval Facilities Engineering Command completed Phase 1 of an initiative to provide 205 battery electric vehicles and 92 charging station to ten Navy and Marine Corps installations across California. Overall, the 92 charging stations were constructed at a cost of $3.2 million to support the electric vehicle fleet. The 205 electric vehicles were also programmed to recharge during grid off peak hours, helping grid management.[261] These initiatives are expected to grow in future years as the Department of Defense continues to enhance its operational resilience and reduce its dependence on fossil fuels.

Larger fleet operators in the region, including the County of Ventura, could generate electric vehicle-related employment opportunities as more internal combustion engine vehicles are transitioned to electric vehicles. New electric vehicle-related employment opportunities will also expand as regional goods movement service providers and transit agencies bring more medium and heavy-duty E-Trucks and E-Buses into their operations, which will drive increased demand for electric vehicle infrastructure development and automotive technicians.

Additional jobs focused on electric vehicle-related research and manufacturing are particularly concentrated in the Los Angeles Basin and in the San Francisco Bay Area. For residents in Ventura County seeking research and manufacturing opportunities, it will be important to look across the Los Angeles Basin, and the state as a whole, to identify best-fit training programs and employment options. To aid in that effort, this chapter reviews all the relevant programs and curricula at Community Colleges, universities, and vocational training institutions. We conclude with recommended strategies whereby Ventura County workforce and educational institutions could expand and enhance their electric vehicle-related offerings.

Electric Vehicle Related Employment Impacts, Trends, and Workforce Opportunities and Needs

Electric Vehicle-related Occupational Categories: Careers related to transportation electrification span a broad assortment of occupational categories and industry segments. Electric vehicle related jobs are therefore difficult to track and forecast accurately, because the occupational categories that capture electric vehicle-related careers do not break out job types according to their association with electric vs. fossil-fueled transportation. Further, transportation electrification-related careers exist within several major industry groupings, including the automotive industry, electrical contracting, utilities, and related fields such as materials science, chemical engineering, electronics, software design, and more. According to a study of transportation electrification-related curricula and training programs conducted by the UCLA

---

[261] US Navy. Press Release: *NAVFAC Southwest Leads Department of Navy's Transition to Electric Vehicles*. May 24, 2017. Access on May 24, 2019. Available online at: https://www.navy.mil/submit/display.asp?story_id=100639

Luskin Center for Innovation, within the major industry groupings referenced above, there are a total of 48 occupational categories directly affected by transportation electrification. These occupations range from infrastructure installers, electricians, and assemblers to utility program managers and software engineers developing the next generation of autonomous systems and smart grid innovations.

Electric Vehicle-related Career Clusters and Opportunities: To assess electric vehicle related workforce opportunities, it is important to group individual occupational categories into broader career clusters. The UCLA Luskin Center developed this approach in a large-scale study of electric vehicle workforce issues published in 2016 with the co-sponsorship of Edison International. The Luskin researchers grouped the transportation electrification workforce into three broad segments:

- **Vehicle-Related Careers:** Electric vehicle design, manufacturing, sales, and service
- **Charging-Related Careers:** Charging infrastructure design, installation, sales, and service
- **Utility-Related Careers:** Transportation electrification related occupations within the utility sector, from distribution system planning and engineering, to customer program design and delivery.

Within the electric vehicle segment, the following career opportunities and activities were identified:

- Electric vehicle component design/engineering and manufacture, chiefly of batteries, electric motors, power electronics, and communications/control systems
- Electric vehicle powertrain design/engineering and integration
- Electric vehicle strategic planning, product planning, market research, and business development
- Electric vehicle marketing, sales, and finance
- Vehicle data collection and analysis
- Vehicle service and repair
- Electric vehicle component refurbishment
- Electric vehicle recycling and scrappage
- Goods movement including port related shipping and receiving as well as last mile delivery

Within the electric vehicle charging segment, career opportunities and job activities include:

- Component design/engineering and manufacture (including chargers and related networking)
- EVSE systems integration
- EVSE strategic planning, product planning, market research, and business development
- EVSE marketing, sales, and finance
- Charging-facility site design
- Electrical panel upgrades and wiring
- EVSE service and repair
- EVSE Network operation (control, aggregation, network management, billing)
- EVSE component refurbishment, recycling, and scrappage

Within the utility segment of transportation electrification, electric vehicle charging represents a new type of load with unique characteristics that must be accommodated with new kinds of metering, communications, and control technologies. Electric vehicles also represent a highly flexible distributed resource that can be modulated to help balance the grid and provide valuable services to both grid operators and utility customers. Given the impact of transportation electrification on the grid, utilities will be employing more electric vehicles specialists in coming years. Moreover, many existing functions, from field technicians to load planners, will be impacted by the transition to electrified transportation. Key transportation electrification-related occupations and activities in the utility industry include:

- Grid strategic planning and policy analysis
- Rate design
- Smart-grid technology market research and business development
- Smart-grid component design/engineering and manufacture (e.g., distributed energy resources management technologies)
- Smart-grid systems integration
- Smart-grid marketing, sales, distribution, and support
- Smart-grid technology installation, repair, and upgrades
- Site design
- Site construction
- Meter upgrades, wiring, and Distributed Energy Resources support-systems installation
- Smart-grid service and repair
- Smart-grid network operation and control, Distributed Energy Resources aggregation

Electric Vehicle Service Technician Skill Requirements and Wages: Electric vehicle service technician jobs will typically be occupied by individuals who have trained for broader motor vehicle service and repair careers, and in programs that mix traditional automotive technology training with hybrid and electric vehicle concepts and skills. The occupational database known as O*NET does not track information about electric vehicle maintenance and repair occupations separately from other automotive occupations. However, as in the case of EVSE-related work and electricians, we anticipate that the proportion of electric vehicle related work in dealerships and independent repair shops will increase in step with the very steep rate of growth in electric vehicle sales (over 50 percent per year in California.)

The median hourly wage for master mechanics in California is $19.46, (USDOL/ETA 2016). Like assembly jobs, automotive maintenance jobs are also considered middle-skill and increasingly require formal training. The integration of increasingly sophisticated information technologies and computer systems into vehicles will further expand the need for technical training of the automotive technicians. For employment at larger repair shops and auto dealerships, auto service workers must be certified by the National Institute for Automotive Service Excellence. Typically, it takes two to five years of experience to become a fully qualified automotive service technician through Automotive Service Excellence. Additionally, programs like the National Alternative Fuels Training Consortium train workers on a variety of incremental skills and knowledge needed to work on electric or alternative fuel vehicles.

Electric vehicle manufacturing skill requirements and wages: The Union of Concerned Scientists reports that many occupations in electric vehicle manufacturing are experiencing a shift away from mechanical skills and toward electrical skills and safety. This is true both at the general assembly level and at the component level. For example, OEMs are shifting from air brakes to electrical brakes. Therefore, conventional brake assemblers need to acquire wire-harnessing skills and electrical-safety training in order to make a successful shift to electrical components. This also requires that entry-level workers require increased electrical skills to be considered for even assembler-level positions. Industry representatives also report that "assembler" is the occupation likely to grow the most with increased deployment of E-Trucks and E-Buses. Other occupations associated with heavy-duty electric vehicle manufacturing include helpers, testers, and welders.

Electric vehicle manufacturing opportunities are expanding rapidly. The Tesla factory in Fremont (Alameda County) employs over 4,000 workers. The BYD factory in Lancaster (Los Angeles County), employs over 1,000 workers building both electric buses and trucks. The Proterra factory in City of Industry employs over 100 assembly workers, producing 400 E-Buses per year from a $20-million-dollar, 100,000-square-foot facility. Most electric vehicle manufacturing jobs are considered middle-skill, requiring more than a high school diploma but less than a bachelor's degree. Unlike conventional manufacturing, heavy-duty electric vehicle production increasingly uses high-voltage electricity, requiring electrical safety and hazard training to prevent injury. General manufacturing jobs require anywhere from a few months (e.g., assemblers and testers) to two years of training (e.g., welders and machinists). While there are few if any apprenticeship programs that lead directly to electric vehicle manufacturing careers, there are many community colleges and other job-training organizations with established vocational programs in transportation electrification; these programs can provide pathways to electric vehicle careers. Curriculum lists of local programs can be found later in this chapter.

Entry-level manufacturing jobs in California typically pay more than the state's minimum wage. For example, median hourly wages for lower-skilled jobs (e.g., helpers, assemblers, painters, testers/inspectors) range from $10.96 per hour to $17.64 per hour (U.S. Department of Labor/Employment Training Administration 2016). Higher-skilled manufacturing jobs have higher average wages— for example, $17.70 for computer-controlled machine tool operators, $18.44 for welders, and $18.77 for machinists (USDOL/ETA 2016). At some companies, assemblers and other manufacturing employees may also receive benefits, stock options, and a 401(k) with company match.

Electric vehicle charging infrastructure skill requirements and wages: The installation of electric vehicle-charging infrastructure has several stages that include civil engineering and construction work, electrical work, and electric vehicle site design and operational planning, which may include helping site hosts define prices, parking policies, and business models for charging services. Electric Vehicle Service Providers and site hosts typically retain general contractors to undertake basic site design and permitting, which includes drawing the electrical panel and submitting the design to the permitting authority. Once a project is permitted, civil workers break the ground and then electrical workers lay down the wires. The utility and the permitting authority inspect this work. Once the utility and permitting authorities approve the work, the civil workers cover up the site and electrical workers place the charging station equipment on the circuits. Finally, the utility inspects the installation and turns on the power. The civil work includes concrete and asphalt trenching and other tasks to prepare the site for the electricians to complete the wiring. The electrical work consists of tasks like laying the electrical wires and installing the charging station. Typically, general contractors with electrical specialization work with subcontracted civil workers to design electrical panels for the charging infrastructure. The installation of electric vehicle charging stations is usually done by electricians and contractors that have a large variety of other electrical work.

Many companies that install solar in the Ventura County region also have a special focus on installing electric vehicle charging stations. For this reason, integrating training for electric vehicle charging station installations into the region's training programs for solar installers could be an effective pathway to advance job opportunities and workforce development for electric vehicle infrastructure development.

Electricians earn a median wage of $29.52 per hour (U.S. DOL/ETA 2016j), although regional variations are large and electricians in higher-cost regions of the state may earn wages of $60 per hour or more, depending on seniority. Electrical power-line installers and repairers earn $49.23 per hour (U.S. DOL/ETA 2016k). Typically, electrical power-line installers and repairers must have a high school diploma or equivalent as well as basic math and reading skills. Generally, they receive one to five years of on-the-job training. Training regularly emphasizes safety because of the danger involved in working with high-voltage electricity. To become an EVSE installer and repairer, technical knowledge of electricity is helpful but not required.

Generally, electricians need a high school diploma or equivalent and must participate in an apprenticeship that lasts at least three years (see www.ucsusa.org/ElectricTrucks for more information on apprentice programs.) The International Brotherhood of Electrical Workers is a prime source of apprenticeship training and career pathways to union positions. Apprenticeships typically include both formal classroom training and on-the-job training. In addition, California, like most states and localities, requires electricians to be licensed, with the licensure examination covering building codes, the National Electric Code, and electrical theory.

Projected overall job growth in light duty electric vehicle-related careers: To date, the most authoritative national study on electric vehicle workforce trends was issued by the U.S. Bureau of Labor Statistics and published in the 2012 issue of the Occupational Outlook Quarterly. This study projected that when electric vehicles make up 64 percent of sales of all light duty vehicles – potentially as early as 2030 -- the electric vehicle industry will drive a net employment gain of 130,000 to 350,000 U.S. jobs. Ventura County is home to .26 percent of the US population. Thus, a crude measure of net job growth attributable to light-duty electric vehicles in the County would be 339 - 910 jobs. Actual jobs may be on the low side of this range as Ventura County does not have a major auto manufacturing facility. However, many of the relevant electric vehicle-related jobs will be in electric vehicle sales, service, in the installation and maintenance of electric vehicle charging stations, and in utility-related occupations.

Projected Job Growth in the Medium and Heavy-Duty Vehicle Segment: In the first decade of the modern electric vehicle era (from 2009 - 2019) California's electric vehicle-related workforce has primarily been impacted by the introduction of light duty electric vehicles, which now number approximately 550,000 in California (as of mid-2019), roughly split between plug-in hybrids and battery electric vehicles. There are a very small number of E-Trucks and E-Buses on the road, by comparison (less than 3,000 statewide.) However, both the number and variety of light and heavy-duty electric vehicles are anticipated to grow rapidly, and with this growth, there will be a far greater need for workers with electric vehicle-related knowledge and skills. Because of the mixing of electric vehicle and internal combustion engine-focused jobs in the automotive sector, specific state-level job growth projections for E-Trucks and E-Buses would require a comprehensive survey of employers, which is outside the scope of this report. However, from assessing the current policy environment and market attributes, it is clear that electric trucks and buses are poised for strong growth, with California manufacturers in the vanguard. Give the scale of goods movement from the Port of Hueneme in Ventura County, growth in the E-Truck and E-Bus market segments is likely to generate the most significant sources for electric vehicle-related employment opportunities and workforce development for the region.

To define the employment opportunities unique to the medium- and heavy-duty electric vehicle sectors, a 2016 study by the Union of Concerned Scientists and the Greenlining Institute provides useful data. The report is titled: *Delivering Opportunity: How Electric Buses and Trucks Can Create Jobs and Improve Public Health in California.* According to the report, as of 2019, a total of 15 manufacturers of electric trucks and buses are based in California -- and that number is growing rapidly. Moreover, the state of California has instituted a wide range of policies and programs that will significantly increase the adoption of E-Trucks and E-Buses, and spur related employment growth in manufacturing, sales, and service roles.[262] These initiatives include the following:

- In 2014, SB 1204 created the California Clean Truck, Bus, and Off-Road Vehicle and Equipment Technology Program to fund electric and other clean truck, bus, and off-road vehicle and equipment technologies.
- In 2015, Governor Brown's Executive Order B-32-15 directed California to develop the *California Sustainable Freight Action Plan,* a multiagency effort completed in 2016. This plan committed the state to deploying 100,000 freight vehicles and equipment capable of zero emission operation by 2030 (CSFAP 2016).
- In 2015, SB 350 was enacted into law. Known as the Clean Energy and Pollution Reduction Act, SB 350 required electric utilities in California to "improve the environment and to encourage the diversity of energy resources through improvements in energy efficiency, development of renewable energy resources, and widespread transportation electrification". SB 350 and follow-on efforts by utilities have injected nearly $1 billion into transportation electrification projects around the state.
- Beginning in 2016, CARB began refreshing the Advanced Clean Transit Rule (a fleet rule for transit agencies), with the goal of transforming the statewide fleet of transit buses by 2040 by requiring renewable fuels and the cleanest available engines, with the goal of phasing in purchases of zero-emission buses for transit agencies (CARB 2016b).
- The California Energy Commission's most recent Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program is allocating substantial funding to medium- and heavy-duty vehicle technology demonstration projects to scale up deployment.

[262] For more information on the specific occupations most relevant to this sector of the electric transportation field, see www.ucsusa.org/ElectricTrucks

Currently, there are no major electric vehicle manufacturers located in Ventura County. However, it is anticipated that growth in Los Angeles County electric vehicle manufacturing is likely to be significant, given the existing and planned growth of the BYD facility in Lancaster, the Proterra facility in Los Angeles, and the expected location of the Chanje manufacturing facility in metro Los Angeles, among other expected electric vehicle manufacturing facilities.

Projected growth in jobs related to electric vehicle charging infrastructure: A modest source of electric vehicle-related jobs will be in electric vehicle infrastructure installation, maintenance, and repair. While there are no formal occupational categories related exclusively to electric vehicle infrastructure, electricians are one of the most strongly impacted occupational categories, as electricians are involved in the load studies, service upgrades, and other site preparation and installation activities related to charging. Electrician jobs in California are expected to grow by 22 percent through 2022 (according to U.S. Department of Labor projections). The proportion of work that consists of EVSE installations should increase by a greater percentage, given year over year growth of more than 50 percent in electric vehicle and EVSE deployment in California.

A regionalized assessment of electric vehicle infrastructure job opportunities can be deduced from growth in charging installations. The state goals for electric vehicle adoption in Ventura County call for an electric vehicle population of 108,000 by 2030. Most of these vehicles will be charged at home, with some charged at workplaces and other commercial charging sites. If a total of approximately 108,000 Level 1 and Level 2 chargers are installed to serve these vehicles, and these take an average of four hours to install (current industry estimates), these installations will require a total of 432,000 hours or 216 person-years of employment. Public charging stations and DC Fast Charge deployments will require additional engineering and contracting work. According to the EVI-Pro Analysis from the National Renewable Energy Laboratory (NREL) and the California Energy Commission, Ventura County will need up to 3,409 new public Level 2 charging ports and up to 209 new DC Fast Charge ports installed between 2019 and 2025 to support state goals for electric vehicle adoption. Public Level 2 charging stations and DC Fast Charge stations require more time and labor to install than residential stations. Using an estimate of 12 hours of work to install one Level 2 or DC Fast Charge port, there would be up to 43,416 additional work hours or just under five person-years of employment to install public charging infrastructure in the region. Note that the estimated five person-years of employment is extremely conservative, as it does not include additional work needed to conduct electrical site assessments, coordinate permitting, update utility electrical infrastructure, and maintain charging infrastructure.

Job growth for electric vehicle maintenance technicians: Automotive maintenance and repair jobs are expected to grow 15 percent in California through 2022, significantly higher than the projected 5 percent growth for these jobs nationwide, according to projections from the Department of Labor (USDOL/ETA 2016). As in other electric vehicle-related job categories, however, electric vehicle technicians are not tracked separately from internal combustion engine auto technicians. Moreover, electric vehicles require less maintenance and repair than do conventional vehicles, so some of the growth in automotive service-related work will be mitigated by the reduced hours of maintenance that may be required per vehicle. For example, certain high-volume services required for internal combustion engine vehicles are not applicable to battery electric vehicles (though they are for plug-in hybrid electric vehicles, at a less frequent rate) – such as oil changes, spark-plug replacements, exhaust system services, and frequent engine tune-ups.

Despite this difference, growth in the total quantity and proportion of electric vehicle-related work compared to internal combustion engines will remain substantial given the “hockey stick” trend in electric vehicle adoption in California.

Within just the Ventura/Oxnard area, there are over 500 automotive repair facilities. According to the California Employment Development Department, 100 new technicians per year are needed in Ventura County. With the growth of electric vehicle sales, these technicians will increasingly be working on fully electric and plug-in electric models. Workforce development for electric vehicle maintenance should emphasize technical skills related to information technology systems and computer science, since all automobiles (electric vehicle and non-electric vehicle) are integrating increasingly sophisticated digital technologies that will may require maintenance over time.

Electric Vehicle-Related Education and Training Programs in California

California’s electric vehicle job seekers are fortunate that there are many electric vehicle-relevant workforce training and educational opportunities located in many of the state’s 105 Community Colleges, as well as relevant courses and programs at multiple campuses of the University of California and California State University systems. In addition, free-standing courses, certificate programs, and apprenticeships are available in other workforce training institutions, including the nationwide Electric Vehicle Infrastructure Training Program, and programs of the International Brotherhood of Electrical Workers.

The recent UCLA Luskin Center Electric Vehicle workforce report evaluated a total of 205 state and national educational offerings for their relevance to transportation electrification. Given the regional focus of the Ventura County Blueprint, we have chosen to list just the relevant programs and courses offered in California. In addition, we provide brief profiles of relevant programs located in the Ventura County area. Overall, the relevant courses and training programs are divided into the following key categories:

I. Community College and Technical School Programs
II. Centers, Institutes, and Departments with Transportation Electrification-Specific Offerings
III. Transportation Electrification-Specific Degree Programs
IV. Transportation Electrification-Specific Workshops and Short Courses
V. Transportation Electrification-Specific Certificate Programs
VI. Transportation Electrification-Related Courses by Organization
VII. Student Electric Vehicle Clubs and Teams

For the most part, issues related to transportation electrification are addressed as new topics within existing courses – in automotive technology or energy management programs, for example – rather than in new standalone courses and programs. However, there are a few certificate programs focused on hybrid and electric vehicle technologies, and these are listed below. In addition, student-driven electric vehicles clubs and teams can provide highly relevant skills and experiences that are taken seriously by employers. Many of the “Defense Advanced Research Projects Agency Challenge” teams that pioneered autonomous vehicle technologies were staffed by both undergraduate and graduate students, who have gone on to careers in Autonomous Vehicle technology development. Likewise, the solar-powered electric vehicle racer programs in colleges (and some high schools) have jump-started careers in electric vehicle technologies.

Electric Vehicle-Related Community College and Technical School Programs

Cerritos College ▪ Advanced Transportation Technology & Energy Center ▪ Automotive Technology	**City College of San Francisco** ▪ Automotive/Motorcycle, Construction, and Building Maintenance
Cypress College ▪ Advanced Transportation Technology Center ▪ Automotive Technology	**El Camino College** ▪ NAFTC National and Associate Training Center
Fresno City College ▪ Applied Technology ▪ NAFTC National and Associate Training Center	**Glendale Community College** ▪ Industrial Technology
J. Sargeant Reynolds Community College ▪ School of Business	**Long Beach City College** ▪ Advanced Transportation Technology & Energy Center
Los Angeles Trade-Technical College ▪ Diesel, Alternative Fuel and Hybrid Vehicle Technologies Department	**Modesto Junior College** ▪ Automotive Technology NAFTC National and Associate Training Center
Rio Hondo College ▪ Automotive Technology ▪ NAFTC National and Associate Training Center	**Pierce College** ▪ Industrial Technology
Yuba College ▪ Automotive Technology ▪ NAFTC National and Associate Training Center	

University Centers and Departments with Electric Vehicle-Related Offerings

California Institute of Technology ▪ Electrical Engineering/Mechanical Engineering	**University of California, Davis** ▪ College of Engineering ▪ Communications Research in Signal Processing ▪ National Sustainable Transportation Center ▪ Plug-In Hybrid & Electric Vehicle Research Center ▪ Policy Institute for Energy, Environment and the Economy ▪ Sustainable Transportation Energy Pathways

University of California, Irvine ▪ Advanced Power and Energy Program ▪ Mechanical and Aerospace Engineering ▪ The National Fuel Cell Research Center	**University of California, Los Angeles** ▪ Chemical and Biomolecular Engineering ▪ Luskin Center for Innovation ▪ Luskin School of Public Affairs ▪ Mechanical and Aerospace Engineering ▪ Smart Grid Energy Research Center
University of California, Riverside ▪ Chemical Engineering ▪ Electrical Engineering	**University of California, San Diego** ▪ Nano Engineering
University of California, Santa Barbara ▪ Electrical Computer Engineering	**University of Southern California** ▪ Electrical Engineering ▪ USC SmartGrid
California Polytechnic State University, San Luis Obispo ▪ Electrical Engineering ▪ Mechanical Engineering	**California State Polytechnic University, Pomona** ▪ Electrical and Computer Engineering
California State University, Long Beach ▪ Chemical Engineering ▪ Electrical Engineering	**California State University, Los Angeles** ▪ Department of Technology
California State University, Northridge ▪ Electrical and Computer Engineering	**California State University, Sacramento** ▪ California Smart Grid Center ▪ University Enterprises, Inc.
Loyola Marymount University ▪ Mechanical Engineering	**San Diego State University** ▪ Electrical Engineering

10.2.3. Electric Vehicle Related Degree Programs

Long Beach City College ▪ A.S. with a major in Alternative Transportation Technology – Alternate Fuels ▪ A.S. with a major in Alternative Transportation Technology – Electric Vehicles	**Rio Hondo College** ▪ Alternative Fuels Technician A.S.
University of California, Davis ▪ Transportation Technology and Policy (M.S. and Ph.D.)	

Electric Vehicle Related Workshops and Short Courses

El Camino College ▪ Alternative Fuel First Responder Training	**Glendale Community College** ▪ Developing and Enhancing Workforce Training Programs

10.2.5. Electric Vehicle Related Certificate Programs

Cerritos College ▪ Alternative Fuels Service Technician ▪ Electric Vehicle Infra Training Program (EVITP) certification	**City College of San Francisco** Automotive Alternative Fuel Technology
Clean Tech Institute ▪ Certified Electric Vehicle Technician Training Program	**College of the Desert** ▪ Automotive Alternate Fuels
Long Beach City College ▪ Certificate: Alternative Transportation Technology – Alternate Fuels ▪ Certificate: Alternative Transportation Technology – Electric Vehicles	**Los Angeles Trade-Technical College** ▪ Hybrid & Electric Plug-In Vehicle Technology
Pierce College ▪ Automotive Advanced Level Hybrid Diagnostic Technician ▪ Automotive Alternative Diagnostic Technician ▪ Automotive Basic Hybrid Service Technician	**Rio Hondo College** ▪ Alternative Fuels Technician

Electric Vehicle-Related Courses by Organization

California Institute of Technology ▪ Introduction to Mechatronics (EE/ME 7)	**California Polytechnic State University, San Luis Obispo** ▪ Advanced and Hybrid Vehicle Design (ME 446) ▪ Alternative Energy Vehicles (EE434) ▪ Alternative Energy Vehicles (EE 434) ▪ Sustainable Electric Energy Conversion (EE420)
California State Polytechnic University, Pomona ▪ Power Electronics (ECE 469)	**California State University, Long Beach** ▪ Electric Vehicles (451) ▪ Electronic Control of Motors (450) ▪ Green Engineering I: Alternative Energy (533/433)
California State University, Los Angeles ▪ Electric, Hybrid and Alternative Fueled Vehicles (TECH 470)	**California State University, Northridge** ▪ Electric Power Systems (ECE 411) ▪ Electrical Machines and Energy Conversion and Lab (ECE 410/L) ▪ Power Electronics (ECE412)
California State University, Sacramento ▪ University Enterprises, Inc. Developing and Enhancing Workforce Training Programs	**Cerritos College** ▪ Advanced Electrical Systems (AUTO 260) ▪ Advanced Technology Electric Vehicles (AUTO 55) ▪ Alternative and Renewable Maintenance Training ▪ Automotive Electricity (AUTO 160) ▪ Automotive Electricity (AUTO 161) Intro to Electric Vehicle (AUTO 54)

City College of San Francisco ▪ Alternative Fuel Vehicles (AUTO 57) ▪ Automotive Electrical (AUTO 51)	**College of the Desert** ▪ Auto Electronics & Electrical Systems (AUTO 11B) ▪ Hybrid, Fuel-Cell & Electric Technology (AUTO 43A) Intro to Alternative Fuel Vehicles (AUTO 45A)
Cypress College ▪ Intro to Electric/Hybrid Vehicles (AT 181C)	**Fresno City College** ▪ Advanced Clean Air Car Course (AUTOT 161B) Basic Clean Air Car Course (AUTOT 161A)
Glendale Community College ▪ Advanced Metering Technology (ITECH 156)	**Long Beach City College** ▪ Advanced Hybrid Diagnosis & Repair (ATT 483) ▪ Advanced Hybrid Fuel Cell & Electric Vehicles ▪ Alternative Fuels Conversion, Diagnosis & Repair (AMECH 493)
Los Angeles Trade-Technical College ▪ Advanced Hybrid and Plug-in Electric Vehicles (DIESLTK 303) ▪ Hybrid and Plug-in Electric Vehicle (DIESLTK 302) ▪ Introduction to Alternative Fuel & Hybrid Vehicle Technology (DIESLTK 301)	**Loyola Marymount University** ▪ Alternative Energy Systems (MECH521)
Modesto Junior College ▪ Automotive Electricity (AUTEC368) ▪ Automotive Electricity (AUTEC369) ▪ Introduction to Alternative Fuels (AUTEC 211)	**NADA University** ▪ Alternative Fuels 101
Pierce College ▪ Hybrid Service and Safety (AST 55)	**Rio Hondo College** ▪ Advanced Hybrid/Electric Vehicle (AUTO 260) ▪ Introduction to Hybrid and Electric Vehicle Technology (AUTO 147)
San Diego State University ▪ Power Electronics (EE484)	**University of California, Irvine** ▪ Engineering Electrochemistry: Fundamentals and Applications (ENGRMAE 212)

University of California, Los Angeles ▪ Design and Analysis of Smart Grids (MECH&AE C137/237) ▪ Electrochemical Engineering (217) ▪ Electrochemical Processes and Corrosion (C114) ▪ Electrochemical Processes and Corrosion (C214) ▪ Special Topics in Chemical and Bimolecular Engineering (290) ▪ Special Topics in Public Policy: Electric-Drive Vehicles: Technologies and Policies (PUB PLC290-1) ▪ Special Topics in Public Policy: Public Policies for Alt. Fuel Vehicles and Infrastructure (PUB PLC290-1)	**University of California, Riverside** ▪ Electrochemical Engineering (CHE131) ▪ Power Electronics (EE123) ▪ Special Topics in Materials Electrochemistry (CEE 259)
University of California, San Diego ▪ Advanced Micro- and Nano- Materials for Energy Storage and Conversion (NANO 164)	**University of California, Santa Barbara** ▪ Introduction to Power Electronics (ECE142)
University of Southern California ▪ Electromechanics (EE 370) ▪ Net-Centric Power-System Control (EE 527) ▪ Power Electronics (EE528)	**California Institute of Technology** ▪ Introduction to Mechatronics (EE/ME 7)
California Polytechnic State University, San Luis Obispo ▪ Advanced and Hybrid Vehicle Design (ME 446) ▪ Alternative Energy Vehicles (EE434) ▪ Alternative Energy Vehicles (EE 434) ▪ Sustainable Electric Energy Conversion (EE420)	**California State Polytechnic University, Pomona** ▪ Power Electronics (ECE 469)
California State University, Long Beach ▪ Electric Vehicles (451) ▪ Electronic Control of Motors (450) ▪ Green Engineering I: Alternative Energy (533/433)	**California State University, Los Angeles** ▪ Electric, Hybrid and Alternative Fueled Vehicles (TECH 470)
California State University, Northridge ▪ Electric Power Systems (ECE 411) ▪ Electrical Machines and Energy Conversion and Lab (ECE 410/L) ▪ Power Electronics (ECE412)	**Cerritos College** ▪ Advanced Electrical Systems (AUTO 260) ▪ Advanced Technology Electric Vehicles (AUTO 55) ▪ Alternative and Renewable Maintenance Training ▪ Automotive Electricity (AUTO 160) ▪ Automotive Electricity (AUTO 161) ▪ Intro to Electric Vehicle (AUTO 54)

City College of San Francisco ▪ Alternative Fuel Vehicles (AUTO 57) ▪ Automotive Electrical (AUTO 51)	**Fresno City College** ▪ Advanced Clean Air Car Course (AUTOT 161B) ▪ Basic Clean Air Car Course (AUTOT 161A)
Glendale Community College ▪ Advanced Metering Technology (ITECH 156)	**Long Beach City College** ▪ Advanced Hybrid Diagnosis & Repair (ATT 483) ▪ Advanced Hybrid Fuel Cell & Electric Vehicles (ATT 481) ▪ Alternative Fuels Conversion, Diagnosis & Repair (AMECH 493)
Los Angeles Trade-Technical College ▪ Advanced Hybrid and Plug-in Electric Vehicles (DIESLTK 303) ▪ Hybrid and Plug-in Electric Vehicle (DIESLTK 302) ▪ Introduction to Alternative Fuel & Hybrid Vehicle Technology (DIESLTK 301)	**Loyola Marymount University** ▪ Alternative Energy Systems (MECH521)
Modesto Junior College ▪ Automotive Electricity (AUTEC368) ▪ Automotive Electricity (AUTEC369) ▪ Introduction to Alternative Fuels (AUTEC 211)	**NADA University** ▪ Alternative Fuels 101
Pierce College ▪ Hybrid Service and Safety (AST 55)	**Rio Hondo College** ▪ Advanced Hybrid/Electric Vehicle (AUTO 260) Introduction to Hybrid and Electric Vehicle Technology (AUTO 147)
San Diego State University ▪ Power Electronics (EE484)	**University of California, Irvine** Engineering Electrochemistry: Fundamentals and Applications (ENGRMAE 212)
University of California, Los Angeles ▪ Design and Analysis of Smart Grids (MECH&AE C137/237) ▪ Electrochemical Engineering (217) ▪ Electrochemical Processes and Corrosion (C114) ▪ Electrochemical Processes and Corrosion (C214) ▪ Special Topics in Chemical and Bimolecular Engineering (290) ▪ Special Topics in Public Policy: Electric-Drive Vehicles: Technologies and Policies (PUB PLC290-1) ▪ Special Topics in Public Policy: Public Policies for Alt. Fuel Vehicles and Infrastructure. (PUB PLC290- 1)	**University of California, Riverside** ▪ Electrochemical Engineering (CHE131) ▪ Power Electronics (EE123) ▪ Special Topics in Materials Electrochemistry (CEE 259)

University of California, San Diego ▪ Advanced Micro- and Nano- Materials for Energy Storage and Conversion (NANO 164)	**University of California, Santa Barbara** ▪ Introduction to Power Electronics (ECE142)
University of Southern California: ▪ Electromechanics (EE 370) ▪ Net-Centric Power-System Control (EE 527) ▪ Power Electronics (EE528)	**Yuba College** ▪ Engine Diagnosis and Rebuilding (AUTO 45)

Student Electric Vehicle Clubs and Teams

California Institute of Technology ▪ Caltech Electric Vehicle Club	**California Polytechnic State University, San Luis Obispo** ▪ Electric Vehicle Engineering Club ▪ Hybrid Vehicle Development Team
Loyola Marymount University ▪ Eco Vehicle Project	

The Electric Vehicle Infrastructure Training Program (EVITP)

In addition to the course offerings and programs described in the statewide listing above, industry stakeholders have recognized the need for a nationally standardized training and certificate program in electric vehicle Infrastructure. In response to the demand for qualified individuals skilled in the installation and maintenance of EVSE infrastructure, a broad-based industry association was formed to develop and deploy the Electric Vehicle Infrastructure Training Program (EVITP). The EVITP is a non-profit national training and certification program that trains licensed or certified electricians on the specialized requirements of EVSE installation and maintenance. The EVITP offers a course of 24 to 30 hours, which includes modules relevant to both commercial and residential EVSE including: load requirements; codes, regulations and standards; renewable energy; technical charging applications; electric vehicles; and field installation practices.

In addition to numerous utilities outside California, the EVITP partners include these national and in-state partner organizations:

- General Motors
- SPX (EVSE Manufacturer; Program Manager)
- BMW North America
- AeroVironment, Inc. (EVSE Manufacturer; Nissan Partner)
- ChargePoint
- Pacific Gas & Electric
- General Electric
- The National Fire Protection Association
- The International Association of Electrical Inspectors
- Schneider Electric
- PEP Stations (EVSE Manufacturer)

- ClipperCreek (EVSE Manufacturer)
- Exergonix (Battery Storage)
- University of California-Davis, PHEV Research Center
- SCE
- EATON Corporation (EVSE Manufacturer)
- The National Electrical Contractors Association
- Hubbell (EVSE Manufacturer)
- Leviton (EVSE Manufacturer)
- Legrand/Pass & Seymour (EVSE Manufacturer)
- The National Joint Apprenticeship Training Committee
- Milbank Manufacturing (EVSE Manufacturer)
- California Community Colleges, Advanced Transportation Technology and Energy Program Network

EVITP courses are intended for licensed electricians with the core training curriculum described below being supplemented with local requirements where applicable. Upon completing written and hands-on lab testing, participants passing the course receive a formal Electric Vehicle Infrastructure Certification through EVITP.

EV Infrastructure Training Program Course Overview: The EVITP training includes the following elements:

- Electric vehicle prospect/customer relations and experience
- Automobile manufacturer's charging performance integrity specifications
- Electric vehicle battery types, specifications, and charging characteristics
- Utility interconnect policies and requirements
- Utility grid stress precautions including demand response integration technologies
- Role of electrical storage devices as charging intermediaries
- Installing, commissioning, and maintaining electric storage devices
- Charging station fundamentals including brand/model-specific installation instructions for:
    - Level 1: 120 VAC 15 amps
    - Level 2: 120-240 VAC 60 amps
    - Level 3: 480 VAC 125 amps or 600 VDC 550 amps
- Service-level assessments and upgrade implementation
- Integration of electric vehicle infrastructure with distributed generation
- Understanding Internet Protocol networking of charging stations
- National Electrical Code standards and requirements
- National Fire Protection Association 70E and OSHA regulations
- National Electrical Installation Standards for electric vehicle equipment
- First responder safety and fire hazard measures
- Next Generation Charging
- EVSE Troubleshooting, Repair and Commissioning
- Facility Based Energy Storage

To date, the EVITP program has certified over 3,000 electricians. A list of California contractors that have EVITP certified electricians on staff is available at: https://evitp.org/california.

Ventura County Electric Vehicle-related Employers: Ventura County has a small number of electric vehicle-related employers, some of which were introduced earlier in this report. These include the BMW Group's Engineering and Emission Test Center in Oxnard; the Volkswagen Research and Development Center in Oxnard; and Haas Automation, a machine toolmaker that supplies NASCAR teams as well as mainstream auto OEMs. Ventura is also a hub for auto dealers as many OEMs with no dealerships in Santa Barbara County serve clients to the north. Volkswagen, Kia, Hyundai, and Mitsubishi all have Ventura County dealerships but none in the Santa Barbara area. Finally, the Port of Hueneme is engaged in the importation of thousands of electric vehicles every year and will also be driving the progressive electrification of Port equipment and vehicles.

- **The BMW Group Engineering and Emission Test Centre** has been based in Oxnard since February 2000. Located on an 11-acre site, this 78,000 square foot single story building includes engineering offices, 34 workspaces for vehicle testing as well as a state-of-the-art emission laboratory. The center houses engineering and research professionals who will test cars and design new emissions-control systems and devices for BMWs and Land Rovers. It is the company's largest engineering hub in the state and one of the largest in the nation. The BMW engineering center is one of three California-based BMW centers. BMW executives cited Oxnard's competitive land prices, high standard of living, skilled labor pool and proximity to Los Angeles and a deep-water port as key elements in the City's favor. For several years, the Oxnard BMW Group operated a fleet of Hydrogen vehicles, Electric Mini, and Active E-vehicles for testing and demonstration purposes. Today, the Engineering and Emission Test Centre is working on cutting-edge future vehicle concepts as well as electrical and hybrid propulsion systems. [263]
- **Volkswagen Research & Development Center:** Also in Oxnard, Volkswagen operates a 64,000-square-foot development and emissions lab called Test Center California. At this facility, 50 permanent engineers and instructors work on government compliance, powertrain, parts analysis, dealer service and training, and emissions and quality testing. In addition, more than 250 Volkswagen Group engineers and partners make the trip to Oxnard each year to conduct a variety of testing projects related to advanced electric powertrains and other Volkswagen projects. [264]
- **Haas Automation** designs and manufactures precision machine tools and specialized accessory tooling, especially computer numerically controlled machining tools. Most of its production and manufacturing process occurs at the company's main facility in Oxnard. Haas is one of the largest machine tool builders in the world by total unit volume – with its tools used by NASCAR Racing Teams and other OEM and aftermarket automotive industries. As OEMs focus increasingly on

[263] BMW Group. Oxnard. Retrieved from: https://www.bmwgroup.jobs/us/en/location/location-oxnard.html#location=US/Oxnard
[264]Gal Pin Volkswagen. VW new California R&D Center. Retrieved from: https://www.galpinvolkswagen.com/newsroom-vw-new-california-r-d-center/

electric vehicle production, Haas Automotive will be increasingly connected directly to the electric vehicle industry. [265]

- **Port of Hueneme:** The Port of Hueneme is indirectly linked to the electric vehicle industry through its role in importing more than 270,000 autos and 49,000 medium and-heavy duty vehicles, including electric vehicles. Relevant OEMs importing through the Port include BMW, Mini Cooper, Rolls Royce, Volvo, Land Rover, Jaguar, Maserati, Ford, Hyundai, Kia, Aston Martin, Mitsubishi, General Motors, Honda, Acura, Toyota, Nissan, Tesla, Subaru. Auto imports represent 60 percent of the Port's operating income. [266]

Ventura County Area Electric Vehicle-Related Workforce Programs & Opportunities

Ventura County has electric vehicle-related programs at its three community colleges, California State University, Channel Islands, and at Ventura County's IBEW Local 952. There are also notable electric vehicle-related courses at four nearby institutions, including Los Angeles Trade-Technical College, Rio Honda College, Long Beach City College, and Pierce College. Local Community College auto instructors interviewed for the Blueprint Report indicated that local dealers have asked for more electric vehicle-related training for their mechanics. The profiles below highlight the specific electric vehicle-related courses and training opportunities.

- **Oxnard College:** Oxnard College recently launched an alternative fuels training program (in January 2019) and are providing students with opportunities to engage hands-on work with hybrids and electric vehicles. Courses in automotive electrical systems offer opportunities to diagnose, adjust, maintain and repair automotive battery, starting, charging, chassis electrical and electronic systems. For more information on the Oxnard College automotive technology curriculum, including electric vehicle coursework, see https://www.oxnardcollege.edu/node/3008.
- **Ventura College:** Ventura College provides a full suite of automotive technology courses. In addition, the College is currently working with Toyota Motor Sales USA, Inc. to provide entry level technicians to the area's Toyota dealerships through the Toyota Technical Education Network (T-TEN) program. T-TEN is a partnership between Toyota, Community Colleges, and Toyota and Lexus dealerships. The program features hands-on automotive diagnosis and repair education and training that blends both classroom and dealership settings. According to T-TEN staff, there is now a large and growing shortage of automotive technicians in the region, and the program offers a pathway specifically to the Toyota dealership network, as well as opportunities with other OEMs. For more information, see https://www.venturacollege.edu/departments/academic/automotive
- **Cal State Channel Islands** – California State University, Channel Islands is one of only three California State University campuses that offers a degree in Mechatronics. Mechatronics is a relatively new discipline that integrates robotics, automated manufacturing, and the design of mechanical devices with embedded intelligence. Knowledge and skills in mechatronics can

---

[265] HAAS CNC Motor Sports. Retrieved from: https://www.haascnc.com/Community/Motorsports.html

[266] Port of Hueneme. Commercial Seaport Cargo Autos. Retrieved from: https://www.portofhueneme.org/business/commercial-seaport/cargo-autos/

provide excellent preparation for a variety of career pathways in electric mobility, including design and engineering careers related to autonomous vehicles and systems. Relevant careers include: Mechatronics engineering, Robotics engineering, Control Systems engineering, Electro-mechanical engineering, Software engineering, and Manufacturing engineering. Mechatronics can also be combined with degrees in computer science. For more information on mechatronics, see https://www.csuci.edu/academics/mechatronics.htm.

- **Los Angeles Trade-Technical College:** The Los Angeles Trade-Technical College offers electric vehicle technical training in its Diesel, Alternative Fuel, and Hybrid Vehicle Technologies department. A certificate of achievement in Hybrid & Electric Plug-In Vehicle Technology is available. This Certificate of Achievement requires twelve units of specific courses that cover basic, intermediate and advanced level hybrid and electric plug-in vehicle configurations used in transportation industries, including automotive, transit, and trucking. More information on the Hybrid & Electric Plug-In Vehicle Technology Program is available at: https://college.lattc.edu/transportation/hybrid-plug-in-electric-vehicle-technology/

- **Rio Hondo College:** Rio Hondo College offers a variety of options in electric vehicle technical training. There are four Certificate of Achievement programs in Automotive Technology with a fifth Plug-in Vehicle Technician Certification program coming soon. Each Certificate of Achievement requires 32 units of specific courses and may be completed in 12 months. Rio Hondo also offers an Associate of Science degree in Automotive Technology, which requires 62 units for completion and typically takes approximately two academic years. The Associate of Science degree has the same course requirements as the Certificate of Achievement but requires the completion of general education courses. Additionally, Rio Hondo now provides electric vehicle-related safety training for first responders. The emphasis of the safety training is on electric vehicles already on the road including: Chevy Volt, Nissan Leaf, Mitsubishi iMiEV, and Tesla. More information on the Alternative Fuel Program is available at: https://www.riohondo.edu/career-and-technical-education/automotive-tech/alternative-fuels/

- **Long Beach City College:** In recent years, Long Beach City College developed an Advanced Transportation Technology Center to introduce students to courses covering alternative fuels, hybrid-electric vehicles, and electric vehicles. A Career Certificate in alternative fuels can be acquired through Long Beach City College once all required courses are completed. Other related courses offered in automotive technology can lead to a license as an Intern Technician, Basic Area Technician or Advanced Emissions Specialist. Additionally, a Career Certificate in electric vehicles is available, as well as an Associate of Science Degree in Advanced Transportation Technology – Electric Vehicles. In the Associate of Science program, students prepare for a career in hybrids, fuel cells, and electric vehicle conversion, maintenance, and repair using state-of-the-art equipment. Program learning outcomes include:
    - Safely work on the high voltages present in electric vehicles without injury
    - Diagnose and repair computer controlled electric vehicles including hybrids, fuel cells, and plug-in electric vehicles, regarding installations and inspections of systems and their related components

- Compare the differences, advantages, and limitations of the various electric vehicles to determine the proper application of each technology

More information on the Long Beach Electric Vehicle programs are available at: https://www.lbcc.edu/program-advanced-transportation-technology-electric-vehicles

- **Pierce College:** Located in Woodland Hills, Pierce College offers two automotive technology skills certificate programs and one automotive service technology associate degree program through its industrial technology department. New construction on the Pierce College campus includes an alternative fuel lab, emissions lab, and a hybrid electric cars lab. Information on the automotive service tech programs can be found at:
  http://www.piercecollege.edu/departments/industrial_technology/autoshop.asp

- **National Alternative Fuels Training Consortium:** The National Alternative Fuels Training Consortium (NAFTC) (based at the University of West Virginia) provides nationwide training curricula and infrastructure for alternative fuel and advanced technology vehicles and associated technologies. NAFTC has 46 National Training Centers that provide post-secondary education and training, five of which are located in California. The California Centers are located at El Camino College, Fresno City College, Modesto Junior College, Rio Hondo Community College, and Yuba College. In addition to its Training Centers, the NAFTC also provides secondary level curriculum to high schools, technical centers, and similar organizations. Consortium training is also available to employers. The U.S. Postal Service, U.S. Department of Energy Clean Cities Programs, and private fleet operators all utilize NAFTC curricula. [267] NAFTC courses include:
  - A Basic Understanding of Battery Electric and Hybrid Electric Vehicles
  - Electric Drive Vehicle Automotive Technician Training
  - Electric Drive Automotive Technician Training
  - Electric Drive Vehicle Career and Technical Training
  - Electric Drive Infrastructure Training
  - Electric Drive First Responder Safety Training

  NAFTC also offers a workshop format course for fleet operators called: Petroleum Reduction Technologies: Electric Drive. Additional information on the NAFTC offerings are available at: http://naftc.wvu.edu/courses-and-workshops/

- **Ventura County IBEW Local 952:** The Ventura County IBEW Local 952 has an electric vehicle charger training curriculum for both apprentice and journeyman electricians -- based upon the National Joint Apprenticeship Training Program. The broader electrician Apprentice program is also operated by IBEW, and trains electricians to:

[267] Shannon Sedgwick and Christine Cooper, *Electric Vehicles: The Market and its Future Workforce Needs,* Economic and Policy Analysis Group, Los Angeles County Economic Development Corporation, p. 30, August 2012.

- Read blueprints or technical diagrams
- Install and maintain wiring, control, and lighting systems
- Inspect electrical components, such as transformers and circuit breakers
- Identify electrical problems with a variety of testing devices
- Repair or replace wiring, equipment, or fixtures using hand tools and power tools
- Follow state and local building regulations based on the National Electric Code
- Direct and train workers to install, maintain, or repair electrical wiring or equipment

At the *Ventura County Electrical Joint Apprenticeship Training Program,* students attend classes twice per week in the evenings at the IBEW training center in Oxnard, while working during the day with an Electrical Contractor. Apprentices do not need to seek their own employment as the Ventura County Electrical *Joint Apprenticeship Training Council* will place apprentices to work with participating contractors. Once the apprentice has completed the five-year program, he/she will be upgraded to Journeyman Level status and will receive a Certificate of Completion from the State of California, the U.S. Department of Labor and the Electrical Training Alliance. For more information, see www.ibewlu952.org

- **Los Angeles Clean Tech Incubator:** LACI is a new venture accelerator with a strategic focus on transportation and mobility, clean energy, and smart, sustainable cities. LACI provides workshops for entrepreneurs and support services for portfolio companies that are committed to taking action on climate change and "creating a cleantech community that integrates women, people of color and the underserved." Programs are offered by competitive application. LACI has appointed a Project Director to engage entrepreneurs in Ventura and Santa Barbara Counties, based at the Community Environmental Council in Santa Barbara. LACI has also co-sponsored the ambitious Transportation Electrification Partnership for Los Angeles, which has laid out a strong vision for accelerated decarbonization of transportation, with a focus on actions to be undertaken in advance of the 2028 Olympics. For more information on LACI programs and e-mobility initiatives, see https://laincubator.org/

Key Recommendations for Electric Vehicle Workforce Development

The synergistic relationship of economic, education, and workforce institutions and programs: An effective workforce development ecosystem requires that education and workforce institutions, employers, and economic development agencies work together to develop the career opportunities and workforce skills that job seekers, incumbent workers, and employers need to be successful. These differentiated responsibilities can be summarized as follows:

- Education and workforce institutions must develop education and training programs that effectively meet employer needs for a skilled workforce
- Employers must develop internal training programs and/or partner with workforce and training institutions to meet the skill needs of incumbent workers
- Economic development institutions must provide incentives and support to grow companies and jobs, optimally in higher-wage, higher-growth, and environmentally sustainable fields.

Ventura County already enjoys substantial strengths in each of these areas. Education and workforce institutions are embracing electric vehicle-related subject matter, employers (such as Toyota) are partnering with education and training institutions to strengthen the clean transportation workforce, and economic development agencies (such as the Economic Development Collaborative) are implementing programs to support green business development. Thus, the actions recommended below are intended to build on these assets to:

- Attract additional electric vehicle-related businesses to the region
- Attract additional workforce-related funding to local education and workforce institutions.

As the recommendations make clear, a key strategy for achieving both actions is to develop a regional electric vehicle-related economic and workforce development vision and action plan. Given the significant work already invested in such efforts in the Los Angeles area, which is part of the Ventura "job shed," [268] a first order activity will be to explore the feasibility of teaming with regional partners to develop a compelling economic and workforce development vision focused on electric mobility. A significant aid in this process will be the regional orientation of both the LACI and the Economic Development Collaborative of Ventura County.

The Economic Impact of Accelerated Electrification: Ventura County residents travel over 18.5 million vehicle miles daily. [269] With gas prices near $4 per gallon, and a 26.4 miles per gallon average, the annual fuel spend for Ventura County residents is over $1 billion per year. As electric vehicles progressively displace internal combustion engines, these household and local business expenditures on fueling could decline by as much as 70 percent, depending on utility rates and time of charging. Reducing transportation fuel costs for the region's households would free up to $700 million dollars in annual household income for other local expenditures. These expenditures are likely to have a much higher local economic development multiplier than gasoline, which is largely sourced from out-of-area refineries and suppliers. Unlike gasoline, electricity is almost entirely sourced regionally. Moreover, with the CPA committed to transitioning to 100 percent renewable power, and with many electric vehicle drivers investing in solar on their rooftops, much of the new electric fueling revenue will be recycled into local renewable energy development projects – creating a "virtuous circle" of investment in the new green economy. Thus, the choice to accelerate transportation electrification has strong local benefits in four key areas: 1) climate; 2) public health; 3) energy security; and 4) economic and job development.

Strengths of Existing Ventura County Electric Vehicle-Related Education and Workforce Training Programs: The UCLA Luskin Center report, *Transport Electrification Workforce Development,* as well as

---

[268] According to the most recent census data, 22 percent of Ventura County residents commute outside the County for work, with the majority heading to Los Angeles County. This compares with just 6 percent and 7 percent respectively for Santa Barbara and Los Angeles Counties. Most residents report that commuting outside Ventura is necessary to find higher paying work. See Tyler Hersko, "Why So Many of Us Need to Commute," VC Star, March 1, 2017. https://www.vcstar.com/story/money/business/2017/03/01/ventura-county-residents-hit-road-higher-paying-jobs/96109736/

[269] Ventura County Transportation Commission. Afternoon Workshop. Retrieved from: https://www.goventura.org/wp-content/uploads/2019/05/May-2019-Workshop-Afternoon-Session.pdf

the current *Ventura Electric Vehicle Blueprint,* identify important strengths of the existing electric vehicle-related education and workforce development ecosystem in Ventura County and the greater Los Angeles Metro region. These include:

- Community College curricula for automotive service technicians that incorporates updated electric vehicle-related content and learning objectives, aligned with best practice curricula from the National Alternative Fuels Training Consortium
- Standardized electric vehicle infrastructure training programs utilizing curricula from the Electric Vehicle Infrastructure Training Program -- available at multiple Community Colleges in the region
- Electrician apprenticeship programs and electric vehicle charging infrastructure courses -- offered through IBEW Local 952

Strengths of the Existing Electric Vehicle-Related Economic Development Ecosystem: Ventura County also has several key economic development assets that provide a strong foundation for further development of the County as a center for Advanced Transportation and Electric Mobility. These include:

- Relatively low land costs compared to much of the Los Angeles Basin
- A skilled workforce and strong workforce development programs
- Several leading electric vehicle-related businesses located in Ventura County, including:
    - BMW Group's Engineering and Emissions Test Centre
    - Volkswagen Research & Development Center
    - Haas Automation (which is a high potential EVSE development site with Disadvantage Communities status, and strong local electric vehicle advocates.)
- A deep-water port that already handles substantial auto shipments

Recommendations for strengthening the region's electric vehicle-related education, workforce, and economic development ecosystem

- **Recommendation #1: develop an e-mobility and advanced transportation economic development action plan**: to attract additional electric vehicle-related economic activity to the region, it is recommended that the economic development collaborative of Ventura county develop an e-mobility economic and workforce development action plan in collaboration with electric drive 805 and other key stakeholders.
- **Recommendation #2: explore development of a SCE vehicle workforce collaborative linked to the Los Angeles transportation electrification partnership and electric drive 805.**
- **Recommendation #3: pro-actively develop workforce training program strategies for disadvantaged & low-income communities as part of a comprehensive regional workforce initiative** and identify specific strategies to serve residents within the state-designated Disadvantaged Community census tracts in the cities of both Oxnard and Ventura (the only two cities with Disadvantaged Communities in Ventura county).

In summary, Ventura stakeholders have important opportunities to build on the County's already strong workforce and education assets to develop a truly exemplary suite of transportation electrification-related education and training offerings. Advancing this outcome will be facilitated by development of more robust regional collaborations involving both Ventura and Los Angeles County. This collaboration can be advanced through the joint efforts of the Economic Development Collaborative, the Ventura Workforce Development Board, LACI, the Ventura Community College District, IBEW, VCREA, and Electric Drive 805, as well as other relevant stakeholders. The development of this broader regional collaborative will be most likely to attract both the program funding and the businesses needed to generate the greatest economic and workforce co-benefits from the electrification of transportation.

Chapter 10 References

BMW Group. Oxnard. Retrieved from: https://www.bmwgroup.jobs/us/en/location/location-oxnard.html#location=US/Oxnard

Gal Pin Volkswagen. VW new California R&D Center. Retrieved from: https://www.galpinvolkswagen.com/newsroom-vw-new-california-r-d-center/

HAAS CNC Motor Sports. Retrieved from: https://www.haascnc.com/Community/Motorsports.html

US Navy. Press Release: *NAVFAC Southwest Leads Department of Navy's Transition to Electric Vehicles*. May 24, 2017. Access on May 24, 2019. Available online at: https://www.navy.mil/submit/display.asp?story_id=100639

HAAS CNC Motor Sports. Retrieved from: https://www.haascnc.com/Community/Motorsports.html

Port of Hueneme. Commercial Seaport Cargo Autos. Retrieved from: https://www.portofhueneme.org/business/commercial-seaport/cargo-autos/

Shannon Sedgwick and Christine Cooper, *Electric Vehicles: The Market and its Future Workforce Needs,* Economic and Policy Analysis Group, Los Angeles County Economic Development Corporation, p. 30, August 2012.

Tyler Hersko, "Why So Many of Us Need to Commute," VC Star, March 1, 2017. https://www.vcstar.com/story/money/business/2017/03/01/ventura-county-residents-hit-road-higher-paying-jobs/96109736/

US Navy. Press Release: *NAVFAC Southwest Leads Department of Navy's Transition to Electric Vehicles*. May 24, 2017. Access on May 24, 2019. Available online at: https://www.navy.mil/submit/display.asp?story_id=100639

Ventura County Transportation Commission. Afternoon Workshop. Retrieved from: https://www.goventura.org/wp-content/uploads/2019/05/May-2019-Workshop-Afternoon-Session.pdf

Ventura County Transportation Commission. Afternoon Workshop. Retrieved from: https://www.goventura.org/wp-content/uploads/2019/05/May-2019-Workshop-Afternoon-Session.pdf

Ventura County Electric Vehicle Ready Blueprint

Chapter 11: Resourcing the Ventura County Electric Vehicle Ready Blueprint

Resourcing Ventura County Electric Vehicle Ready Blueprint: Introduction

Public funding support for transportation electrification can help overcome otherwise daunting cost barriers to electric vehicle adoption and electric vehicle charging infrastructure deployment. For local government and public agencies, employers, fleet operators, and other electric vehicle charging site hosts, successfully accessing federal, state, and regional investment programs can be an essential factor in moving forward with an electric vehicle project. Funding for electric vehicle awareness activities - such as brand-neutral marketing, education, and direct community outreach events – is also essential to advancing regional electric vehicle adoption. To ensure that Ventura County stakeholders and communities have the information they need to access all available funding sources, this chapter provides information on key funding sources and requirements. This chapter, as well as the full Blueprint, includes strategies that County stakeholders can implement to successfully secure funding from competitive opportunities. Funding sources discussed in this chapter include:

Federal Incentive Programs – including the IRS Electric Vehicle Tax Credit, U.S. Department of Transportation Low and Zero Emission Public Transportation Research, Demonstration, and Deployment Funding (known as "Low-NO"), and other Public Transportation Innovation Programs

- **California Energy Commission Programs** – ARFVTP, also known as AB 118 funds, and AQIP
- **California Air Resources Board Programs** – including the HVIP, EFMP, Carl Moyer Program, and related funding programs supporting the Sustainable Freight Action Plan
- **LCFS Credit Program**
- **SCE Charge Ready Program**
- **Electrify America Settlement Funds**
- **Local Government Resources**

Federal Electric Vehicle Support Programs

Internal Revenue Service Plug in Electric Drive Vehicle Credit (IRC 30D): The Internal Revenue Code Section 30D provides a credit for Qualified Plug-in Electric Drive Motor Vehicles, including passenger vehicles and light trucks. For vehicles acquired after December 31, 2009, the credit is equal to $2,500 for an electric vehicle with at least 5 kWhs of battery capacity, plus an additional $417 for each kWh of battery capacity in excess of 5 kWhs. The total amount of the credit allowed for a vehicle is limited to $7,500.

Credits are progressively reduced and ultimately phase out completely for each manufacturer after 200,000 qualifying vehicles have been sold for use in the United States (determined on a cumulative basis for sales after December 31, 2009). Thus far, credits for Tesla have been reduced as of January 1, 2019, and will soon expire completely as of December 31, 2019. Credits for General Motors are also being reduced in 2019. As of mid-2019, efforts are underway in Congress to reauthorize the credit program for all manufacturers (lifting existing caps), but the fate of that effort is uncertain under the current Presidential Administration. [270]

---

[270] **Internal Revenue Service. Internal Revenue Service Plug in Electric Drive Vehicle Credit (IRC 30D). Retrieved from:** https://www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d

Low and Zero Emission Public Transportation Research, Demonstration, and Deployment Funding: Funding is available for electric and other low or zero emissions transit buses and related research to local, state, and federal government entities, public transit agencies, private and non-profit organizations, and higher education institutions. Programs include the Low or No Emission (Low-No) Vehicle Program and the Public Transportation Innovation Program.

The Low-No Program provides funding to state and local governmental authorities for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities. Under the Federal Surface Transportation Act, $55 million per year is available until fiscal year 2020. Eligible projects include:

- Purchasing or leasing low- or no-emission buses
- Acquiring low- or no-emission buses with a leased power source
- Constructing or leasing facilities and related equipment (including intelligent technology and software) for low- or no-emission buses
- Constructing new public transportation facilities to accommodate low- or no-emission buses
- Rehabilitating or improving existing public transportation facilities to accommodate low- or no-emission buses [271]

The Public Transportation Innovation Program: This program provides funding to develop innovative products and services assisting transit agencies in better meeting the needs of their customers. Grant opportunities are allocated on a discretionary basis and posted on http://www.grants.gov/ under the CFDA Number 20.514. [272]

U.S. Environmental Protection Agency Safer Affordable Fuel-Efficient Vehicle Rule: In 2018, the Environmental Protection Agency froze an increase in fuel efficiency standards for light duty vehicles in model years 2021-2025. [273] The outcomes of the program are likely to impact federal program support for electric vehicles. It is therefore recommended for stakeholders to monitor the rulemaking process and pending California litigation challenging the U.S. U.S. Environmental Protection Agency Safer Affordable Fuel-Efficient Vehicle Rule since the outcome will influence the availability of federal and state funding for local transportation projects and programs.

California Energy Commission Electric Vehicle Support Programs

The Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP): In 2007, Assembly Bill (AB) 118 (Nunez) created the AQIP, administered by the CARB, and the ARFVTP, managed by the Energy Commission. Extended in 2013 by AB 8 (Perea), this legislation distributes approximately $100 million per

---

[271] Federal Transit Administration. Public Transit Innovation. Retrieved from: https://www.transit.dot.gov/funding/grants/lowno

[272] Federal Transit Administration. Low and No Emission Vehicle Program. Retrieved from: https://www.transit.dot.gov/funding/grants/public-transportation-innovation-5312

[273] Webb R. Columbia Earth Institute. Five Important Points about the EPA's "SAFE Vehicle Rule". Retrieved from: https://blogs.ei.columbia.edu/2018/08/07/five-points-epa-safe-vehicle-rule/

year for low-carbon vehicle incentives and infrastructure, of which a substantial portion is allocated to electric vehicle initiatives. The AQIP program in turn is supported by the Low Carbon Transportation Program with funds from the state's Cap and Trade Program (also known as the Greenhouse Gas Reduction Fund). The AQIP is designed to accelerate the transition to advanced low carbon freight and passenger transportation with a focus on California's Disadvantaged Communities.

The ARFVTP is focused primarily on GHG reduction within the transportation sector, while the AQIP is primarily responsible for reducing specific transportation-related criteria air pollutants, such as NOx, which is the primary contributor to smog, and diesel-related PM. Diesel-related PM has a direct causal link to both asthma and lung disease and is especially noted in Oxnard Census tracts where Asthma rates are in the 95th percentile according to CalEnviroScreen. Together the CARB and Energy Commission programs have jointly contributed funds toward California's CVRP – focused on light-duty electric and fuel cell vehicles -- as well as the HVIP to accelerate the purchase of cleaner, more efficient trucks and buses. Through AB 118 and various CARB technology demonstration programs, the state has also invested in electric vehicle charging infrastructure; regional electric vehicle planning, fuel cell electric vehicle research and deployment, alternative fuel vehicle planning; in-state manufacturing of clean vehicles; development and demonstration of advanced hybrid and fully electric truck and bus models; and VGI.

Sources and Uses of Allocations from the ARFVTP (AB 118) Program: The $100 million annual investment in clean vehicle technologies provided by the ARTVP is funded through vehicle and vessel registration fees, special vehicle plates, and smog-abatement fees. For FY 2019-2020, the Energy Commission staff have proposed an investment of $95.2 million under the ARFVTP, which will include $32.7 million for electric vehicle charging infrastructure, and $17.5 million for Advanced Freight and Fleet Technologies. Up to $5 million will be provided for manufacturing and workforce development projects. Actual allocations will depend on specific grant funding opportunity guidelines and responses received.

Likely Areas of Emphasis Within the 2019-20 Energy Commission Electric Vehicle Infrastructure Grant Programs: As of the time of this report the California Energy Commission is still engaged in staff-level deliberations regarding potential areas of emphasis within the $32.7 million 2019-20 electric vehicle charging infrastructure grant program allocation defined above. Discussions with Energy Commission staff have indicated strong interest in a robust multi-family residential housing initiative, as well as ongoing interest in supporting the statewide DC Fast Charging network. In addition, there will likely remain significant funding available for manufacturing and workforce efforts.

California Electric Vehicle Incentive Program (CALeVIP): Funded by the California Energy Commission and implemented by the Center for Sustainable Energy, CALeVIP works with local partners to develop and implement electric vehicle charger incentive projects that meet regional needs for Level 2 and DC Fast Chargers. The statewide project aims to provide a streamlined process for getting chargers installed to fill the significant gaps in charging availability. CALeVIP and its regional incentive projects are made possible through a grant by the Energy Commission's ARFVTP, which supports innovations in transportation and fuel technologies. CALeVIP is currently funded for more than $39 million, with the potential of up to $200 million.[274] The Ventura County Electric Vehicle Ready Blueprint's outreach team spoke with the California

[274] CALeVIP funding availability can be tracked at https://calevip.org/available-funding.

Energy Commission's CALeVIP Program Manager, in January 2019.[275] At that time, there was uncertainty as to the CALeVIP budget and it was unclear if funding for a CALeVIP project serving the region would be available. According to Commission staff, approximately $13 million in funding would be needed for a CALeVIP project covering the Ventura County region, based on charging station gap analysis.

CARB Programs

AQIP and the Low Carbon Transportation Program: As noted in Chapter 4, AQIP focuses on reducing criteria pollutants and diesel particulate emissions as well as GHG reductions. The program is supported by Cap and Trade Funds and provides deployment incentives for electric and zero emissions vehicles through HVIP, as well as loans to assist fleets in diesel modernization projects. The proposed Fiscal Year 2018-19 Funding Plan for Clean Transportation Incentives represents a total of $483 million in clean transportation investments. Most of these funds are typically provided on a formula basis to individuals (CVRP) or fleet operators (via the Enhanced Fleet Modernization Program). However, some concepts for targeting and stacking these funds in partnership with intermediaries and fleet operators are discussed below.

State Allocations	Program Implications for Ventura County
▪ **$200 million for CVRP**, with the requirement that $25 million fund increased rebates for low-income recipients	▪ **Targeted and stacked funding for low-income households:** Some CVRP funds for low-income recipients could potentially be combined with local utility incentives for targeted deployment to specific households through intermediaries and non-governmental organizations.
▪ **$75 million for the EFMP and EFMP Plus-up Pilot Project / Clean Cars 4 All, Financing Assistance, Clean Mobility Options, replacement of school buses, and light-duty equity pilot projects authorized by SB 1275**	▪ **Electric school bus projects:** Electric school bus funding is eligible to flow to Ventura County school districts in the form of pilot project opportunities in the next round of VGI funding, as well as the separate Prop 39 school bus replacement program. (Current Prop 39 funds are over-subscribed for 2019-20 but the fund will likely be replenished in future years). ▪ **Pro-active development of regional e-school bus strategy:** Targeted partnerships with local districts and regional stakeholders as appropriate can result in highly competitive proposals for accelerated electrification of school bus fleets, and potential deployment of school buses in V2G configurations as new funding becomes available.
▪ **$55 million for the Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project,**	▪ **Pilot Project Options:** The nearby presence of the Port of Hueneme could provide opportunities for accelerated electrification of cargo handling and ground equipment at the port or related freight forwarding facilities. Further research on locations of freight vehicles can provide information on the feasibility of freight pilot projects.

[275] Email correspondence and phone call with Brian Fauble, Energy Commission Specialist II, on January 10, 2019.

including projects for ships at berth	▪ **Recommendation:** Continue working with the Port of Hueneme to engage their contracted goods movement operators and build partnerships for grant-funded pilot projects.
▪ **$125 million for clean truck and bus vouchers** through the HVIP [276]	▪ **Accelerated Fleet Electrification:** Many fleet managers are not yet aware of newly emerging electric vehicle models, infrastructure strategies, and related grants and funding, including mobility-as-a-service and charging-as-a-service models that require no up-front capital spend. Various approaches to fleet technical assistance could increase HVIP and related program utilization rates in Ventura. The E-Fleet Accelerator program funded by the Energy Commission and operated by EV Alliance in collaboration with local APCDs and the Community Environmental Council of Santa Barbara provides a useful program model to build on.

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project and Related Vehicle Incentives and Grant Programs: As discussed in Chapter 4, the HVIP was established by CARB to cover most or all of the incremental cost difference between clean vehicles and their fossil-fueled counterparts. HVIP is a voucher program based on first-come, first-served allocation of available funding within a given program year. The vouchers are administered by CalSTART (with AQIP oversight) through vehicle dealers. Fleet operators in Ventura County are eligible to obtain HVIP vouchers through the vehicle dealers and OEMs. The table below (also presented in Chapter 4) highlights the 2018-2019 zero emissions truck voucher amounts. HVIP and other funding for buses is discussed in more detail in Chapter 4. Please note that hydrogen fuel cell vehicles are also considered to be electric drive ZEVs.

HVIP - Zero Emission Truck Voucher Amounts (2018-2019) [277]

GVWR (lbs)	Base Vehicle Incentive: Outside Disadvantaged Community	Base Vehicle Incentive: In Disadvantaged Community
5,001 – 8,500	$20,000	$25,000
8,501 – 10,000	$25,000	$30,000
10,001 – 14,000	$50,000	$55,000
14,001 – 19,500	$80,000	$90,000
19,501 – 26,000	$90,000	$100,000
26,001 – 33,000	$95,000	$110,000
>33,000	$150,000	$165,000
>33,000 Hydrogen Fuel Cell Truck	$300,000	$315,000

[276] California Air Resources Board. (September 21, 2018). Proposed Fiscal year 2018-2019 Funding Plan for Clean transportation Incentives for Low Carbon Transportation Investments and the Air Quality Improvement Program.
[277] California HVIP. HVIP FY18-19 Funding tables. Retrieved from: https://www.californiahvip.org/wp-content/uploads/2018/11/HVIP-FY18-19-Funding-Tables-11-19-2018.pdf

Additional HVIP incentive support is available to projects within Low-income and Disadvantaged Communities of up to $5,000-$15,000. Applications are processed through the HVIP web portal at http://www.californiahvip.org/ .

California Clean Vehicle Rebate Program: Dependent upon vehicle type, California offers $1,500-$2,500 rebate towards purchase or lease of a new electric vehicle, and up to $5,000 for a fuel cell electric vehicle. Rebates are provided through the CVRP, administered by the Center for Sustainable Energy under a contract with the California Air Resources Board (see www.CleanVehicleRebate.org). Single income tax filers making more than $150,000 and joint filers making more than $300,000 are not eligible for the program. Pending state legislation may slightly reduce these caps. However, low-income filers making less than 300 percent of the federal poverty level are eligible for a $2,000 rebate increase.[278] Monthly rebates for California electric vehicles hit record highs by mid-2018, thanks in part to a surge in purchases of the Tesla Model 3 before the phase out of the $7,500 federal tax rebate for all Tesla models as of January 1, 2019. Rebate growth has continued despite the imposition of the high-income cap on program participation.

Low Carbon Fuel Standard Program Credit Program: As discussed in Chapter 4, the LCFS program enables EVSE providers to generate credits valued between $100 to $185 per $MTCO_2e$ offset by alternative fuel sources.[279] For individual light-duty vehicles, the LCFS credits are modest and are typically unclaimed. However, for fleet vehicles with very large batteries, notably transit buses, LCFS credits can amount to as much as $10,000 per vehicle per year. Higher values are possible if local solar is used for electric fueling. Guidance documents outlining the LCFS process are available on the CARB website at: https://www.arb.ca.gov/fuels/lcfs/guidance/guidance.htm#guidance. An application template for Fast Charging Infrastructure is also available for download on the CARB website.[280]

SCE Charge Ready Program: The SCE Charge Ready Program is a pilot program currently that provides free installation of some commercial electric vehicle charging stations and a rebate to cover some or all the costs of the charging equipment. The program also pre-qualifies EVSE vendors and specific charging station models. The Charge Ready program installs covers the full cost of electrical upgrades and EVSE "make-ready" preparations, including panel upgrades and installation of necessary conduit and wire for EVSE installations, for charger deployment at sites selected by Charge Ready staff for electric vehicle charging station installations. Key program elements include:

1. Deployment of a minimum of ten charging stations per site (the minimum is lowered to five EVSE for disadvantaged communities and multi-family complexes)
2. Eligibility for either Level 1 (120v) or Level 2 (240v) charging stations
3. All charging stations must be installed on a new dedicated circuit deployed by the utility (with its own panel, meter, and service), separately from any existing panel, meter, or service
4. The program covers all-electric infrastructure costs related to the new circuit

[278] More information available from the ARB at: https://www.arb.ca.gov/msprog/lct/cvrp.htm

[279] California Air Resources Board (2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons. March

[11] Available for download: https://www.arb.ca.gov/fuels/lcfs/guidance/fci_apptemplate.xlsx

5. SCE offers a rebate to offset some or all of the costs for the charging stations and their installation. Rebates vary by site and SCE has provided a rebate calculator to facilitate the application and estimate process [281]
6. All permits and inspections are obtained directly by SCE or Charge Ready vendors [282]

SCE Charge Ready Phase 2: SCE has secured bridge funding to continue the pilot and is now requesting funding to continue the Charge Ready program in a Phase 2 deployment. Phase 2 seeks to deploy 48,000 new electric vehicle charging ports through the SCE territory as part of a four-year, $760 million program. [283] SCE's Phase 2 request for funding focuses on:

- Make ready infrastructure for workplace, public, and MUD charging, including 32,000 charging ports at approximately 3,200 sites
- Reduced minimum requirement of four ports for projects to be eligible (compared to the previous Charge Ready pilot minimum requirement of five ports for Disadvantaged Community or MUD installs and ten ports for all other locations)
- Deployment of 16,000 electric vehicle charging ports at MUDs
- Deployment of 35 percent of EVSE in Disadvantaged Communities
- Educational outreach programs for SCE customers

SCE Fleet Incentives – via "Charge Ready Transportation" The CPUC recently approved another expansion of the SCE electric vehicle infrastructure support program to include a medium and heavy-duty fleet support initiative called Charge Ready Transportation. [284] At least 25 percent of the program's $356 million budget will be dedicated to vehicles operating at ports and warehouses in SCE's territory.

SCE Residential Single-Family Rebates: SCE also offered a Charge Ready Home Installation pilot program rebate for households installing electric vehicle charging stations at a single-family residence. As of early 2019, SCE offered residential customers a rebate of $500 or $1,500 toward their out-of-pocket costs for the electrical upgrades and permitting fees necessary for Level 2 electric vehicle charging stations - but not for the EVSE hardware itself. The larger $1,500 rebate was offered for households that installed a new separate meter for the electric vehicle charging station, while households that did not install a new separate meter received the $500 rebate. Electrical upgrades eligible for the rebate included a new 240-volt circuit and socket, new or upgraded panel, new meter socket, and permit fees. In order to receive the rebate, the applicant must be a customer of SCE and enroll in an eligible SCE TOU rate. TOU rates are based on the time of day and season when electricity is used and provide steep discounts for customers that charge primarily during off-peak periods. The Charge Ready Home Installation pilot closed on May

---

[281] Rebate calculator available at:
https://chargeready.sce.com/(S(uvmlb2s0nwugauy1uluzvinx))/calculator/Default.aspx

[282] Southern California Edison. *Charge Ready Program Fact Sheet.* Retrieved from:
https://www.sce.com/wps/wcm/connect/ff4d5544-c304-495f-9251
372a0f4b6031/4950_SCE_ChargeReadyFactSheet_20160412.pdf?MOD=AJPERES

[283] Southern California Edison. *Charge Ready 2 EV Charging Infrastructure Proposal.* Retrieved from:
https://www.edison.com/content/dam/eix/documents/innovation/electric-transportation/charge-ready-2-ev-charging-infrastructure-proposal.pdf

[284] Griffo, Paul. (May 31, 2018). SCE Gets Thumbs-Up for Program to Electrify Thousands of Industrial Vehicles. Retrieved from: https://energized.edison.com/stories/sce-gets-thumbs-up-for-program-to-electrify-thousands-of-industrial-vehicles

31, 2019. SCE may launch a new iteration of the Charge Ready Home Installation program in the future, although the rebate levels and program criteria are subject to change.

Electrify America/Volkswagen Settlement: As discussed in Chapter 4, court orders following the Volkswagen NOx scandal required the company to invest $2 billion in ZEV infrastructure, access, and brand neutral education and outreach programs throughout the U.S. A new wholly owned subsidiary of Volkswagen was formed, known as Electrify America, to install, own, and operate charging stations and provide education and outreach programs as ordered by the Court. A California-specific investment of $800 million has been planned to be invested over the ten-year period from 2017 – 2026, according to a program developed by Electrify America and new plans are subject to review and approval by the CARB.[285] The investment cycle timeline is outlined below.

Electrify America Investment Cycles[20]

	Cycle 1 (Q1 2017 – Q2 2019)	Cycle 2 (Q3 2019 – Q4 2021)	Cycle 3 (Q1 2022 – Q2 2024)	Cycle 4 (Q3 2024 – Q4 2026)	Full 10 years
California Plan	$200M	$200M	$200M	$200M	**$800M**

Plans for Cycle 2 of program funding have been announced and will focus on two core areas: 1) ZEV Fueling Infrastructure and 2) ZEV Education, Awareness, and Marketing."[286] Electrify America will also focus 35 percent of total investment into low-income and disadvantaged communities. Within the Electrify America Cycle 2 program, $153 million will be allocated to Fueling Infrastructure divided across programs for metro community charging, highway and regional routes, and emerging infrastructure opportunities. $47 million will also be allocated to Education and Awareness efforts.

Cycle 2 funding is largely allocated based on Electrify America's own internal planning process and is being invested largely in Electrify America's own branded charging business. **It is not a grant program**; however, there may be opportunities for interested local governments, CPA, and Electric Drive 805 stakeholders to negotiate the location of electric vehicle charging stations and potentially to collaborate on deployment of promotional resources.

Ventura County APCD

The Ventura County APCD operates important electric vehicle-related programs that provide significant assistance to households and fleet operators in the region. These include the following key programs:

California Bureau of Automotive Repair's Consumer Assistance Program: the program enables consumers who meet eligibility requirements to receive either $1,000 (regular) or $1,500 (low-income) to voluntarily retire their operational vehicle from California roadways at a Bureau of Automotive Repair-

---

[285] Electrify America. Investment Cycle Planning Overview. Retrieved From: https://www.electrifyamerica.com/our-plan

contracted dismantler site. More info is available at: https://bar.ca.gov/Consumer/Consumer_Assistance_Program/CAP_Vehicle_Retirement_Program.html

Old Car Buy-Back: An alternative to the Consumer Assistance Program, The Ventura County APCD old car buy-back program pays up to $1,000 to voluntarily retire a 1997 or older car, pick-up truck, van, or SUV. Funding of this program is limited and is provided on a first-come, first-served basis until current year grant funds are depleted. To qualify for the buy-back program, vehicles must be operational and registered in Ventura County and additional eligibility requirements apply.[287] See www.vcapcd.org for details.

The Carl Moyer Memorial Air Quality Standards Attainment Program: The Carl Moyer Memorial Air Quality Standard Attainment Program is a state supported grant program administrated by the Ventura County APCD that funds incremental costs of engine upgrades. Since 1998, the program has provided funding focused on older heavy-duty diesels with electric, alternative-fuel, or cleaner diesel technologies.[288] Since 1999, a total of $39 million has been awarded within Ventura County. In 2018, approximately $4.4 million was available to fund projects in Ventura. Eligible projects included:

- Repower model year 2006 and newer agricultural irrigation and water well pumps with electric motors or Final Tier 4 diesel engines. Pumps with model year 2005 and older engines are no longer eligible for grant funding
- Repower commercial fishing boats with new, lower-emission engines
- Repower farm tractors, construction equipment, and locomotives with new, lower-emission engines
- Replace farm tractors and construction equipment with new, lower-emission equipment
- Replace emergency vehicles (fire trucks) with new, lower-emission equipment

The 2019 program status is yet to be released at the time of this report. The latest updates on the program can be found at the Ventura County APCD website, www.vcapcd.org/grant_programs.htm

Local Electric Vehicle Support Resources

Local government resources for electric vehicle infrastructure within Ventura County and its incorporated towns and cities have been surveyed. While local electric vehicle-related building code and ordinance requirements do exist, currently, direct local investment in electric vehicle infrastructure and vehicle program is not significant at the municipal level. We believe that the best way forward to increase local investment in electric vehicles may be:

- To accelerate public fleet electrification through local fleet goals and mandates;

---

[287] http://www.vcapcd.org/grant_programs.htm

[288] AQMD. Incentives & Programs: Carl Moyer Memorial Air Quality Standards Attainment Program. Retrieved from: http://www.aqmd.gov/home/programs/business/carl-moyer-memorial-air-quality-standards-attainment-(carl-moyer)-program

- To accelerate infrastructure deployment through buildout of workplace and public charging at local government sites;
- Development of “reach” building codes, increasing the requirement for parking set-asides and EVSE make-ready infrastructure above current and planned CALGreen code;
- To explore local grassroots and elected leadership support for a potential region-level bond issue that could make available hundreds of millions of dollars for regional electric vehicle infrastructure and electrification initiatives.

Summary of Key Recommendations for Resourcing Ventura County Electric Vehicle Readiness Programs

Careful planning and a collaborative approach to winning competitive grant proposals can substantially increase success in funding Ventura County’s Electric Vehicle Blueprint and related transportation electrification initiatives. In addition, local and regional approaches to increasing transportation electrification resources should be carefully considered. The following are key recommendations for increasing available resources for countywide and regional transportation electrification efforts.

Recommended Actions to Position for Success in Resource Development

- **Recommendation #1: Develop an Electric Vehicle Funding Project Team** to plan for key funding initiatives and to monitor Energy Commission, CARB, and other funding initiatives.
- **Recommendation #2: Identify specific targets of potential investment within the MUD residential sector,** including DC Fast Charge plaza sites that could serve both MUD residents and on-route corridor charging.
- **Recommendation #3: Proactively collaborate with regional stakeholders to develop a Green City planning framework** that could be used both for Electrify America’s Green City funding opportunities, and for potential regional bond issues and public and private sector investment generally. (Preparing for Green City funding opportunities could also help position the region for the California Sustainable Growth Council’s Transformative Climate Communities funding awards.)
- **Recommendation #4: Explore regional partnerships in the freight and port/maritime sectors**. Continue working with the Port of Hueneme, Ventura County APCD, and VCTC to engage the region’s private goods movement operators and build partnerships for grant-funded pilot projects through the AQIP Freight Equipment Advanced Demonstration and Pilot Commercial Deployment Project, and other relevant initiatives.
- **Recommendation #5: Develop an outreach strategy to ensure local fleets, workplaces, MUDs, and residents are aware of first-come, first-served funding** through programs such as HVIP and SCE’s Charge Ready.
- **Recommendation #6: Develop projects serving the region’s low-income areas and Disadvantaged Communities** that lack access to affordable public electric vehicle charging currently (e.g. Fillmore and Santa Paula)

Chapter 11 References

Ambrose, H. Pappas, N. Kendall, A. UC Davis. October 2017. Study *Exploring the Costs of Electrification for California's Transit Agencies.*

AQMD. Incentives & Programs: Carl Moyer Memorial Air Quality Standards Attainment Program. Retrieved from: http://www.aqmd.gov/home/programs/business/carl-moyer-memorial-air-quality-standards-attainment-(carl-moyer)-program

California Air Resources Board (2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons. March

California Air Resources Board (CARB) (2018). Proposed Amendments to the Low Carbon Fuel Standard Regulation and Regulation on Commercialization of Alternative Diesel Fuels. Staff Report: Initial Statement of Reasons. March 6, 2018. Available: https://www.arb.ca.gov/regact/2018/lcfs18/isor.pdf.

California Air Resources Board. (September 21, 2018). *Proposed Fiscal year 2018-2019 Funding Plan for Clean transportation Incentives for Low Carbon Transportation Investments and the Air Quality Improvement Program.*

California HVIP. Eligible Technologies. Retrieved from: https://www.californiahvip.org/eligible-technologies/#your-clean-vehicles

California HVIP. HVIP FY18-19 Funding tables. Retrieved from: https://www.californiahvip.org/wp-content/uploads/2018/11/HVIP-FY18-19-Funding-Tables-11-19-2018.pdf

CARB. LCFS Basics. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/background/basics.htm

CARB. LCFS Data Management System. Retrieved from: https://www.arb.ca.gov/fuels/lcfs/reportingtool/datamanagementsystem.htm#lrt-cbts

Electrify America. California ZEV Investment Plan: Cycle 2. Retrieved from: https://www.electrifyamerica.com/sites/default/files/inline-files/Cycle%202%20California%20ZEV%20Investment%20Plan.pdf

Electrify America. Investment Cycle Planning Overview. Retrieved From: https://www.electrifyamerica.com/our-plan

Electrify America. Our Plan. Retrieved from: https://www.electrifyamerica.com/our-plan

Federal Transit Administration. *Low and No Emission Vehicle Program*. Retrieved from: https://www.transit.dot.gov/funding/grants/public-transportation-innovation-5312

Federal Transit Administration. *Public Transit Innovation*. Retrieved from: https://www.transit.dot.gov/funding/grants/lowno

Gig Car Share. Sacramento Gigs it: All-Electric Car Sharing. Retrieved from: https://gigcarshare.com/sacramento/?gclid=CjwKCAiA4t_iBRApEiwAn-vt-6jfIJZWfQJKDlZZ9IDHnNO9R6k97oNth1QgtF9at3kALonFHDTp3xoCamcQAvD_BwE

Griffo, Paul. (May 31, 2018). SCE Gets Thumbs-Up for Program to Electrify Thousands of Industrial Vehicles. Retrieved from: https://energized.edison.com/stories/sce-gets-thumbs-up-for-program-to-electrify-thousands-of-industrial-vehicles

Internal Revenue Service. *Internal Revenue Service Plug in Electric Drive Vehicle Credit (IRC 30D).* Retrieved from: https://www.irs.gov/businesses/plug-in-electric-vehicle-credit-irc-30-and-irc-30d

Southern California Edison. *Charge Ready Pilot Program Q3/2018 Report.* Retrieved from: https://www.sce.com/sites/default/files/inline-files/CR%20QuarterlyReport_2018%20Q3%20r1%20%281%29.pdf

Southern California Edison. *Charge Ready 2 EV Charging Infrastructure Proposal.* Retrieved from: https://www.edison.com/content/dam/eix/documents/innovation/electric-transportation/charge-ready-2-ev-charging-infrastructure-proposal.pdf

Southern California Edison. *Charge Ready Program Fact Sheet.* Retrieved from: https://www.sce.com/wps/wcm/connect/ff4d5544-c304-495f-9251 372a0f4b6031/4950_SCE_ChargeReadyFactSheet_20160412.pdf?MOD=AJPERES

Chapter 11 Appendix

Funding Agency	Program	Description	Eligible Stakeholders
California Bureau of Automotive Repair's	Consumer Assistance Program	The Consumer Assistance Program enables consumers who meet eligibility requirements to receive either $1,000 (regular) or $1,500 (low-income) to voluntarily retire their operational vehicle from California roadways.	Individual car owners
California Energy Commission	ARFVTP (AB 118)	Provides $100 million annually for alt fuel programs Electric vehicle and infrastructure programs receive 30 percent – 40 percent in annual allocations. 2019-20 funding of $32.7 million for electric vehicle infrastructure, with approximately $10 million likely for MUD Local match of 50 percent is typical, and 25 percent allocation to Disadvantaged Communities	Public agencies, local government, fleets
California Energy Commission	CVRP	Provides $200 million for electric vehicle rebates, including $25 million for low income adders Low-income rebates can be stacked with utility and Air Quality Management District's rebates	Individuals. Single income tax filers making more than $150,000 and joint filers making more than $300,000 are not eligible for the program
California Energy Commission	Enhanced Fleet Modernization Program	Provides $75 million for clean mobility options, including school bus replacement and light-duty equity pilot projects	Fleet operators, school districts
California Energy Commission	Freight Equip. Advanced Demonstration	$55 million for pilot commercial projects, including airport & seaports. Eligible projects include electrification of ground equipment at airports	Ports, Fleet Operators, freight
CARB	HVIP	Provides $125 million in clean truck and bus vouchers on first-come, first-served basis. Includes adders for deployment in Disadvantaged Communities. HVIP also provide up to $20,000+ per vehicle for charging infrastructure	Fleet operators, medium and heavy-duty trucks
CARB	Carl Moyer Program	State supported grant program administrated by the Ventura County APCD that funds incremental costs of engine upgrades. Since 1998, the program has provided funding focused on older heavy-duty diesels with electric, alternative-fuel, or cleaner diesel technologies.	Commercial equipment owners, public agencies
CARB	LCFS	The LCFS program supports the fueling of vehicles in California with alternative fueling sources, including electricity enabling Electric Vehicle Service Equipment providers to generate credits valued between $100 to $185 per $MTCO_2e$ offset by alternative fuel sources.	Electric Vehicle Service Providers. Owners of charging infrastructure

CEC	ARFTVP (AB118)	Distributes approximately $100 million dollars per year for low-carbon vehicle incentives and infrastructure, of which a substantial portion is allocated to electric vehicle initiatives. The AQIP program in turn is supported by the Low Carbon Transportation Program with funds from the state's Cap and Trade Program (also known as the Greenhouse Gas Reduction Fund. The AQIP is designed to accelerate the transition to advanced low carbon freight and passenger transportation with a focus on California's Disadvantaged Communities.	Eligibility varies by funding cycle
CEC	AQIP	The AQIP has provided deployment incentives for electric and zero emissions vehicles through HVIP, as well as loans to assist fleets in diesel modernization projects. The AQIP also provides grants for demonstration and testing of emission reduction technologies, with projects addressing railroads, port vessels, and other applications.	Advanced low carbon freight and passenger transportation with a focus on California's disadvantaged communities.
CEC	CALeVIP	The CALeVIP program provides incentives for the purchase and installation of EVSE at publicly accessible locations throughout California. The program is funded by the California Energy Commission ARFTVP and administrated by the Center for Sustainable Energy. Current funding for CALeVIP is $39 million, with potential for up to $200 million in allocations over the 2019-2021 period. CALeVIP program allocations are typically negotiated directly with regional electric vehicle consortia, including local government and utility partners	Public charging provided by Utilities, Community Choice Aggregators, and Electric Vehicle Service Providers
Electrify America	Investment Program	Cycle 2 California program (2018 - 2021) provides approximately $100 million for Metro Charging, $30 million for Highways, $10 million for residential, $5 million for bus/shuttle, $2 million for rural Level 2, $3 million for ACES, $17 million education & outreach Cycle 3 (2022-24) will likely provide another approximately $40 million for a Green City program that could resemble the current Sacramento program	Public Agencies, CCAs
Federal	IRS Tax Credit	For vehicles acquired after December 31, 2009, the credit is equal to $2,500 for an electric vehicle with at least 5 kilowatt hours of battery capacity, plus an additional $417 for each kilowatt hour of battery capacity in excess of 5 kilowatt hours. The total amount of the credit allowed for a vehicle is limited to $7,500.	Individuals
Federal	U.S. Department of Transportati on LOW-NO Program	provides funding to state and local governmental authorities for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities. Under the federal Surface Transportation Act, $55 million per year is available until fiscal year 2020. The Public Transportation Innovation Program provides funding to develop innovative products and services assisting transit agencies in better meeting the needs of	Transit agencies

		their customers. Grant opportunities are allocated on a discretionary basis	
Foundation	Hewlett	Hewlett is investing in public-private partnerships and public support for policy change on climate, with a largely national focus.	NGO, Utilities
Foundation	Packard Foundation	Packard has invested in low carbon transportation options. Both Packard and Hewlett supported International Council on Clean Transportation work on electric vehicle issues. Packard invested in the regional Baylands restoration bond issue and expressed interest in supporting a regional decarbonization bond.	NGO, Utilities
SCE	Residential Single-Family Rebates	SCE also offered a Charge Ready Home Installation pilot program rebate for households installing electric vehicle charging stations at a single-family residence. As of early 2019, SCE offered residential customers a rebate of $500 or $1,500 toward their out-of-pocket costs for the electrical upgrades and permitting fees necessary for Level 2 electric vehicle charging stations -- but not for the EVSE hardware itself.	SCE residential customers
Southern California Edison	Charge Ready Program	A pilot program currently that provides free installation of some commercial electric vehicle charging stations and a rebate to cover some or all the costs of the charging equipment. Phase 2 seeks to deploy 48,000 new electric vehicle charging ports through the SCE territory as part of a four-year, $760 million program.	SCE commercial customers
Southern California Edison	Fleet Incentives – via “Charge Ready Transportation”	The CPUC recently approved another expansion of the SCE electric vehicle infrastructure support program to include a medium- and heavy-duty fleet support initiative called Charge Ready Transportation. At least 25 percent of the program’s $356 million budget will be dedicated to vehicles operating at ports and warehouses in SCE’s territory.	SCE fleet customers
Ventura County APCD	Old Car Buy Back Program	An alternative to the Customer Assistance Program, The Ventura County APCD old car buy-back program pays up to $1,000 to voluntarily retire a 1997 or older car, pick-up truck, van, or SUV. Funding of this program is limited and is provided on a first-come, first-served basis until current year grant funds are depleted. To qualify for the buy-back program, vehicles must be operational and registered in Ventura County and additional eligibility requirements apply.	Individuals