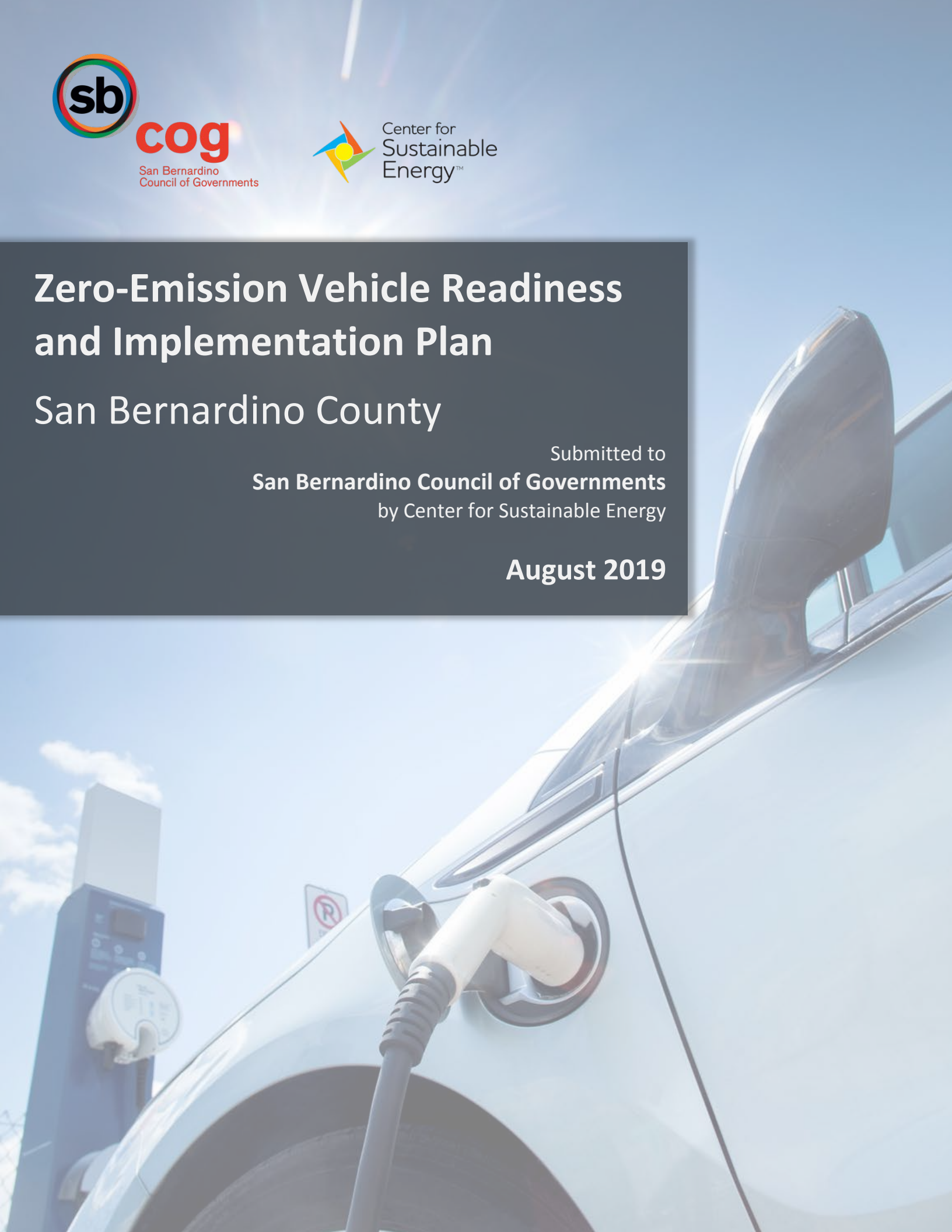

Zero-Emission Vehicle Readiness and Implementation Plan

San Bernardino County

Submitted to

San Bernardino Council of Governments

by Center for Sustainable Energy

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Contents

Appendices

List of Acronyms

Name	Acronym
Alternative and Renewable Fuels and Vehicle Technology Program	ARFVTP
Analytical Hierarchy Process	AHP
California Air Resources Board	CARB
California Capital Access Program - Electric Vehicle Charging Stations	CALCAP-EVCS
California Electric Vehicle Infrastructure Program	CALeVIP
California Energy Commission	CEC
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California Government Codes	CGC
California Governor's Office of Business and Economic Development	GO-Biz
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Nitrogen Oxide	NOX
Plug-in Electric Vehicles	PEV
San Bernardino Council of Governments	SBCOG
San Bernardino County Transportation Authority	SBCTA
Senate Bill	SB

Name	Acronym
South Coast Air Quality Management District	SCAQMD
Southern California Association of Governments	SCAG
Southern California Edison	SCE
Surface Transportation Block Grant Program	STBG
Volkswagen Environmental Mitigation Trust	EMT
Weighted Linear Combination	WLC
Zero Emission Bus	ZEB
Zero Emission Vehicles	ZEV

Executive Summary

Governor Edmund G. Brown Jr.'s Executive Order B-16-2012 tasked the California Energy Commission (CEC) and other state agencies to support benchmarks to bring 1.5 million zero emission vehicles (ZEVs) to California's roads and in conjunction make sure that Californians have easy access to ZEV infrastructure to charge those vehicles by 2025. Further committing to the adoption of ZEVs, Governor Brown signed Executive Order B-48-18 in January 2018, committing to the adoption of five million ZEVs on the road by 2030. To meet state and regional targets for ZEV charging infrastructure investment by 2020 and 2025, the San Bernardino Council of Governments (SBCOG) engaged the Center for Sustainable Energy (CSE) to develop a ZEV Readiness and Implementation Plan (Plan). The Plan accomplished the following goals:

1) Assessed the current ZEV charging infrastructure within San Bernardino County;
2) Provided quantitative analysis and recommendations for additional ZEV infrastructure at public agencies, workplace, destinations, transit stations, and multi-unit dwellings (MUDs) with focus on disadvantaged communities (DACs);
3) Identified implementation actions to promote ZEV and ZEV infrastructure adoption over the next 10 years; and
4) Provided local governments and stakeholders with tools to effectively procure, site, and install ZEV infrastructure; develop a list of potential "shovel-ready" projects in the County.

San Bernardino County has existing ZEVs on the road and existing ZEV fueling infrastructure, but neither have secured wide adoption compared to internal combustion vehicles and fueling infrastructure. Currently, there are 8,095 ZEVs registered with the California Department of Motor Vehicles (DMV) in San Bernardino County. ZEVs encompass two distinct types of vehicle technology: hydrogen fuel-cell electric vehicles (FCEVs) and plug-in electric vehicles (PEVs). Less than 1% of the registered ZEVs in San Bernardino are FCEVs and more than 99% are PEVs. Both types of technology are considered "zero-emission" due to the lack of combustion exhaust generated during their operation. The CEC projects a 554% increase in market demand for ZEV by 2025, requiring heavy buildout of electric vehicle (EV) charging stations within the county's urban centers and rural corridors.

Electric Vehicle Infrastructure

The San Bernardino County region currently has approximately 100 public Level 2 electric vehicle charging stations (EVCS) and 33 public Direct Current fast charging (DCFC) stations. The existing EV charging infrastructure is located primarily in the southwest corner of the county, serving the densely populated San Bernardino County metropolitan area. EV corridor charging is located on the heavily-traveled Interstate (I) 15 and I-10 routes (leading to Las Vegas, Nevada and Phoenix, Arizona), State Route (SR) 62, and parts of United States (U.S.) Route 395. Future fast chargers will be located along I-40.

To meet the expected EV demand projections for 2020 and 2025 (21,894 and 44,846 EVs, respectively), the majority of EV infrastructure should continue to be sited in the heavily populated urban areas of the county. If increases in EV adoption are distributed equally among each of the municipalities, commensurate with their population, the urban region will require a minimum of 40 additional DCFC plugs, and 1,011 additional Level 2 plugs in 2020, and more than 400 new DCFCs and 3,500 Level 2 plugs in 2025. Excluding Tesla Supercharger infrastructure, rural portions of the county will require a minimum of six additional DCFC and 52 Level 2 plugs in 2020, increasing to 23 DCFC and 171 Level 2 plugs in 2025. Projections indicate that unincorporated regions will require up to 19 additional DCFC plugs (79 total DCFC plugs in 2025) and an additional 230 Level 2 chargers (664 total Level 2 plugs in 2025).

San Bernardino County should invest in publicly accessible Level 2 charging infrastructure at public institutions (e.g., city halls, courthouses, parks, schools, etc.), transit sites (e.g., Metrolink stations, future Arrow stations, Park & Ride lots), and within DACs. Because public infrastructure is geographically distributed through the region, siting EV charging infrastructure at these site types will ensure that EV charging infrastructure is available to multiple community stakeholders. Having a regional distribution of EVCS will not only benefit individual EV drivers (i.e., reducing range anxiety) but support visitor and inter-county driving. It will have the added impact of reducing regional greenhouse gas (GHG) emissions.

Siting DCFC along heavily traveled corridors in the urban core and the high desert is recommended to facilitate long-range commuting, visitor travel, and inter-regional driving. Investing in a DCFC network that provides adequate charging (50-mile range) across the County is recommended. Desert destinations, such as Twentynine Palms and Needles, should evaluate siting both Level 2 EVCS and DCFC to meet demands of short dwell (less than one hour) and long-dwell (more than one hour) drivers.

Fuel-Cell Infrastructure

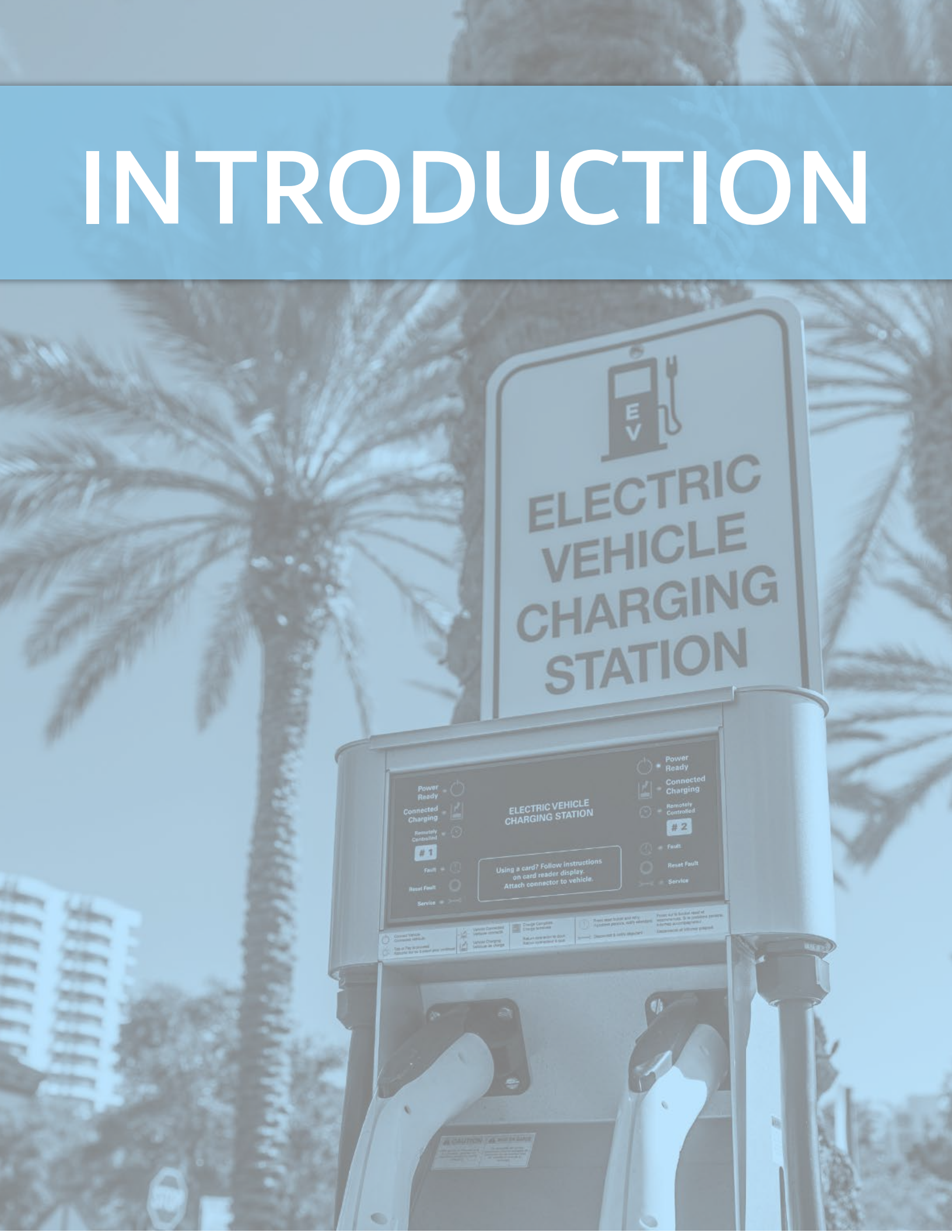
As of writing, there was only one installed FCEV fueling station in San Bernardino County (in Ontario); however, an additional station in Chino is scheduled to open in 2020. Many additional hydrogen refueling stations are operating or planned in Los Angeles and Orange counties. Based on the low number of current FCEV vehicle registrations (64 FCEV) and limited regional FCEV infrastructure, near-term demand for FCEV infrastructure investment should be aligned with the needs of inter-county commuters. Investing in corridor FCEV charging station siting is warranted to ensure that travel to other regions is possible but also to provide drivers from outside the county access to mountain and desert recreation areas and resort destinations (e.g., Las Vegas and Palm Springs). I-15 and I-10 should be evaluated for near-term corridor investment with Barstow and Victorville as targets for FCEV infrastructure based on population growth and proximity to aforementioned corridors.

Implementation Recommendations

This Plan recommends implementation strategies that can be pursued on an ongoing basis, near-term (0-2 years), mid-term (2-5 years), and long-term (5-10 years) intervals. Priority recommendations include developing public/private partnerships, streamlining permitting, identifying and pursing funding/incentives, developing a regional technical advisory service, deploying a marketing/outreach program for ZEV and ZEV infrastructure, and tracking/reporting on Plan progress. A summary of recommended implementation strategies in each timeline is provided in the following table and are dependent upon available funding and resources.

Timeline	Recommendations
Near-term (0–2 years)	• Begin planning for zero emission bus (ZEB) adoptions (large transit agencies) • Streamline permitting and local electric vehicle infrastructure (EVI) ordinances • Prioritize installing DCFC infrastructure to provide County coverage with a 50-mile radius • Develop EVI expert and technical advisory program • EV and EVI outreach and education
Mid-term (2–5 years)	• Incentivize renewables and EV infrastructure • Begin planning for ZEB adoptions (small transit agencies) • Update high-impact EVI project status • Conduct second EV and EVI outreach and education
Long-term (5–10 years)	• Complete transit fleet ZEB conversions (full rollout by 2040) • Examine the potential for adoption of autonomous vehicles and inductive charging

INTRODUCTION



I. Introduction

Project and SBCOG Goals

ZEVs encompass two distinct types of vehicle technology: FCEVs and PEVs. Both types of technology are considered "zero-emission" due to the lack of combustion exhaust generated during their operation.

California currently leads the nation in PEV and ZEV infrastructure goals and deployment over the next decade. In 2012, Governor Edmund G. Brown Jr.'s Executive Order B-16 tasked the CEC and other state agencies to support benchmarks to bring 1.5 million ZEVs to California's roads by 2025. Due to its size and population, San Bernardino County will play a large part in helping the state reach this goal.

San Bernardino County is comprised of 24 cities and multiple unincorporated areas that form a collective association of governments, the San Bernardino County Transportation Authority (SBCTA) and SBCOG. Both agencies foster regional transportation planning and act as the regional planning organization for the county with representation from policy makers consisting of mayors, council members, and county supervisors. They also act as funding agencies for the county's transit systems, which include Metrolink, Morongo Basin Transit Authority, Mountain Area Regional Transit Authority, Needles Area Transit, Omnitrans, and Victor Valley Transit Authority.

SBCOG, in conjunction with CSE, developed this Zero Emission Vehicle Readiness and Implementation Plan (Plan). The Plan places San Bernardino County on a pathway to achieve GHG reduction goals and accelerate the transition of transportation electrification projects in the region. To achieve this, the Plan goals are to:

1. Assess the current ZEV charging infrastructure within San Bernardino County;
2. Provide quantitative analysis and recommendations for additional ZEV infrastructure at public agencies, workplace, destinations, transit stations, and MUDs with focus on disadvantaged communities (DACs);
3. Identify and recommend implementation strategies to promote ZEV and ZEV infrastructure adoption over the next 10 years; and
4. Provide local governments and stakeholders with tools to effectively procure, site, and install ZEV infrastructure; develop a list of potential "shovel-ready" projects in the County.

Plan Structure

Section I: Introduction: Describes the project goals, outlines the structure of the document and recognizes regional contributors to the ZEV Readiness Plan development and deployment.

Section II: Policy Context: Provides a brief introduction to the policies and programs that guide ZEV infrastructure installation and ZEV adoption.

Section III: Existing Conditions: Discusses the current state of ZEV infrastructure and adoption within San Bernardino County, as well as current funding opportunities and incentives. Summarizes current existing barriers to ZEV adoption.

Section IV: Future Needs: Details the additional chargers needed to support the projected increase in the number of vehicles by 2025. Provides potential solutions to existing barriers to ZEV adoption.

Section V: Implementation: Provides recommendations for Plan implementation and provides a deployment schedule for San Bernardino County to meet ZEV goals.

Section VI: Conclusions: Identifies key areas for public agencies to focus/invest resources to support ZEV infrastructure growth.

Appendices and Resources

Contributors

The development of this Plan was possible through input from many stakeholder agencies. As part of the project, an informal working group was assembled, with representatives from the County's 24 municipalities, County of San Bernardino, Mojave Desert Air Quality Management District (MDAQMD), San Manuel Band of Mission Indians, South Coast Air Quality Management District (SCAQMD) and Southern California Edison (SCE). A full listing of agencies who participated in the informal working group is listed below.

Informal Working Group

Agency	
City of Barstow	City of Upland
City of Chino Hills	City of Victorville
City of Colton	City of Yucaipa
City of Fontana	Mojave Desert Air Quality Management District
City of Needles	County of San Bernardino
City of Ontario	Southern California Edison
City of Rancho Cucamonga	San Manuel Band of Mission Indians
City of Rialto	South Coast Air Quality Management District
City of Twentynine Palms	

ZEV Readiness Plan Contributors

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POLICY CONTEXT

II. Policy Context

Over the past 20 years, there have been an increasing number of national and state level policies that have improved and guided the climate for ZEVs. Policy is typically directed at one of two areas: the vehicles themselves or the infrastructure used to fuel them, commonly referred to as EVCS for PEVs and hydrogen fueling stations for FCEVs.

State Policies and Regulations to Promote EVCS Design and Deployment

Federal, state, and local policies can impact the planning and deployment of EVCS; the policies most relevant to California are summarized in Table 1, with additional details in the paragraphs below.

Table 1: Summary of Relevant Policies for EVCS Deployment

Policy	Overview and Key Provisions	Related Policies
CPUC Proceeding R.18-12-006 (initiated by CPUC in 2018)	This California Public Utilities Commission (CPUC) proceeding will oversee the development of rates and infrastructure to promote transportation electrification. R.18-12-006 has the following objectives: • Develop a transportation electrification framework (TEF) to govern the evaluation of utilities' transportation electrification proposals. • Develop cost-effectiveness methodologies. • Identify infrastructure ownership models, particularly for utilities	This proceeding may impact certain aspects of the California Air Resources Board (CARB) Low Carbon Fuel Standard (LCFS) program, particularly with respect to utilities' credit generation activities.
AB 2127 – Statewide Assessment of EV Infrastructure (Ting, Chapter 365, Statutes of 2018)	This bill directs State agencies to prepare statewide assessments of EV infrastructure. The statewide assessment must identify whether sufficient infrastructure exists to support the State's 2025 and 2030 targets to deploy 1.5 million and 5 million ZEVs, respectively. CEC is the lead agency in charge of developing this assessment and will update the assessment every other year.	
Executive Order B-16-2012 (Governor Brown, 2012)	This Executive Order established targets for the deployment of ZEVs and ZEV infrastructure. Specifically, the Executive Order outlines the following targets: • 1 million ZEVs by 2020 • 1.5 million ZEVs by 2025 The Executive Order also directs State agencies to replace 10 percent of fleet vehicle purchases with ZEVs by 2015, and 25 percent by 2020.	
Executive Order B-48-18 (Governor Brown, 2018)	This Executive Order established targets for the deployment of ZEVs and ZEV infrastructure. Specifically, the Executive Order outlines the following targets: • 5 million ZEVs in California by 2030	This Executive Order builds off Executive Order B-16-2012.

Policy	Overview and Key Provisions	Related Policies
	• 250,000 ZEV charging stations by 2025, including: o 10,000 DC fast charging stations o 200 hydrogen refueling stations	
AB 1082 and AB 1083 (Burke, Chapter 638, Statues of 2017) (Burke, Chapter 637, Statutes of 2017)	These bills authorized the investor-owned utilities to propose EV charger pilot programs at schools and state parks and beaches. As of February 2019, there has been approximately $56 million in proposed utility funding for EV charger pilot programs. None of these programs have been approved by the CPUC as of yet.	
SB 350 – Clean Energy and Pollution Reduction Act (SB 350, de León, Chapter 547, Statues of 2015)	This bill directed the investor-owned utilities to submit transportation electrification (TE) proposals to the CPUC. All the investor-owned utilities have submitted TE proposals to the CPUC. As of February 2019, nearly $1 billion has been approved for these proposals. These proposals include programs relating to residential chargers, DCFCs, fleet modernization, grid integration, and port electrification.	
SB 375 – Sustainable Communities Act (SB 375, Steinberg, Chapter 728, Statues of 2008)	This bill establishes GHG reduction targets for the transportation and land use sectors. This bill requires CARB to establish regional GHG emissions reductions targets from passenger vehicles. These targets must be updated every eight years. Currently, targets have been established for 2020 and 2035 for each region with a metropolitan planning organization (MPO).	
Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) (AB 8, Perea, Chapter 401, Statues of 2013) (AB 109, Núñez, Chapter 313, Statutes of 2008) (AB 118, Núñez, Chapter 750, Statutes of 2007)	The Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) was established to provide funding for alternative fuels and transportation technologies. The program has an average annual budget of approximately $100 million a year. The ARFVTP program funds the following goals: • The development of alternative and renewable fuels (including electricity, hydrogen, and natural gas). • The expansion of fueling infrastructure and equipment. • The advancement of vehicle technologies. • The development of workforce training programs.	
Low Carbon Fuel Standard (LCFS) (overseen by CARB, and developed in response to AB 32, Nunez, Chapter 488, Statutes of 2006)	The LCFS program requires providers of transportation fuels to gradually reduce the carbon intensity of these fuels. The LCFS also includes a crediting system, whereby producers whose transportation fuels are below the carbon intensity requirements can generate and sell credits to producers whose fuels are above the requirements. In 2018, modifications to the LCFS program allowed owners of DCFC to generate additional credits based on the electrical	

Policy	Overview and Key Provisions	Related Policies
	capacity of their charging infrastructure. This provision is meant to incentivize the generation of electricity as a transportation fuel.	
Volkswagen Settlement Consent Decrees (issued by the U.S. District Court, Northern District of California)	As a result of Volkswagen's Settlement with the Federal Government for cheating on emissions testing, Volkswagen was required to invest $800 million over ten years to support the adoption of ZEVs in California. Volkswagen's investment plans must be submitted to and approved by CARB.	
Zero-Emission Vehicle Program (Charge Ahead California Initiative) (SB 1275, de León, Chapter 530, Statues of 2014)	CARB's Charge Ahead California Initiative was established to help place into service at least one million zero- and near-zero emission vehicles in California by January 1, 2023. Through the Charge Ahead California Initiative, CARB is required to: • Develop a plan every three years to forecast funding necessary to achieve ZEV deployment targets; • Modify the Clean Vehicle Rebate Project to increase participation, ensure eligibility is based on income, and phase down rebates over time; and • Establish programs to benefit disadvantaged and low-income communities.	
AB 465 – Parking Space Regulations for Plug-in Electric Vehicles (AB 465, Butler, Chapter 274, Statutes of 2011)	This bill requires that parking spaces specifically designated for parking and charging PEVs must only be inhabited by PEVs in the process of charging.	This requirement is found in California Vehicle Code Sections 22511 and 22511.1.
SB 1016 – EVCS Policies for Multi-Unit Dwellings (Allen, Chapter 376, 2018)	This bill prevents multi-unit dwellings (like apartments and condominiums) from prohibiting the installation or use of EVCS in a homeowner's designated parking space. Reasonable restrictions can be placed on the installation of EVCS, but these restrictions cannot increase the cost or decrease the efficiency of the EVCS.	This requirement is found in California Civil Code Sections 4745 and 4745.1.
AB 2565 and SB 880 – EVCS Policies for Residential and Commercial Renters AB 2565 (Muratsuchi, Chapter 529, 2014) & SB 880 (Corbett, Chapter 6, 2012	SB 880 prevented any common interest developments (like apartments or condominiums) from prohibiting the installation or use of EVCS. AB 2565 expanded on SB 880 by requiring the lessor of common interest development to approve written requests from a lessee to install EVCS at a designated parking space in qualified properties. The lessee of the parking space is responsible for the cost of installation and maintenance of EVCS, as well as any electricity consumption charges.	The AB 2565 requirements are found in California Civil Code Sections 1947.6 and 1952.7. The SB 880 requirements are found in Sections 1353.9 and 1363.07.
SB 454 – Open Access Requirements for EVCS (SB 454, Corbett,	This bill mandated that EVCS service providers not charge a fee or membership for use of public charging stations. In addition, providers must: • Disclose payment charges for using public EVCS at point of sale;	CARB is currently considering adopting interoperability billing standards for EVCS through the Standards

Policy	Overview and Key Provisions	Related Policies
Chapter 418, Statutes of 2013)	• Allow at least two payment options; and • Disclose the geographic location, fee schedule, payment methods, and network roaming charges to the National Renewable Energy Laboratory.	Rulemaking.
AB 1236 – Local Permitting Ordinances for EVCS (AB 1236, Chiu, Chapter 598, Statues of 2015)	This bill required cities or counties of a certain size to adopt an ordinance that develops a streamlined permitting process for EVCS. Cities and counties were required to coordinate with local fire department and relevant permitting entities.	

ZEV Vehicles

Historically, one of the largest barriers to EV adoption was the price premium associated with buying a ZEV over an internal-combustion vehicle. To combat this, in 2010, the Internal Revenue Service (IRS) implemented Code Section 30D, which offers a national-level tax credit for the purchase of a plug-in hybrid, battery-electric, or fuel-cell-electric vehicle, set to sunset on a per-manufacturer basis as each manufacturer sells 200,000 cumulative eligible vehicles in the United States.

In 2012, California Governor Edmund G. Brown Jr. set a mandate for one and a half million ZEVs to be on the road by 2025. This mandate was supplemented in 2018 by Executive Order B-48-18, which set a goal of five million ZEVs on California roads by 2030. Additionally, several bills, Assembly Bill (AB) 32, AB 197, and Senate Bill (SB) 32, have been adopted to reduce statewide GHG emissions. With the transportation sector contributing over 40% of GHG emissions in California, ZEVs are an integral component of meeting GHG emission reduction goals.

Charging Infrastructure

Electric Vehicle Charging Stations

As part of Governor Brown's 2018 ZEV mandate, the state of California has set a statewide goal for 250,000 EVCS by 2025. Throughout the state, critical stakeholders are working to incentivize and install stations to meet that goal. The state's three largest utilities – Pacific Gas and Electric (PG&E), SCE, and San Diego Gas and Electric (SDG&E) – all offer some form of financial support to potential site hosts who are interested in installing EV charging on their properties.

Fuel-Cell Electric Vehicles and Infrastructure

In January of 2018, Governor Edmund G. Brown Jr. signed Executive Order B-48-18, boosting the use of ZEVs including hydrogen refueling infrastructure in California. Part of this order calls for a hydrogen station network development target of 200 hydrogen fueling stations by 2025 with proposed funding activities totaling $20 million

In 2018, the signing of Executive Order B-48-18 set a goal of 5 million ZEVs on California roads by 2030…the state of California has set a [goal for] 250,000 electric vehicle charging stations by 2025.

in annual awards to meet this goal.

The California Fuel Cell Partnership (CaFCP) members recently published an ambitious shared vision for the potential growth of the industry to 2030. In their vision, the targets of the Executive Order are a stepping stone on the path to one million FCEVs on the road by 2030, supported by a network of 1,000 hydrogen stations. Accomplishing these goals in such a short period of time requires a significant change in the pace of developments going forward, along with combined resolve and commitment from all stakeholders.

DMV registration data identifies FCEV adoption in San Bernardino County at roughly 0.01% of registered autos with 62 FCEVs registered among more than 1.3 million registered light-duty vehicles. With CaFCP's ambitious target in mind and if the county wishes to accommodate the projected FCEV ownership goal as well as additional commuter demand, a potential range of increased FCEV infrastructure would include between 10 and 50 new hydrogen stations by 2030.[1] Currently there are more than 3,000 FCEVs in Los Angeles, Orange, and Riverside counties. Growth projections from the CARB estimate more than 23,600 FCEVs by 2021 with potential growth to more than 47,000 by 2024.[2]

As of August 2019, only one hydrogen fueling station is located in San Bernardino County, however the station is not operable as of the date of this Plan, September 2019. Another hydrogen fueling station is scheduled to open in Chino by 2020. Additional stations are located nearby but outside of the County, in Riverside County. With many hydrogen refueling stations planned and in operation in Los Angeles and Orange counties, FCEVs are a potential solution for regional commuters. Additionally, FCEV drivers from these counties could be expected to travel in San Bernardino County to mountain and desert recreation areas, as well as resort destinations like Las Vegas and Palm Springs. I-15 is a good target for FCEV charging infrastructure based on travel demand to/through Barstow and Victorville. These cities are not only the most logical fueling points along this corridor but have also experienced population growth of 1-6% year over year for the past ten years. I-10 East is another major corridor that supports intra/inter-regional travelers and should be evaluated for FCEV charging infrastructure.

Building Codes

The 2016 California Green Building Standards Code (CALGreen Code), effective since January 1, 2017, identifies mandatory and voluntary codes for EV infrastructure in buildings and parking lots within California. These codes establish construction requirements for new residential and commercial buildings.

[1] Assuming current San Bernardino population (2.157 million as of June 2019) to be 5% of California population (39.56 million as of June 2019), proportional allocation of FCEV stations would equal either 5% of the 2025 target from executive order B-48-18 or 5% of the CaFCP 2030 target.[1]

[2] https://ww3.arb.ca.gov/msprog/zevprog/ab8/ab8_report_2018_print.pdf

- **Section 4.106.4 of the CALGreen Code (New Residential)** describes EV charging guidelines for new residential construction, detailing parking space dimension designations and electricalconfigurations in accordance with California Electrical Code, Article 625. New single- and two-family dwellings must have raceways installed that accommodate 208/240-volt circuits for every unit, while 3% of parking spaces at MUDs with 17 or more units must accommodate 40-amp circuits (California Building Standards Commission, 2016). Service or subpanels with EV charging circuits must be marked as "EV CAPABLE" to support future EV charging. This code is being updated for 2020 to require that 10% of spaces at new MUDs be able to accommodate 40-amp circuits.
- **Section 5.106.5.3 (Commercial)** provides codes for new construction at commercial locations, which provides electrical configuration and parking space requirements for EV charging spaces. Newly designated EV charging spaces are required to support 40-amp circuits and mark EV-capable panels for future spaces.
- **Section A5.106.5.3 (commercial)** introduces additional tiers for new commercial development, which is summarized in Table 2.

Table 2: CALGreen Building Code EV Requirements

Total Number of Parking Spaces	5.106.5.3 Mandatory Commercial Requirements	A5.106.5.3 Optional Tier 1 Requirements	A5.106.5.32 Optional Tier 2 Requirements
0-9	0	0	1
10-25	1	2	2
26-50	2	3	4
51-75	4	5	6
76-100	5	7	9
101-150	7	10	12
151-200	10	14	17
201 and over	6% of total spaces	8% of total spaces	10% of total spaces

Source: California Building Standards Commission, 2016

Regional Plans

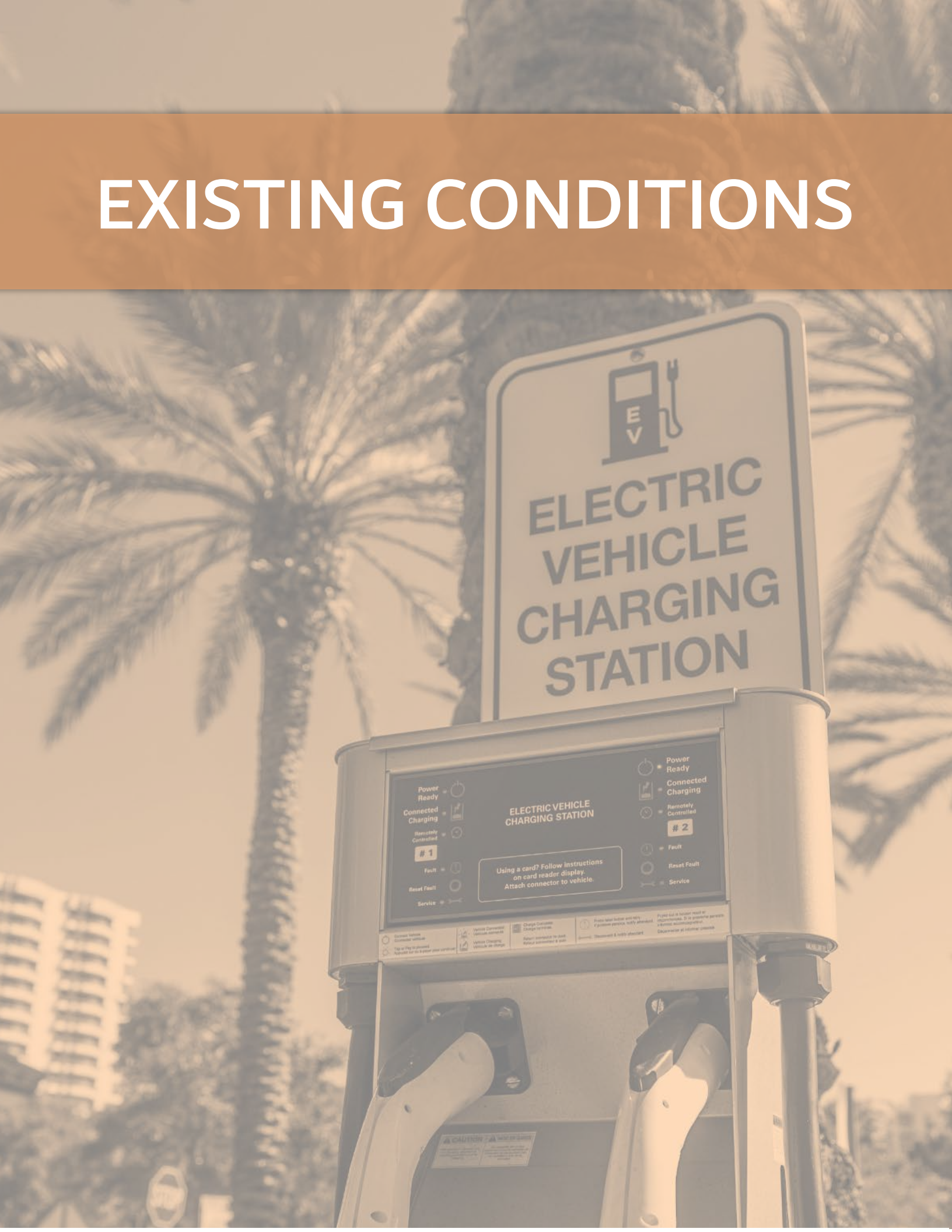
In 2016, the Southern California Association of Governments (SCAG), which includes San Bernardino County, adopted the 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy (the Plan), "a long-ranging visioning plan [balancing] future mobility and housing needs with economic, environmental, and public health goals" (SCAG, 2016). The Plan supports improving EV adoption and infrastructure installation by proposing collaborative work with its municipalities and other stakeholders to develop a strategy to deploy and implement a regional charging network.

The Plan seeks to fulfill the goals of several higher-level California Government Codes (CGCs) related to transportation, including the following:

- Section 65080(b) (2)(B)(vii): "Set forth a forecasted development pattern for the region, which, when integrated with the transportation network, and other transportation measures and policies, will reduce the greenhouse gas emissions from automobiles and light trucks to achieve… the greenhouse gas emission reduction targets approved by the state board."
- Section 65080(b) (2)(E)(i): "Outreach efforts to encourage active participation of a broad range of stakeholder groups in the planning process, consistent with the agency's adopted Federal Public Participation Plan, including, but not limited to, affordable housing advocates, transportation advocates, neighborhood and community groups, environmental advocates, home builder representatives, broad-based business organizations, landowners, commercial property interest, and homeowner associations."
- Section 65080(b) (2)(E)(ii): "Consultation with congestion management agencies, transportation agencies, and transportation commissions."
- Section 65080(b) (2)(F): "In preparing a sustainable communities strategy, the metropolitan planning organization shall consider spheres of influence that have been adopted by the local agency formation commissions within its region."

This ZEV Readiness and Implementation Plan provides a concrete, actionable path to achieve the sustainable transportation goals outlined in the 2016-2040 Regional Transportation Plan and the directive issued by the State of California.

EXISTING CONDITIONS



III. Existing Conditions

The following Section inventories the current conditions within San Bernardino County that impact ZEV infrastructure planning, siting and operations. Specifically, it discusses the unique geographic and demographic characteristics of the Region and discusses the existing number of EVs and EVCS.

County Characteristics

Geography and Transportation Context

San Bernardino County is the largest county in the United States. It covers more than 20,000 square miles of urban, mountain, and desert land between Los Angeles in the southwest, Ridgecrest in the northwest, and the California-Nevada border to the east. According to California Department of Finance E-1 population estimates, the County had a population of 2,155,590 people in 2017, making up nearly 5.5% of California's statewide population. More than 36% of county residents live in the urban cities of Fontana, Ontario, Rancho Cucamonga and San Bernardino. Fourteen percent of the population is dispersed among small, unincorporated regions within the county. Figure 1 depicts the county and its population distribution and Table 3 identifies population by City.

Figure 1: San Bernardino County cities, highways, and national parks.

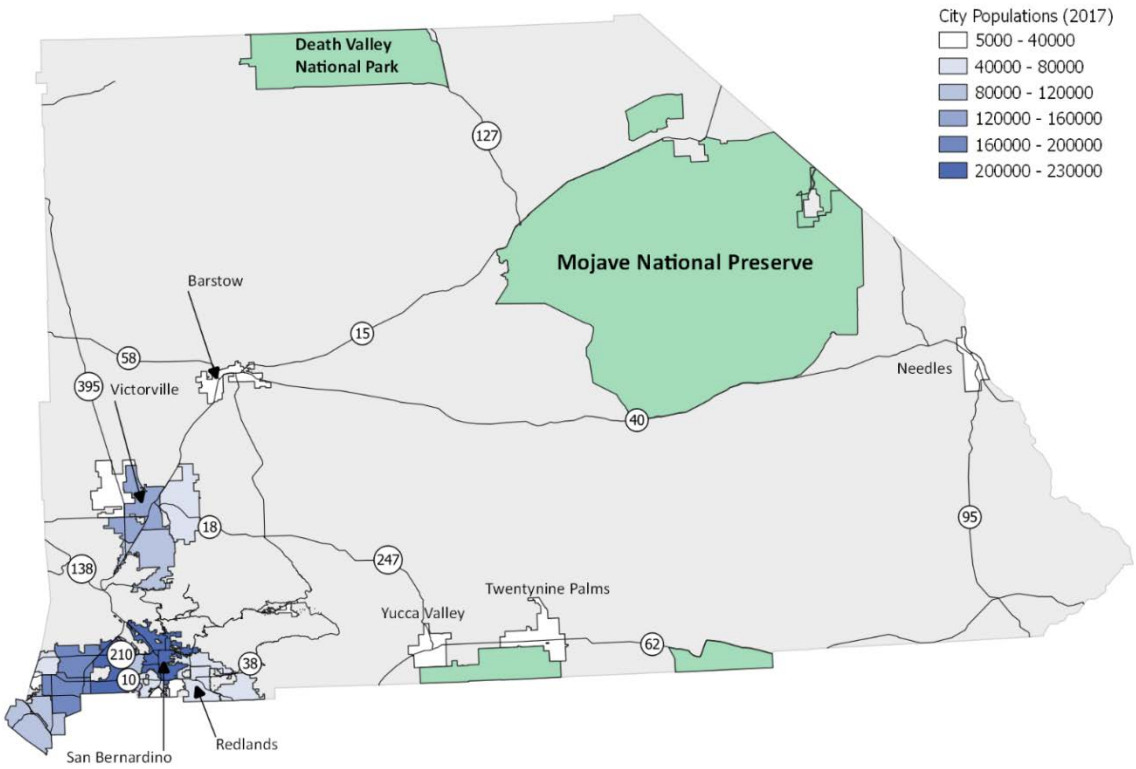


Table 3: Population by City within San Bernardino County (listedby population count)

City	Population Count as of January 1, 2019	Population Percentage	Classification
Needles	5,085	0.23%	Rural
Big Bear Lake	5,461	0.25%	Rural
Grand Terrace	12,654	0.58%	Urban
Yucca Valley	22,050	1.01%	Rural
Barstow	24,150	1.10%	Urban
Loma Linda	24,335	1.11%	Urban
Twentynine Palms	28,958	1.32%	Rural
Adelanto	35,136	1.60%	Rural
Montclair	39,563	1.80%	Urban
Colton	54,391	2.48%	Urban
Yucaipa	54,844	2.50%	Urban
Highland	55,778	2.54%	Urban
Redlands	71,839	3.28%	Urban
Apple Valley	73,464	3.35%	Urban
Upland	78,481	3.58%	Urban
Chino Hills	84,364	3.85%	Urban
Chino	89,829	4.10%	Urban
Hesperia	96,362	4.40%	Urban
Rialto	107,271	4.89%	Urban
Victorville	126,543	5.77%	Urban
Ontario	178,268	8.13%	Urban
Rancho Cucamonga	179,412	8.18%	Urban
Fontana	212,078	9.67%	Urban
San Bernardino	219,233	10.00%	Urban
Unincorporated Area	312,654	14.26%	Unincorporated
Total Population	**2,192,203**	**100.00%**	

Source: California Department of Finance, 2019

The County's eastern half, which shares a border with both Arizona and Nevada, is defined primarily by the sparsely-populated Mojave Desert. Cities and towns such as Needles, Twentynine Palms and Yucca Valley serve as popular jumping-off points for visitors to Joshua Tree National Park and the Mojave National Preserve. Barstow, sitting at the confluence of I-15 and I-40, serves as a connection point between California's Central Valley, Kingman, Arizona (AZ), Los Angeles megaregion, and Las Vegas, Nevada (NV). Several major highways cross the region, including I-15 and I-40, U.S. Route 395 (connecting the region to the Sierra Nevada Mountains), SR-62 (connecting to Joshua Tree National Park), and SR-18, connecting Victorville to Palmdale.

The San Gabriel Mountains separate metropolitan San Bernardino from the Mojave Desert, and contain numerous opportunities for outdoor recreation: ski resorts, the San Bernardino National Forest, and

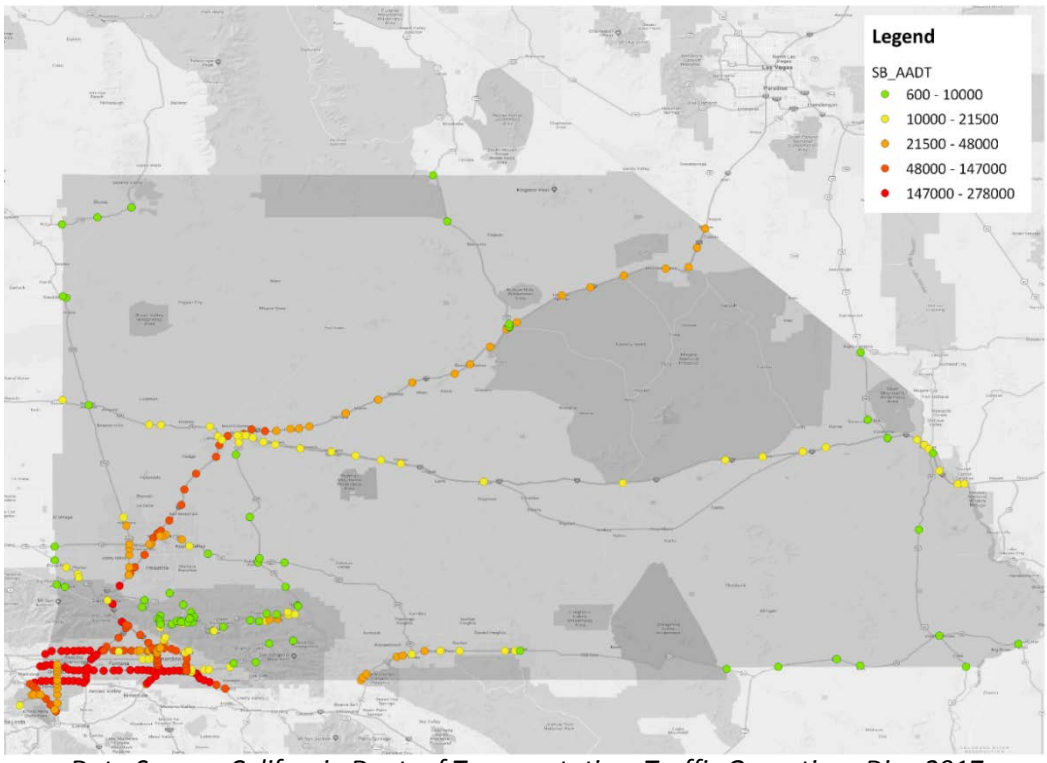
several reservoirs. Major highways traversing the region include I-15 and I-215. SR18, SR-38, SR-138 and SR-330 connect the mountain resorts of Big Bear, Lake Arrowhead, and Running Springs to the Inland Empire.

San Bernardino County's extreme southwest corner includes a portion of the region colloquially known as the Inland Empire. This relatively dense urban area between Orange County, Los Angeles County, the foothills of the San Gabriel Mountains, and the Mojave Desert includes the county seat of San Bernardino and contains most of the county's population.

Due to San Bernardino County's location between the Los Angeles and Las Vegas urban areas and its numerous opportunities for recreational activities, its highways and interstates see significant use. I-10 and SR-60 serve as major arterial routes for commuters between San Bernardino County and the Los Angeles metropolitan area, with average annual daily traffic counts of more than 275,000 vehicles along the Los Angeles-San Bernardino Border on I-10, and 219,000 vehicles on SR-60 (Caltrans, 2019). I-15 is the most direct route between the Southern California region and the resort town of Las Vegas, NV, and on average sees 44,000 vehicles per day at the California-Nevada border. As seen in Figure 2, other high-traffic routes include SR-62, which serves both northern entrances to Joshua Tree National Park, and I-40, a major arterial between Lake Havasu and the Los Angeles basin.

At present, six bus lines and a single rail line serve the San Bernardino Valley. Omnitrans provides bus service within the primarily urban southwestern portion of the County, ranging from the western border in Chino Hills to Yucaipa, and from the Riverside County line to just north of the SR-210 corridor. Foothill Transit also operates within this area, with service to Los Angeles and Orange counties. The Metrolink Commuter Rail System has two eastern termini at the San Bernardino Downtown station: one connects to the Los Angeles region, the other links riders to Riverside, Orange, and San Diego Counties. Mountain Transit operates in the mountains separating the urban region from the desert communities, serving Big Bear Lake, Crestline, Lake Arrowhead and Running Springs. The High Desert regions are served by Victor Valley Transit Authority in the north, and the Morongo Basin Transit Authority in the east. Needles Area Transit provides service within the border town of Needles. Omnitrans alone serves roughly 13 million passenger trips annually. Providing opportunities for EV drivers to charge can further reduce the carbon intensity of these individual trips by electrifying the first and last miles of these trips at the stations (passenger trips between the station/depot and home) and encourage further adoption of electric vehicles within the region to bolster the County's contribution toward state goals.

Figure 2: Caltrans Annual Average Daily Traffic (AADT) Count within the San Bernardino County Region.



Data Source: California Dept. of Transportation, Traffic Operations Div., 2017

Demographics

Using data from the 2013-2017 American Community Survey Five-Year Estimates, more than 70% of San Bernardino County residents commuted outside of their residence city for work, with a mean travel time of approximately 31 minutes. More than three-quarters of workers at a county level drove themselves to work. However, it should be noted that there are significant differences in commuting patterns between cities in the County's urban core; those in the suburbs; and those in the region's High Desert. While residents of the county seat of San Bernardino displayed a tendency to work outside the city, this was seen at an even stronger level in Victorville, which sits on the northern side of the San Gabriel Mountains. Moving further into the desert with Barstow and Twentynine Palms, significantly fewer residents work outside of their cities of residence.

Data in Table 4 and **Figure *2*: Caltrans Annual Average Daily Traffic (AADT) Count within the San Bernardino County Region.** Figure 2 suggest that a significant number of commuter trips originate within the Los Angeles-Orange-San Bernardino County region and from the Barstow-Hesperia area into the Los Angeles Basin. Assuming long commutes from urban to suburban regions of San Bernardino are required by many residents, investing in workplace EVCS within the urban cores and siting direct DCFC infrastructure along major travel corridors and arterial highways is advised to provide adequate coverage.

Table 4: San Bernardino County Commute Statistics (sorted in descending order of mean travel time)

	Victorville, CA	San Bernardino County, CA	San Bernardino City, CA	Barstow, CA	Twentynine Palms, CA
Representative Area	Suburban	County	Urban	Rural	Rural
Mean Travel Time to Work (minutes)	34.7 minutes	30.9 minutes	27.8 minutes	22.2 minutes	15.8 minutes
Worked outside place of residence	67.0%	70.4%	65.4%	45.6%	18.7%
Drove Alone to Work	77.8%	78.9%	74.8%	71.7%	65.6%

Source: United States Census Bureau American FactFinder

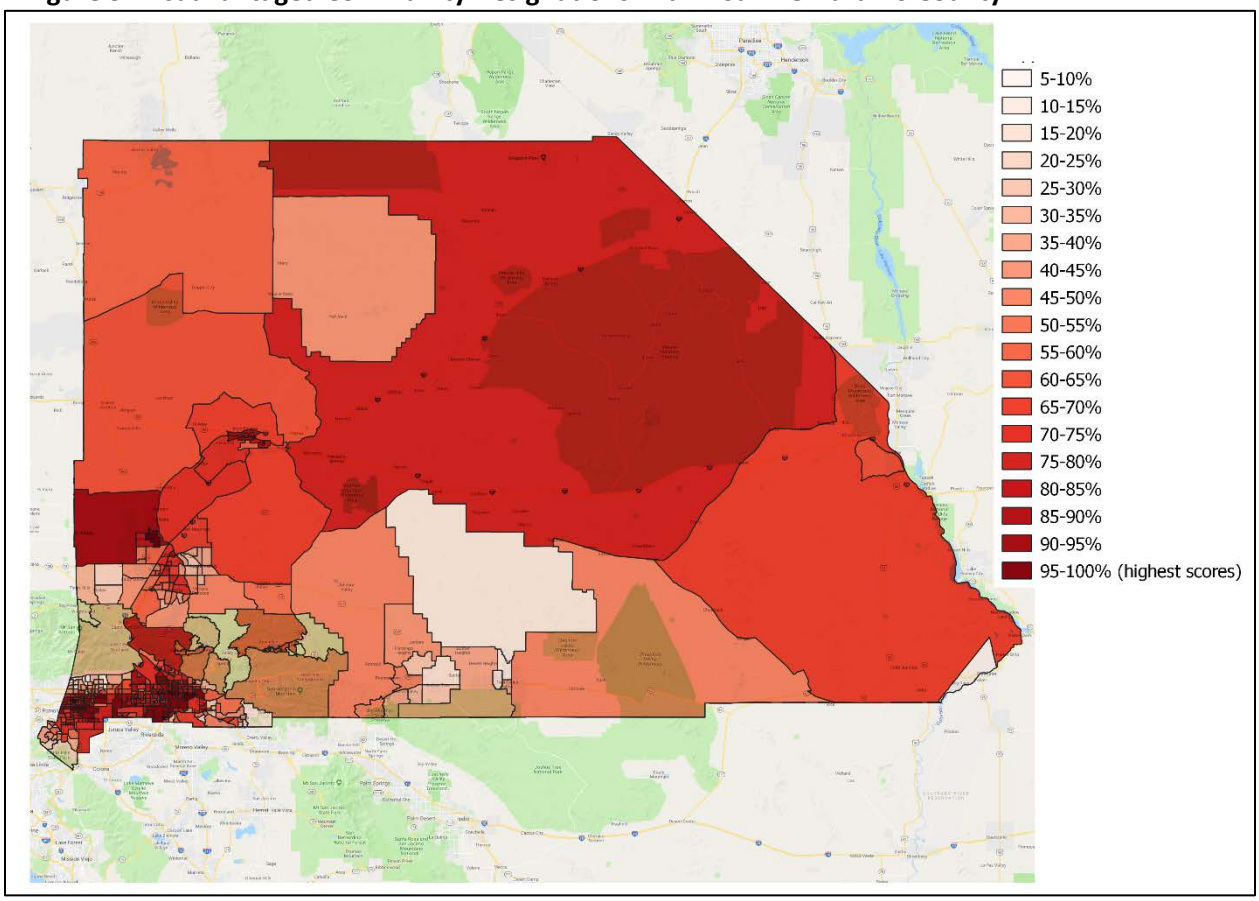
Disadvantaged Communities

San Bernardino County is challenged by poor air quality. Compared to the statewide average, San Bernardino County has a higher proportion of DAC census tracts; communities disproportionately burdened by pollution. According to the California Communities Environmental Health Screening Tool (CalEnviroScreen), 42% of the County's census tracts are DACs, compared to 25% statewide. Per the California Environmental Protection Agency (CalEPA) website, DACs in California are specifically targeted for investment of proceeds from the state's cap-and-trade program. These investments are aimed at improving public health, quality of life and economic opportunity in California's most burdened communities while simultaneously reducing pollution that causes climate change.

42% of San Bernardino County's census tracts are DACs…CalEPA provides specific direction to provide funding for projects which improve public health and reduce emissions in these areas.

Figure *3* illustrates the geography of these DACs; any community scoring over 75% is classified as a DAC by CalEnviroScreen and the CalEPA.

Figure 3: Disadvantaged Community Designations within San Bernardino County.



Data Source: CalEnviroScreen 3.0, 2019

Electric Utility Service

San Bernardino County electricity is serviced by six utilities. A brief description of each is provided below.

- Southern California Edison
    - Southern California Edison (SCE) has been serving the communities of Southern California for over a century with reliable electric power. With a customer base of broadly 14 million people, they offer an option to subscribe to a 'green rate' for renewable energy, as well as a history of providing support for electric vehicles and charging infrastructure. Currently, SCE is awaiting approval from the California Public Utilities Commission (CPUC) to provide $760 million in EV infrastructure funding.

- Bear Valley Electric
    - Bear Valley Electric is a small electric service serving Big Bear Lake, Baldwin Lake, Sugarloaf and the surrounding communities comprising a total of about 23,000 customers. Their supply mix includes 29% generation from renewable sources, including the use of renewable energy credits, at about 3.39 megawatts (MW). The utility has been approved to offer an EV incentive program beginning in Summer 2019, which will offer to cover the cost of infrastructure installation for Level 2 charging at visitor-serving businesses within its service territory. This includes sites such as restaurants, grocery stores, retail, and hotels. Prospective site hosts must agree to host their stations for 10 years, fund the charger units themselves, and maintain their stations on an approved network for a minimum of two (2) years. Hosts will receive a special EV Time-of-Use rate for charger operation, and will be able to leverage exclusive EV-only marketing channels.
- Colton Electric Utility
    - Colton Electric is the oldest utility in San Bernardino County, beginning service in 1887. Today with their own powerplant, five substations, and the entire electric infrastructure within the City of Colton, they provide electricity to approximately 16,000 residential and 2,500 commercial and industrial customers.
- Needles Electric Department
    - The City of Needles formed its Electric Department after purchasing the Needles Public Utility Authority from CP National in 1991. The Needles Electric Department currently does not have any programs related to electric vehicles or charging infrastructure.
- Rancho Cucamonga Municipal Utility
    - The city of Rancho Cucamonga, with a population of just under 180,000, is partially serviced by a local municipal utility. Covering more than 900 businesses in the southeastern region of Rancho Cucamonga, Rancho Cucamonga Municipal Utility offers customers several rebate and incentive programs such as an energy efficiency program, a renewable energy program, a new development program, and for commercial customers a direct savings program and an Electric Vehicle Commercial Charger Rebate program.
- Victorville Municipal Utilities Services
    - The Victorville Municipal Utility services residential and commercial customers, along with the Foxborough Industrial Park and the Southern California Logistics Airport. The Utility runs an Energy Efficiency Program that sets parameters for customers to receive incentives and rebates in a few categories including energy audits, lighting incentives, construction incentives, customer energy efficiency incentives, city facilities, and utility-side projects. Funding for these programs comes from the Public Purpose Program surcharge billed to customers. The Utility currently does not offer special incentives or rebates for electric vehicles or charging infrastructure.

ZEV Presence in San Bernardino County

Electric Vehicle Deployment

According to the Alliance of Automobile Manufacturers, there were 49,765 Battery Electric Vehicles (BEVs) and 45,107 plug-in hybrid electric vehicles (PHEVs) sold in California in 2017, an increase from 38,861 and 34,933 in 2016, respectively. Overall, the deployment of EVs in the State of California has steadily increased since 2011 and is expected to grow at an even faster rate from 2018 to 2025. As more EV models are released and as the deployment of charging infrastructure increases, residents will have more incentive to purchase EVs. Table 5 shows the growth of the California EV market between 2011 and 2017.

Table 5: PHEVs and BEVs Sold in California (2011 – 2017)

Year	PHEV	PHEV%	BEV	BEV%	Annual PEV Sales	PHEV:PEV ratio
2011	1,656	1%	5,062	3%	6,718	0.25
2012	13,971	8%	5,160	3%	19,131	0.73
2013	17,512	10%	20,943	11%	38,455	0.46
2014	29,797	17%	28,749	16%	58,546	0.51
2015	27,645	16%	33,945	19%	61,590	0.45
2016	34,993	21%	38,861	21%	73,854	0.47
2017	45,107	26%	49,765	27%	94,872	0.48
Total	**170,681**	**100%**	**182,485**	**100%**	**353,166**	**0.48**

Source: Alliance of Automobile Manufacturers, 2019

As of January 1, 2018, there were 8,095 ZEVs registered with the California DMV in San Bernardino County. Less than 1% of the registered ZEVs were fuel cell vehicles. 62% of the registered ZEVs were PHEVs, and 37% were BEVs.

Table 6: San Bernardino Vehicle Registrations by Fuel Type (sorted in descending number of registered vehicles)

Vehicle Fuel Type	Number of Registrations	% of Total Registrations
Gasoline	1,405,052	86.3%
Ethanol	103,257	6.3%
Diesel	76,244	4.7%
Hybrid Gas	32,032	2.0%
Plug-in Hybrid	**5,014**	**0.3%**
Battery Electric	**3,019**	**0.2%**
Other Fuel Types*	3,310	0.2%
Fuel Cell	**62**	**0.0%**
Total	**1,627,990**	**100.0%**

*Aggregate registration totals for compressed natural gas/natural gas, methanol, propane, diesel hybrid, and butane fuel types. *Source: California Department of Motor Vehicles, 2018*

Hydrogen Fuel-Cell Vehicles

Overview of FCEVs

Fuel-cell electric vehicles (FCEVs) are powered by the most abundant element in the universe: hydrogen. They have many advantages over gas-powered vehicles, like better miles per gallon (mpg) (more than 50 mpg) and fast fueling (3-7 minutes for passenger vehicles).

Although a fuel-cell vehicle runs on electricity, it does so differently than battery-powered or plug-in hybrid vehicles. A fuel-cell "engine" includes numerous fuel-cell stacks that use hydrogen gas from the vehicle's tank and oxygen from the air and through a chemical reaction combine to create electricity. The energy generated from that chemical reaction is then transferred to the electric motor to power the car. The byproduct of this reaction is harmless water vapor that is emitted from the tailpipe.

The vehicle's tank is filled with hydrogen gas, pressurized to either 35 or 70 megapascals (MPa), roughly 5,000-10,000 pounds per square inch (psi) depending on the make and model. The typical driving range is between 300-400 miles per full tank. In terms of safety, the hydrogen tanks are much stronger than typical gasoline fuel tanks and undergo rigorous testing to validate the structural integrity of the tanks under extreme conditions. The fuel cell stack and high-voltage battery pack in FCEVs pose no additional risks over a conventional gas-powered vehicle.

The benefits of FCEVs are comparable to those of BEVs including zero tailpipe emissions, reduced maintenance compared to gas cars, and the availability of incentives such as California's Clean Air Vehicle decal allowing single-occupancy access to the carpool/diamond lane and a state-level financial incentive from the Clean Vehicle Rebate Project.

Considerations for FCEV Infrastructure Permitting and Deployment

Hydrogen fueling stations are high-pressure gaseous storage facilities. The on-site technologies consist primarily of high-pressure hydrogen storage (roughly 15,000 psi), hydrogen compression, and hydrogen dispensing for consumer and fleet vehicles. While hydrogen can be generated on-site most stations do not have this capability because it requires additional cost, permitting, operational management, and safety standards. Most stations do not generate hydrogen on-site but have infrastructure to store and dispense fuel that is delivered to the site by a qualified transporter.

Initial pre-application outreach for new hydrogen fueling stations should consider how a station will be supplied with hydrogen, on-site traffic flow and aesthetics, as well as engagement with local utilities. Part of this outreach often requires property and neighborhood notification and potentially an appeals process, however other California cities have faced little if any opposition. With respect to environmental oversight, it is important to note that although new hydrogen fueling stations will trigger the California Environmental Quality Act (CEQA) review, the addition of hydrogen to an existing gasoline station does not trigger CEQA review. Hydrogen station development heavily involves the California Fire Code and National Fire Protection Association (NFPA). The permitting process involves regulatory review from the planning, building, and fire departments. Coordination between the building and fire departments is most essential in establishing appropriate plan review and inspection responsibilities.

Coordination with the fire department largely consists of ensuring compliance with the NFPA Standard 2 (NFPA 2). This standard encompasses the production, storage, transfer, and use of hydrogen as they pertain to fueling standards and meeting necessary inspection requirements. A best practices and permitting guidebook was developed through a partnership between the California Governor's Office of Business and Economic Development (GO-Biz) and CaFCP, and serves as a valuable resource in ensuring compliance with state-level permitting requirements[3].

Clean Vehicle Rebate Project (CVRP) Data

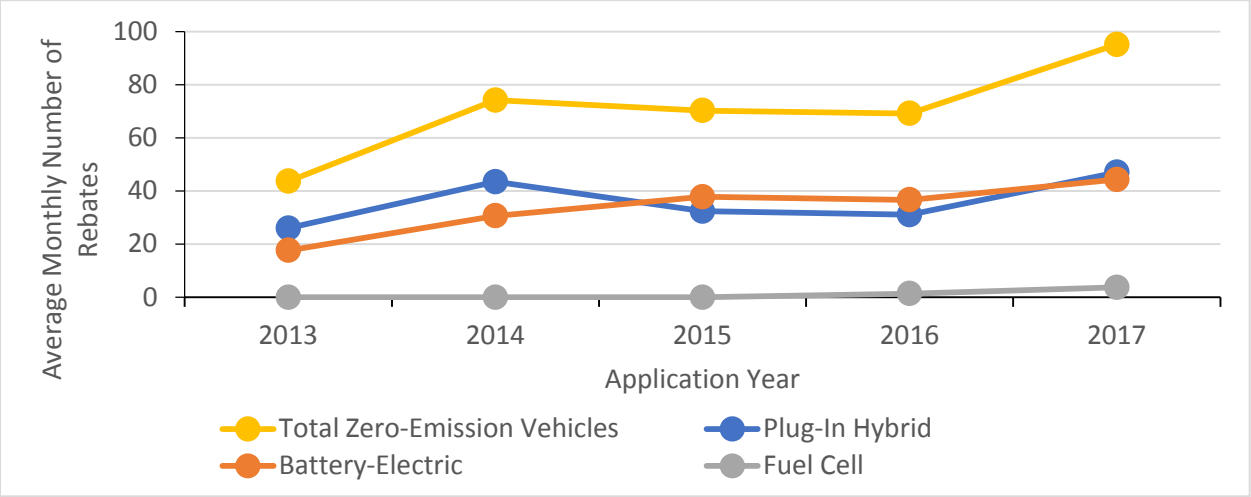
Another method for gauging trends in San Bernardino County's ZEV market uses data from the Clean Vehicle Rebate Project (CVRP). Funded by the CEC and administered by CSE, the CVRP offers rebates up to $7,000 for new, eligible ZEVs – including PHEVs, BEVs and FCEVs. Through June 30, 2018, a total of 5,273 rebates were issued for ZEVs in San Bernardino County. Of rebates distributed to applicants in the county, 52% were for PHEVs, 46% for BEVs, and 2% for FCEVs.

The County has a larger proportion of CVRP participation in disadvantaged census tracts (19%) compared to the state (8%). The higher percentage of disadvantaged census tracts in the county (42% vs. 25%, respectively) explains part of this difference.

The average number of rebates annual averages increased from 69 in 2016 to 95 in 2017 (Figure 4). The number of rebates issued in the county per year has fluctuated but increased overall since the start of the CVRP program in 2010 (Figure 5).

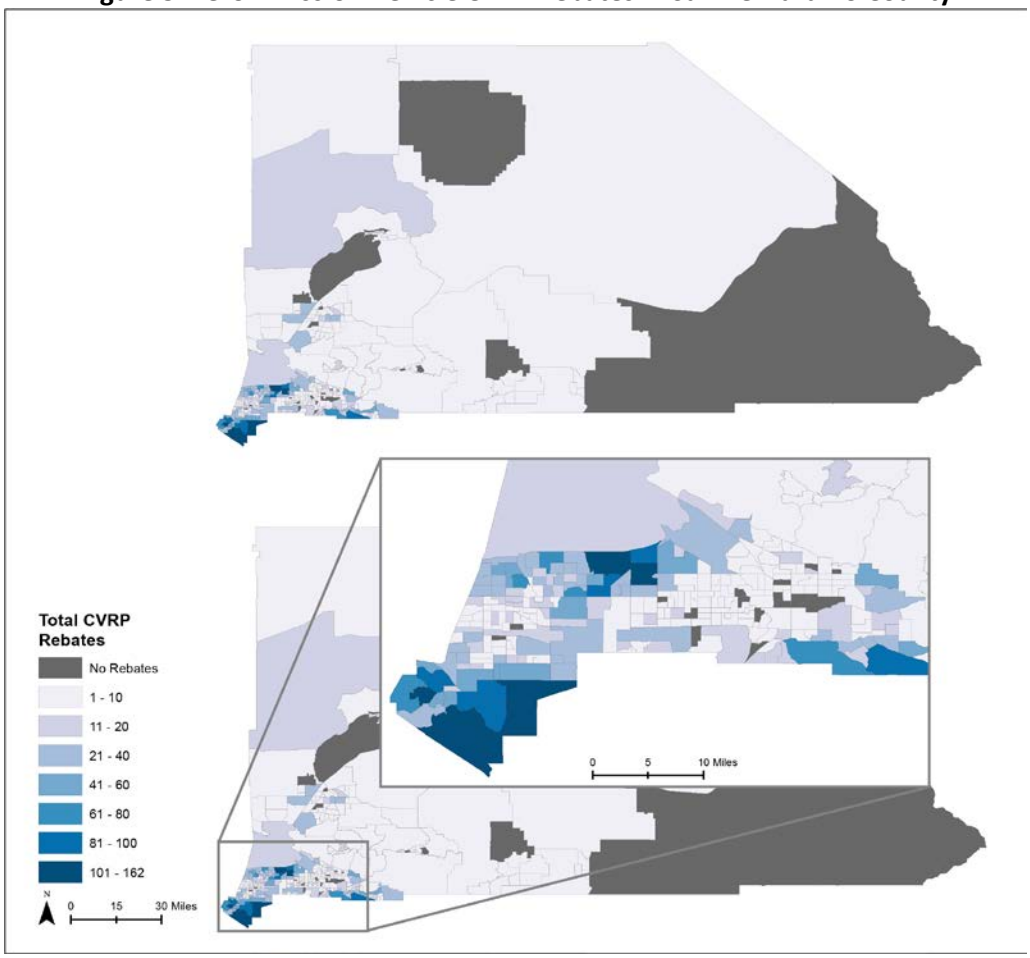
[3] http://www.businessportal.ca.gov/wp-content/Documents/ZEV/Hydrogen-Permitting-Guidebook.pdf

Figure 4: Average Monthly Number of CVRP Rebates in San Bernardino County per Year, by Fuel Type



Data Source: Clean Vehicle Rebate Program, 2019

Figure 5: Zero-Emission Vehicle CVRP Rebates in San Bernardino County



Source: Center for Sustainable Energy, 2018

ZEV Infrastructure Inventory

Existing ZEV Charging Infrastructure

Three main power levels of BEV charging exist, as detailed below in Table 7.

Table 7: EV charging power level comparison

Power Level	Description	Best Suited for…
Level 1	1.2 - 1.8 kilowatt (kW) chargers. Lowest power available, can be provided through simple household outlets. Replenishes range at roughly 3.5-6.5 miles per hour. Serves ~1 driver per day.	Extremely long-dwell sites or areas where charging volume is significantly more important than speed.
Level 2	3.3 kW – 7.6 kW chargers, requires 240V power, like dryer outlets. Replenishes range at roughly 14-35 miles per hour. Serves ~3-4 drivers per day.	Moderate-to-long dwell sites, including retail centers, hotels, or tourist attractions.
DCFC	50 kW+ chargers. Requires 480V, 3-phase current. Typically requires a new transformer and careful consideration of utility tariffs. Replenishes range at up to 100 miles per 30 minutes. Can serve ~40+ drivers per day.	Short-dwell sites where charging speed is significantly more important than volume (e.g. highway corridor sites, gas stations)

Hydrogen fueling infrastructure, as mentioned above, comes in two distinct pressures: 35 MPa or 70 MPa. Most light-duty vehicles use 70 MPa, whereas the older 35 MPa option is typically found on heavy-duty vehicles with large fuel tanks. Fueling rates closely approximate that of gasoline vehicles. Currently, only two stations exist within San Bernardino County: one in Ontario (undergoing repairs as of August 2019) and one in Chino (under construction as of August 2019, expected to open in 2020).

The Alternative Fuels Station data[4] maintained by the National Renewable Energy Laboratory (NREL) and Department of Energy on the Alternative Fuels Data Center website provides users with an extensive, and mappable dataset of existing EV charging, connector types, and networks. NREL gathers information from trade media, Clean Cities coordinators, equipment providers and manufacturers, industry groups, and station users and updates the status and operation of stations at least once per year.

As of September 5, 2018, this dataset included 328 public Level 2 charging station plugs across 100 sites, 179 public DCFC station plugs across 33 sites, and two (2) hydrogen fueling stations in San Bernardino County. The City of Ontario contained the most sites, accounting for 25% of Level 2 charging and 21% of DCFC in the county.

[4] https://afdc.energy.gov/stations/#/find/nearest

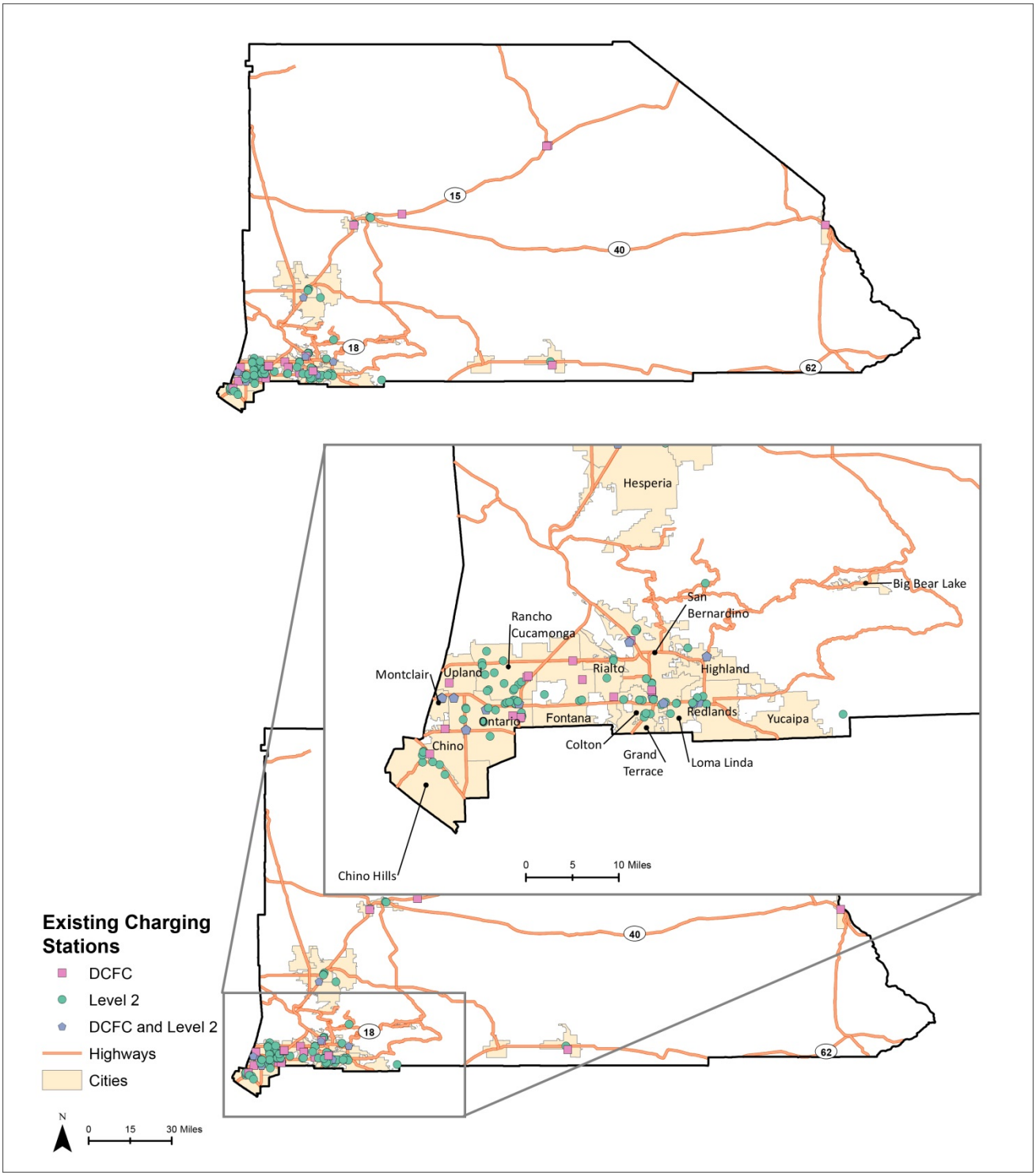
Table 8: ZEV Fueling Stations in San Bernardino County (sorted by decreasing number of Level 2 Plugs)

	Number of Sites			Number of Plugs		
City	**Level 2**	**DCFC**	**Hydrogen Fuel**	**Level 2**	**DCFC**	**Hydrogen Fuel**
Ontario	25	7	1	84	15	2
San Bernardino	14	6	0	69	25	0
Fontana	4	2	0	41	5	0
Redlands	6	2	0	19	5	0
Rancho Cucamonga	13	2	0	18	14	0
Victorville	5	1	0	17	3	0
Loma Linda	3	0	0	16	0	0
Colton	9	0	0	14	0	0
Chino Hills	7	0	0	13	0	0
Highland	3	1	0	13	4	0
Barstow	3	1	0	10	16	0
Rialto	3	1	0	7	4	0
Montclair	2	2	0	3	3	0
Lake Arrowhead	1	0	0	2	0	0
Twentynine Palms	1	1	0	1	8	0
Oak Glen	1	0	0	1	0	0
Chino	0	2	1	0	7	2
Upland	0	1	0	0	4	0
Baker	0	2	0	0	44	0
Needles	0	1	0	0	4	0
Yermo	0	1	0	0	18	0
Total	**100**	**33**	**2**	**328**	**179**	**4**

Source: Alternative Fuels Data Center, 2018

As shown in Figure 6, most ZEV infrastructure locations are concentrated in the southwest corner of the county and gap areas exist in the eastern portions of the county, particularly along travel corridors.

Figure 6: EV Charging Stations in San Bernardino County



Source: Alternative Fuels Data Center, 2018

There are four types of high-powered EV chargers that are typically tracked. J1772 plugs are the most common Level 2 chargers and can be used by PHEVs and BEVs. Tesla destination chargers are another Level 2 charger, generally restricted for Tesla-use only. CHAdeMO and SAE/combined charging system (CCS) chargers are both DCFC plugs and serve BEVs nearly exclusively, as PHEVs typically cannot accept the fast-charge rate of power delivery. CHAdeMO is primarily found on vehicles from Japanese manufacturers, while SAE/CCS is common on vehicles from American and European manufacturers. Tesla Superchargers are proprietary and restricted for Tesla use only. Of the sites with Level 2 charging stations in San Bernardino County, 93% use the J1772 standard, which are often present with DCFC (Table 9). DCFC standards (CHAdeMO, SAE/CCS, and Tesla Superchargers) are present to support fast charging.

Table 9: EV Charging Connector Types in San Bernardino County (sorted in alphabetical order)

	Number of Sites		Number of Plugs	
Connector Type	**Level 2**	**DC**	**Level 2**	**DC**
CHADEMO (DCFC)	0	1	0	1
CHADEMO and J-1772	6	6	13	7
CHADEMO, J1772, and SAE J-1772 Combo (DCFC)	8	8	10	25
CHADEMO and SAE J-1772 Combo (DCFC)	0	9	0	32
J-1772 (Level 2)	79	0	288	0
SAE J-1772 Combo (DCFC)	0	2	0	2
Tesla (DCFC and Level 2)	7	7	17	112
Total	**100**	**33**	**328**	**179**

Source: Alternative Fuels Data Center, 2018

ChargePoint is the most prevalent network provider for public Level 2 charging in the county, representing 53% of sites with identified network providers and 56% of networked plugs (Table 9). Although there are only seven sites with Tesla Superchargers, they represent 64% of the networked DCFC in the county.

Table 10: EV Charging Network Providers in San Bernardino County (sorted in alphabetical order)

	Number of Sites		Number of Plugs	
Network Provider	**Level 2**	**DC**	**Level 2**	**DC**
Blink Network	6	2	18	3
ChargePoint Network	40	5	159	7
EVgo Network	6	15	6	53
EV Connect	8	0	43	0
Greenlots	7	0	12	0
SemaCharge Network	2	0	27	0
Tesla	7	7	17	112
Unknown/No Network	24	4	46	4
Total	**100**	**33**	**328**	**179**

Source: Alternative Fuels Data Center, 2018

Existing Barrier Identification

As observed through previously conducted assessments by CSE (2018, 2019) and NREL (2018), there are several commonly observed barriers to EV adoption within the public sector. These are compiled below as Table 11.

Table 11: Common Barriers to Electric Vehicle and EV Charging Station Adoption with potential solutions supplied

Barrier	Description	Potential Solution
Vehicle-Specific		
Short Vehicle Range	Consumers view BEVs as being unable to fill the same roles as conventional internal combustion engine vehicles	EV ranges have been steadily increasing since 2011; the median EV full-battery range is now 125 miles, up from 73 miles in 2011 (US Department of Energy, 2019). Fostering awareness of the average EV range may help alleviate range anxiety.
High Upfront Cost	Due to ZEVs' higher upfront costs, if consumers aren't aware of state- and federal-level incentives, they are unlikely to purchase based solely on economics.	Holding educational workshops to improve awareness of external incentives and local benefits (e.g. High Occupancy Vehicle (HOV) lane stickers, free parking, etc.)
EVs not available within segment	Few EVs are currently offered within the minivan, crossover utility, sport utility, and pickup truck segments of the automotive market.	Manufacturers are quickly filling gaps within market sectors; compact crossovers are expanding particularly quickly.

Barrier	Description	Potential Solution
Infrastructure-Specific		
Lack of EVI Awareness or Knowledge	Due to a variety of EV charger plug standards, charge rate acceptances, and charging networks, improving public knowledge of compatible PEV charging infrastructure can be a critical component of improving PEV adoption.	Holding informational workshops to improve awareness of locally available charging infrastructure and compatible plug types. Potential to adopt a common, standardized symbology (such as the Chargeway design language[5]) to simplify compatibility recognition.
Complex Infrastructure Installation Process	There is currently a lack of standard permitting processes in the region that facilitate the installation and access to publicly available charging infrastructure	Provide an easily accessible, standardized permitting process that conforms with the criteria suggested by the California Governor's Office of Business and Economic Development (GO-Biz)
Cost of Installing, Operating, and Maintaining EVCS	Real and perceived issues exist relative to the capital costs required to install EVI as well as operational & maintenance costs, which can impact the business case for installing EVI.	Improve awareness of available EVI funding programs, as detailed later in this Report.
Difficulty Sustaining Demand from Regional Drivers	In 2018, San Bernardino County total ZEV registrations (8,095) accounted for less than 1% of total vehicle registrations. This may indicate that the region has not been provided the resources and information to support EVs.	Providing additional, highly visible public charging infrastructure can help drive demand for electric vehicles. Implementing an "EV Expert" program where regional dealers can send sales representatives to develop their EV knowledge and skills may help dealerships sell additional PEVs.

[5] http://www.chargeway.net/easy-to-use/

Future Needs

IV. Future Needs

In 2018, the CEC and NREL used projections from their *California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025* report to estimate statewide ZEV needs. Results indicate that San Bernardino County is expected to have 44,846 PEVs by 2025, which represents approximately 3.4% of the statewide share.

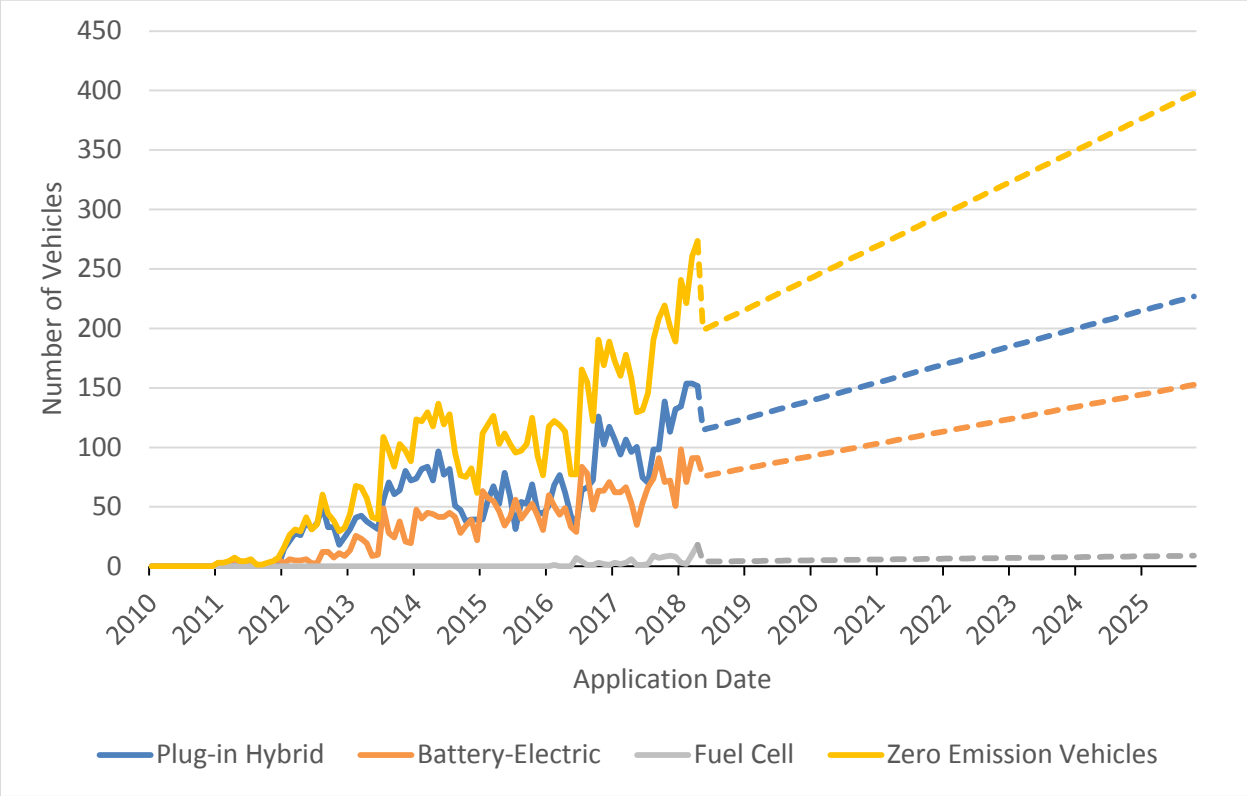
Another method for estimating the size of the County's future ZEV fleet uses linear forecasting based on CVRP rebates and program participation rates (i.e., what percentage of the overall ZEV market participates in the CVRP). In the *Clean Vehicle Rebate Project Participation Rates: The First Five Years (March 2010 - March 2015)* report, CSE calculated CVRP participation rates using CVRP rebate data and IHS Markit-provided vehicle registration data for qualified vehicles. The authors of this report divided the monthly number of rebated vehicles since March 2010 by the participation rates for San Bernardino County to estimate the size of the ZEV market from March 2010 through March 2016. For April 2016 through June 2018, the authors calculated the proportion of CVRP rebates to DMV vehicle registrations for each fuel type and divided them by monthly rebate totals. Linear regression was then used to forecast the size of the market beyond May 2018. Regression results forecast 35,415 ZEVs in San Bernardino County by December 2025. Table 12 summarizes participation rates and Figure 7 illustrates linear extrapolations.

Table 12: Clean Vehicle Rebate Program (CVRP) Participation Rates for San Bernardino County

Vehicle Category	Plug-in Hybrid	Battery-Electric	Fuel-Cell	All Zero-Emission Vehicle Types
CVRP Participation Rates for San Bernardino County **(March 2010 – March 2016; analysis relative to IHS Markit registration data)**	61%	82%	100%	68%
CVRP Participation Rates for San Bernardino County **(April 2016 – June 2018; analysis relative to DMV registration data)**	47%	69%	100%	56%

Source: IHS Market; California Department of Motor Vehicles; Center for Sustainable Energy, 2018

Figure 7: Forecast Monthly Zero-Emission Vehicle Market for San Bernardino County



Source: California Department of Motor Vehicles; Center for Sustainable Energy, 2018

To estimate EV charging needs for San Bernardino County by 2020 and 2025, the authors examined the CEC fleet projection calculations.

California Energy Commission Fleet Projections

During Plan development, CSE used county and statewide PEV estimates calculated by the CEC in its 2017-2025 infrastructure projections report. By 2025, the CEC estimated that there will be 44,846 PEVs in San Bernardino County, representing 3.4% of the statewide PEV fleet. The authors calculated the 2025 BEV fleet by multiplying the statewide proportion of BEVs by the county's 2025 PEV fleet estimate. The CEC did not provide county-level estimates for the 2020 fleet; the following formulas were used.

44,846

CEC Projected Number of PEVs in San Bernardino County by 2025

San Bernardino County 2020 PEV Fleet

$$2020\ County\ Plug\text{-}in\ Electric\ Fleet\ Projection = 2020\ Statewide\ PEV\ Fleet\ Projection \times 3.39\%$$

San Bernardino County 2020 BEV Fleet

$$\textbf{\textit{2020 County BEV Fleet Projection =}}\ \frac{\textit{(2020 County PEV Fleet Projection x 2020 BEV Fleet Projection)}}{\textit{2020 Statewide PEV Fleet Projection}}$$

Table 13: PEV Fleet Scenarios for San Bernardino County

	2020		2025	
Fleet Scenarios	**Total PEVs**	**Total BEVs***	**Total PEVs**	**Total BEVs***
Energy Commission	21,894	12,110	44,846	24,745

included in Total PEVs count

Source: National Renewable Energy Laboratory; California Energy Commission, California Department of Motor Vehicles, Center for Sustainability, 2018

EV Charging Infrastructure Needs Projections

CEC fleet scenarios were used to determine the Energy Commission's assumed ratio of future vehicles to EV chargers. To calculate the ratios, the authors divided the 2020 and 2025 Energy Commission-projected fleets by its projected charger needs with the following formula:

$$Vehicle\text{-}to\text{-}Charger\ Ratio = \frac{Projected\ number\ of\ vehicles}{Projected\ number\ of\ chargers}$$

The CEC calculated lower, upper, and average charger estimates for the 2025 PEV fleet, but only calculated an average for the 2020 fleet (Table 14, Table 15). The vehicle-to-charger ratios ranged from 10 to 14 for Level 2 plugs and from 41 to 159 for DCFC plugs.

Table 14: Projected Vehicle-to-Plug Ratios for San Bernardino County – 2020

Level 2 Destination (Workplace and Public)			DCFCs		
Level 2 Plug Count Demand	**Number of ZEVs**	**ZEV-to-Level 2 Plug Ratio**	**Plug Count Demand**	**Number of BEVs**	**BEV-to-DC Fast Plug Ratio**
1,619	21,894	14	158	12,110	77

Table 15: Projected Vehicle-to-Charger Ratios for San Bernardino County – 2025

	Level 2 Destination (Workplace and Public)			DCFCs		
	Level 2 Plug Count Demand	**Number of ZEVs**	**ZEV-to-Level 2 Plug Ratio**	**Plug Count Demand**	**Number of BEVs**	**BEV-to-DC Fast Plug Ratio**
Lower Estimate	3,292	44,846	14	156	24,745	159
Average	3,980		11	377		66
Upper Estimate	4,666		10	598		41

The ratios were then applied to the other two vehicle scenarios to estimate the number of chargers needed. First, the number of vehicles in each type of fleet was divided by the ratios calculated in Table 14 and Table 15 to determine the number of chargers needed to support the fleet. Level 2 charging needs were calculated using PEV fleets while DCFC needs used BEV fleets. The number of existing chargers in the county were then subtracted from estimated charging needs to determine the remaining number of chargers needed to support these scenarios. Since Tesla chargers only allow Tesla vehicles, the authors developed Tesla and Non-Tesla estimates. Table 16 summarizes Level 2 charging needs by 2020; Table 17 summarizes DCFC needs by 2020.

Table 16: Projected Level 2 Destination EV Charger Demands for San Bernardino County – 2020

Total ZEVs	Estimated Plug Demand	Existing Level 2 Plugs	Plugs Needed
21,894	1,619	**Tesla Level 2 Included**	
		328	1,291
21,894	1,619	**Tesla Level 2 Excluded**	
		311	1,308

The CEC anticipates needing 1,619 Level 2 destination plugs to support 21,894 PEVs by 2020; when considering existing Level 2 plugs, this would require the installation of 1,291 Level 2 plugs by 2020.

Table 17: Projected DCFC Demand for San Bernardino County – 2020

Number of BEVs	Estimated Plug Count Demand	Existing DCFC Plugs	Plugs Needed
12,110	158	**Tesla Superchargers Included**	
		179	-21
12,110	158	**Tesla Superchargers Excluded**	
		67	91

Note: A negative "plugs needed" number indicates that projected plug demand has been exceeded by the indicated number of plugs.

The county would need an additional 91 DCFC plugs when Tesla Superchargers are excluded.

Table 18: Projected Level 2 Destination EV Infrastructure Demands for San Bernardino County – 2025

Scenarios		Estimated Plug Count Demand			Plugs Needed		
Fleet Scenarios	**Number of ZEVs**	**Lower Estimate**	**Average**	**Upper Estimate**	**Lower Estimate**	**Average**	**Upper Estimate**
CEC	44,846	3,292	3,980	4,666	**Tesla Level 2 Included**		
					2,964	3,652	4,338
CEC	44,846	3,292	3,980	4,666	**Tesla Level 2 Excluded**		
					2,981	3,669	4,355

Overall, CEC fleet projections anticipate needing between 2,964 and 4,338 additional Level 2 destination plugs by 2025.

Table 19: Projected DCFC EV Infrastructure Demands for San Bernardino County – 2025

Scenarios		Estimated Plug Demand			Plugs Needed		
Fleet Scenarios	**Total BEVs**	**Lower Estimate**	**Average**	**Upper Estimate**	**Lower Estimate**	**Average**	**Upper Estimate**
CEC with Tesla Superchargers	24,745	156	377	598	**Tesla Superchargers Included**		
					-23	198	419
CEC without Tesla Superchargers	24,745	156	377	598	**Tesla Superchargers Excluded**		
					89	310	531

Note: A negative "plugs needed" number indicates that projected plug demand has been exceeded by the indicated number of plugs.

Gaps Analysis

Site Types

This Plan will examine four primary EVI site types and discuss the specific installation considerations and cases for each of the following: public institutions; destinations; multi-unit dwellings; and workplaces.

Public Institutions are defined as any site that is designated for open access to members of the public. These include municipal government buildings, libraries, and public schools.

As a subset of public institutions, this Plan recommends sites that aid commuters in accessing Metrolink or public transit. Park & Ride lots, transit centers, and public parking proximate to transit access serve as long-dwell sites that are ideally suited for lower-power Level 2 charging.

Destinations are commonly visited sites that attract usage from both residents and inter-city travelers. These can include shopping malls, tourist attractions, and hospitals.

Multi-unit dwellings include any single living community with multiple units on-site. This can include condominium units, apartment complexes, and townhomes.

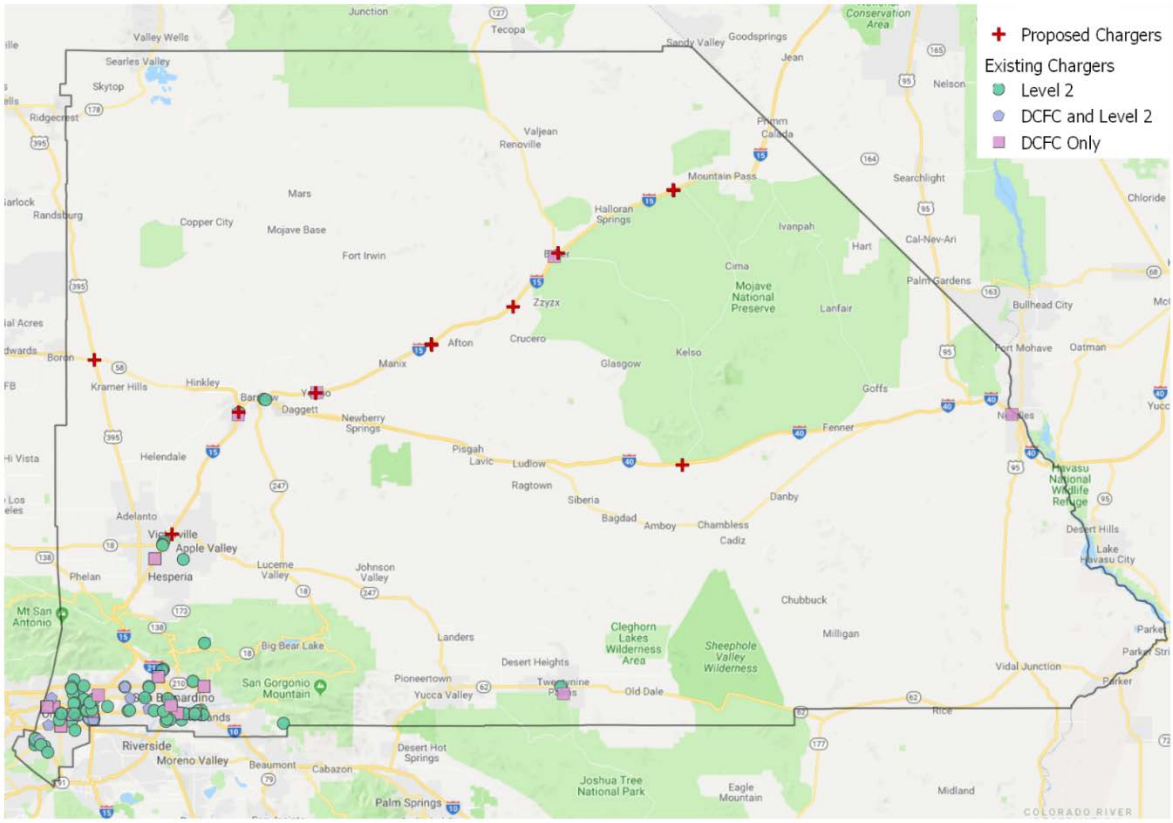
Workplaces are primarily commuter destinations that primarily host full-time employees: office buildings, medical facilities, and/or agricultural facilities.

Geographic EVCS Coverage

EV drivers are currently served by 328 Level 2 and 179 DCFC plugs across 133 sites, however, current infrastructure will be insufficient to meet demand in 2020 and 2025.

A significant spatial gap exists in areas along travel corridors in the eastern portion of the county, which provides direct access to points of interest such as Joshua Tree National Park, Lake Havasu and Las Vegas. These corridors have been identified as opportunity areas for both Level 2 charging (to extend the range of PHEVs on long-distance trips) and DCFC (for long-distance BEV travel). With Electrify America and Caltrans expected to install approximately 11 new DCFC stations along I-15, I-40, and US 395, gaps should be partially filled soon. Figure 8 depicts existing stations and expected DCFC stations based on Caltrans and Electrify America planning.

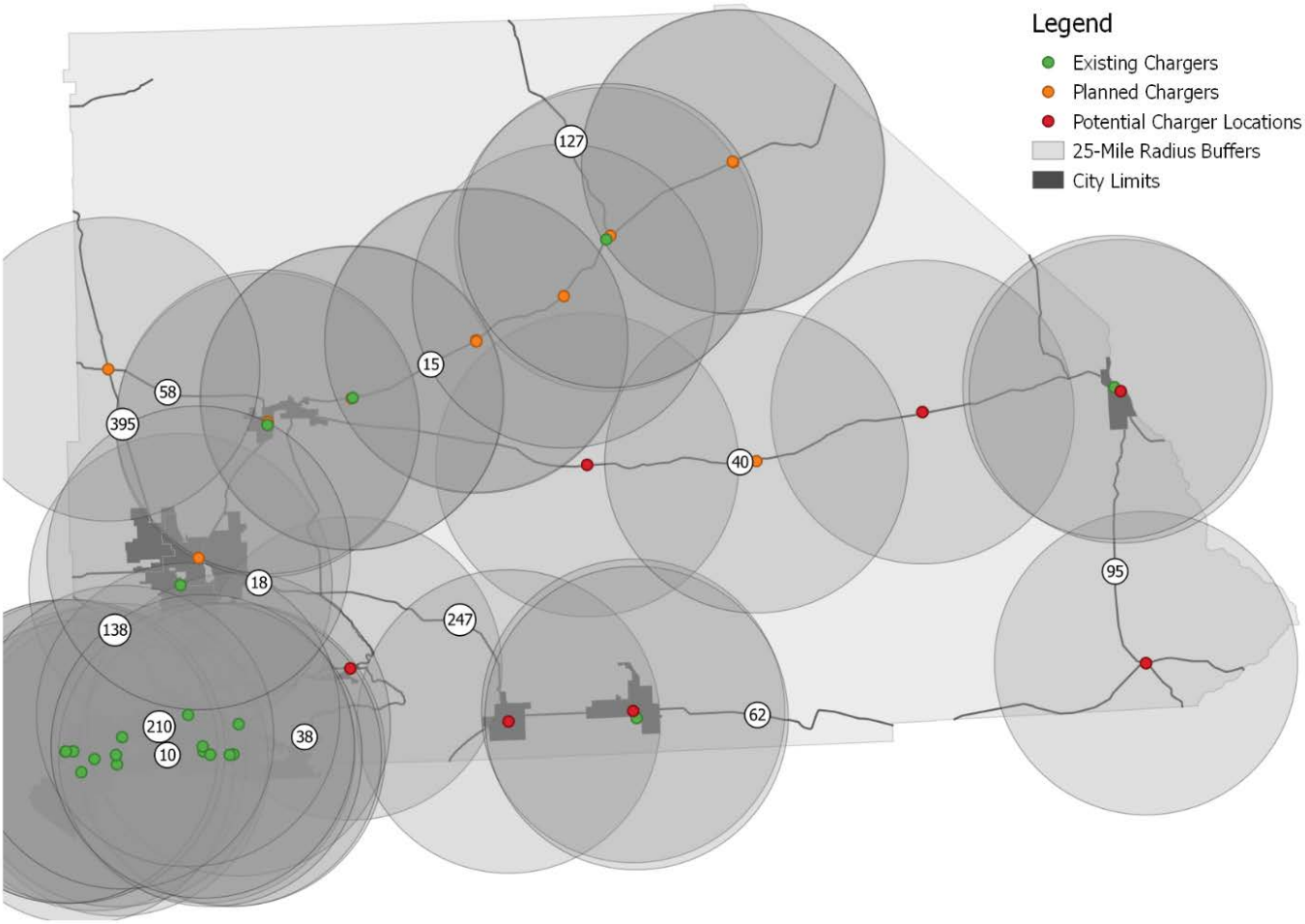
Figure 8: Existing stations mapped alongside potential DCFCstations from Caltrans and Electrify America (red crosses), San Bernardino County, CA



Existing DCFC siting combined with Caltrans and Electrify America locations still leave charging gaps along I-40, SR 18, SR 62, and SR 247.

Based on siting DCFC at 50-mile intervals, six additional DCFC stations are required to provide adequate CCS/CHAdeMO coverage to fill most of these gaps. Due to limited electrical infrastructure along the County's remote desert corridors, certain gaps (e.g., SR 62 between Twentynine Palms and the SR 62/SR 177 junction) are unable to be served at the 50-mile interval. Figure 9 depicts 50-mile interval coverage for DCFC and the six additional stations are listed in Table 21.

Figure 9: 50-Mile DCFC Intervals (existing, planned, and potential locations). Overlapping buffers along highways indicate <50 mile spacing between stations.



Data Sources: CEC, 2018; AFDC, 2018; Electrify America, 2019

Table 20: Potential charger locations to provide highway coverage.

New DCFC Location	Potential Sites	Rationale
Ludlow (I-40)	Dairy Queen, Chevron, Ludlow Inn	Additional coverage between Barstow and planned Electrify America station
Fenner (I-40)	Hi Sahara Oasis	Additional coverage between Needles and planned Electrify America station
Needles I-40)	Needles Chamber of Commerce	Provide CCS/CHAdeMO coverage in Needles
Vidal (SR 62)	Vidal Chevron	Additional coverage between Needles and County Line
Twentynine Palms (SR 62)	Phoenix Redevelopment Site	Additional coverage between Yucca Valley and County Line, provide CCS/CHAdeMO coverage in Twentynine Palms
Yucca Valley (SR 62)	Stater Bros. Market, Southern California Edison, Vons	Additional coverage between Los Angeles and Big Bear and Twentynine Palms
Big Bear Lake (SR 18)	Big Bear Lake Convention Center	Additional coverage between Los Angeles and Yucca Valley

EVCS Infrastructure Demand

The numerical portion of this analysis examines the quantity of chargers including Tesla proprietary connectors, which cannot be used by vehicles from other makes, as well as the quantity of chargers excluding those proprietary connectors.

The bulk of charge plug demand is likely to occur in the heavily populated urban areas of the County and in proximity to heavily used travel corridors, as illustrated previously in Figures 6 and 2, respectively. As demand increases, significant amount of EVCS construction will be required to continue meeting the needs of EV drivers. If increases in EV adoption are distributed equally among each of the municipalities commensurate with their population, urban regions will require a minimum of 40 additional DCFC plugs, and 1,011 additional Level 2 plugs in 2020, and more than 400 new DCFCs and 3,500 Level 2 plugs in 2025. Depending on whether Tesla chargers are included, rural portions of the county may require as many as six additional DCFC and 52 Level 2 chargers in 2020, increasing to 23 DCFC and 171 Level 2 chargers in 2025. Using similar siting methodology, unincorporated regions (defined as all municipalities not listed in Table 2) will require up to 19 additional DCFC (79 in 2025) and 230 Level 2 chargers (664 in 2025). A summary of EVCS plugs required to meet projected EV market demand is listed in Table 21 and Table 22.

The CEC anticipates needing 1,619 Level 2 destination plugs to support 21,894 PEVs by 2020; when considering existing Level 2 plugs, this would require the installation of 1,291 Level 2 plugs by 2020.

Table 21: 2020 projections of additional need for charging plugs and estimated electric vehicle penetrations within San Bernardino County.

	Urban Regions			Rural Regions			Unincorporated Regions		
	2020	**Existing**	**Needed**	**2020**	**Existing**	**Needed**	**2020**	**Existing**	**Needed**
DCFCs	129	89	40	6	28	-22	23	62	-39
		63	66		0	6		4	19
Level 2 Chargers	1,325	314	1,011	63	11	52	231	3	228
		299	1,016		11	52		1	230
Vehicles	17,916	6,624	11,292	856	316	540	3,123	1,155	1,968

Note: A negative "plugs needed" number indicates that projected plug demand has been exceeded by the indicated number of plugs. Blue cells indicate charger counts exclusive of Tesla proprietary connectors.

Table 22: 2025 projections of additional need for charging and estimated electric vehicle penetrations within San Bernardino County.

	Urban Regions			Rural Regions			Unincorporated Regions		
	2025	**Existing**	**Needed**	**2025**	**Existing**	**Needed**	**2025**	**Existing**	**Needed**
DCFCs	489	89	400	23	28	-5	85	62	23
		63	426		0	23		4	79
Level 2 Chargers	3,818	314	3,504	182	11	171	665	3	662
		299	3,519		11	171		1	664
Vehicles	36,697	6,624	30,073	1,753	316	1,437	6,396	1,155	5,241

Note: A negative "plugs needed" number indicates that projected plug demand has been exceeded by the indicated number of plugs. Blue cells indicate charger counts exclusive of Tesla proprietary connectors.

Siting Analysis

The siting analysis is a quantitative exercise that utilizes regional travel data, land parcel data, existing station locations, vehicle registration data and site-specific factors to identify high-impact project locations for EV infrastructure investment. The overarching goal of the siting analysis is to ensure that future EV charging station deployment is highly utilized, provides adequate range for regional/interregional drivers and reduces greenhouse gas emissions associated with internal combustion engine vehicle travel. The value of investing in quantitative siting analysis has been proven through an Idaho National Laboratory study[6] conducted in Oregon, which measured the utilization of charging stations deployed as part of a planning process versus siting in unplanned locations. Results indicated charging station deployment within areas identified as part of a planning process experienced nearly 90% greater utilization (measured in charging events/week) than stations deployed in unplanned locations.

The project team used a quantitative siting methodology which consisted of a Multi-Attribute Decision Making (MADM) method, Weighted Linear Combination (WLC) method, and the Analytical Hierarchy Process (AHP) technique to assess San Bernardino County parcel data within each municipality. Utilizing this analysis, the project team identified criterion for weighted analysis used in each site type equation:

[6] https://avt.inl.gov/sites/default/files/pdf/EVProj/UtilizationOfNonResEVSEInstallationVsPlan.pdf

Public, Workplace, MUD, and Destination. These criteria and variables are shown below as Table 23. A complete methodology is provided as Appendix B. Based on working group and individual city feedback, the project team provided an abbreviated output of the analysis to working group members as approximately 20 of the top-ranked sites by city, included herein as Appendix C.

Table 23: Variables and definitions involved in the execution of the quantitative siting methodology.

Criteria	Description
net value	Assessed net value
DAC	Disadvantaged Community
d_ev2_chrg	Distance to nearest EV Level 2 public charging station (miles)
d_dcfc_chrg	Distance to nearest DCFC public charging station (miles)
#bev	Count of BEV in zip code
#pev	Count of PHEV in zip code
%BEV	Percent of vehicles that are BEVs in zip code
%PHEV	Percent of vehicles that are PHEVs in zip code
tot_pop	Total population residing in corresponding travel analysis zone (TAZ)
#emp	Total number of employees that work in TAZ
#office emp	Total number of office employees that work in TAZ
#trips	Total number of trips to/from TAZ

It should be noted that in addition to quantitative analysis, implementation also requires multiple qualitative factors (e.g., property owner readiness, values alignment, risk tolerance, etc.) be analyzed, which is not specifically addressed in this quantitative siting analysis. Resources to help stakeholders perform qualitative analysis are provided as supplementary literature in Appendices D-G.

A brief summary of the total number of analyzed and recommended parcels in each category follows below as Table 24.

Table 24: Siting analysis results

Site Type	Destination	Institution	MUD	Workplace	Total
Total Parcels	8,566	9,131	2,510	8,836	29,043
Recommended Parcels	278	20	115	82	495
Percentage Recommended	3.245%	0.219%	4.582%	0.928%	1.704%

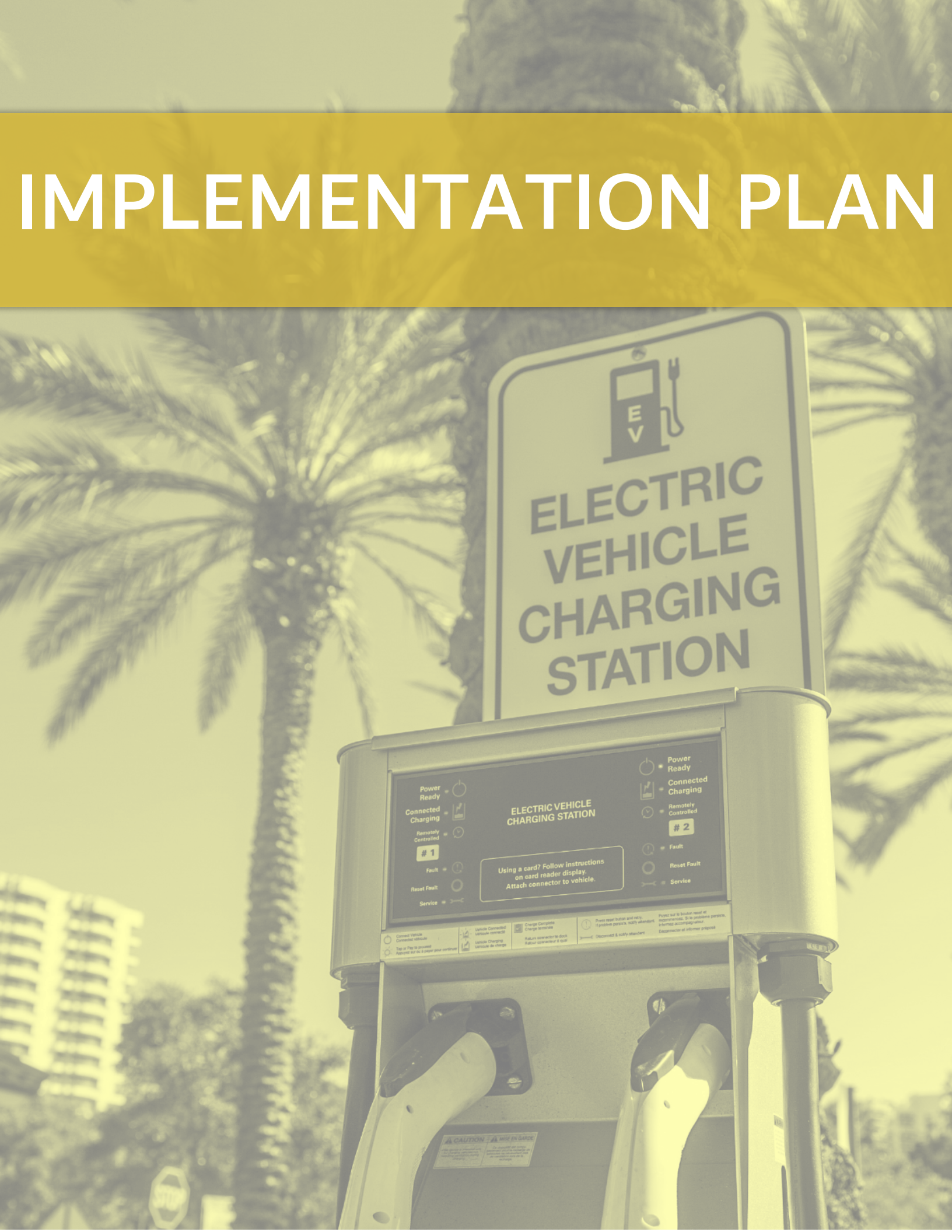
Gaps Analysis Conclusions

Electric vehicle adoption is expected to grow significantly as the County moves toward 2020 and 2025. As of 2018, there were 8,095 ZEVs represented within San Bernardino County. That number is expected to reach nearly 21,894 in 2020, and grow to 44,846 vehicles by 2025, representing 13,799 additional ZEVs being placed into service between 2019 and 2020 and 22,952 additional ZEVs being placed into service between 2020 and 2025.

As PEV adoption increases through 2025, the existing EV charging infrastructure will also need to expand and change to continue adequately serving the EV community. Tesla Superchargers have been installed in large quantities along major corridors in the rural and unincorporated regions of the County, to the point where they represent 96% of all DCFCs installed outside of urban areas. Urban areas are expected to require the most EVCS buildout to meet demand, with a maximum of additional 1,082 charging ports required by 2020 and 3,945 additional ports needed by 2025. (Note that these numbers do not include Tesla proprietary connectors, and so represent the upper bound of the projected need estimates). In the rural (High Desert and San Bernardino Mountain) regions, there already exists a significant need for additional DCFCs along major corridors.

Appendix C details the top 20 identified sites for each incorporated city in San Bernardino County, as identified by a combination of client feedback and internal CSE siting methodology (detailed in Appendix B). These site recommendations provide a first level screening for charging sites integrating considerations for vehicle dwell time, vehicle access, and high-level assessment of electrical infrastructure adequacy. The list can be viewed as a high-level assessment of properties that are well-suited for EV charging. The guidance in this Plan and the toolkits are resources that can be used to validate site readiness and ultimately deploy infrastructure.

IMPLEMENTATION PLAN



V. Implementation Plan

This section identifies recommendations proposed for San Bernardino County to meet the goals outlined by Governor Brown in 2012 and 2018. Four implementation goals are identified, along with recommendations for regional stakeholders. Metrics for tracking progress over time, stakeholder assignments, and a proposed EVI implementation schedule are included. The implementation goals are recommended for San Bernardino County and are intended to promote EV and EVI adoption. Current funding and incentive programs are identified to support stakeholders' implementation of recommended strategies

Municipalities could pair implementation goals with the Guidance and Costs document in Appendix A, the list of identified EV charging sites for their municipality (Appendix C), and the toolkits applicable to each site type (Appendices D-G) to install EV charging stations efficiently. The list of EV charging sites identified in Appendix C serve as a master list of favorable sites for EVI investment and largely relies on travel demand data, existing station siting, and other quantitative data. The guidance provided in Appendix A and Appendices D-G identify the key decision criteria for further evaluating recommended sites with key decision factors and practical implementable steps.

Implementation Goals

Implementation Goal 1 (GHG Emissions Reduction): Enhance the performance of the transportation system while protecting and enhancing the natural environment. Improve air quality in San Bernardino County and reduce the impact to DACs through reducing GHGs as mandated by California AB 32 and SB 375 and detailed in the county Greenhouse Gas Reduction Plan. Individual municipalities have goals of reducing their greenhouse gas emissions between 15%-30% by 2020.

Performance Metrics

- 1a: Electric Vehicle Registration data and electric vehicle market share calculations;
- 1b: GHG emissions attributed to electric vehicle-miles traveled (eVMT) and reduction of GHGs attributable to added eVMT over time; and
- 1c: Total number of charging stations sited in DACs as well as the DAC percent versus total.

Implementation Goal 2 (Transportation Infrastructure Readiness): Enhance the performance of the transportation system.

Performance Metrics

- 2a: Number of EVCS deployed in San Bernardino County over time;
- 2b: Regional EVCS utilization rates; and
- 2c: EV range density measured Countywide and by City. Calculation of the maximum and average EV range per area.

Implementation Goal 3 (EV and EVI Awareness and Increased Adoption): Improve EV and EVI awareness and advance adoption among San Bernardino County residents, employees, and travelers through education and outreach.

Performance Metrics

- 3a: Number of public participants reached during dedicated outreach activities.
- 3b: Increased awareness of EV and EVI over implementation phase (10 years). Measured through public surveys administered in each implementation phase and the total number of EV registrations/EV chargers counted at beginning/end of each phase.

Implementation Goal 4 (EVI Affordability): Reduce cost and effort required to install EVI making it more accessible to a broader range of users. Position public and private stakeholders (e.g., business owners, fleet managers, MUD owners) to capitalize on funding opportunities and to bring investment to their communities to improve access to low-cost fueling.

Performance Metrics

- 4a: Time and Cost required to issue permits for charging infrastructure.
- 4b: EVI installation timeline, defined as the period between permitting and first charging event.
- 4c: Number of EVI incentives and grants received in San Bernardino County.
- 4d: Average cost of EVI project measured over time.

Recommended Implementation Strategies

Tables 25-29 and subsequent subsections describe recommendations, the implementation goals those recommendations address, associated metrics, and responsible stakeholders. Recommendations are broken out by phase (ongoing, near-term, mid-term, and long-term), most which may be contingent upon available funding and stakeholder capacity for implementation. A brief discussion of each recommendation is included.

Table 25: Ongoing Recommended Strategies

Strategy No.	Implementation Goal	Area of Impact	Recommendation	Metric	Frequency	Stakeholder (lead)
1	**Goal 1** GHG Emissions Reduction	GHG Emissions Tracking & Reporting	Develop annual GHG emissions reporting for EV market share and EVCS kilowatt hour (kWh) utilization/capacity in San Bernardino County.	Total GHG emissions eVMT/kWh	Ongoing	All
2	**Goal 2** Transportation Infrastructure Readiness	Regional Coordination	Examine development of a regional EVI collaborative/task force to share lessons learned, best practices, and track metrics.	# of participants, # meetings	Semi-Annual (or more frequent)	SBCOG
3	**Goal 3** EV/EVI Awareness & Increased Adoption	Workforce Training	Provide regional EV/EVI workforce development training for the current and future workforce to connect the community with existing and project opportunities in the EV/EVI industry.	Program Development, Partners engaged, # of training events, # people trained	Annual	CBOs, Education & EVI Technology Partners
4	**Goal 3** EV/EVI Awareness & Increased Adoption	Integrate ZEV Readiness Plan into Local Planning	Evaluate feasibility to integrate ZEV Readiness Plan into local planning efforts (e.g., regional plans and strategies).	Frequency of ZEV Readiness Plan cited in local plans	Ongoing	All
5	**Goal 3** EV/EVI Awareness & Increased Adoption	Integrate ZEV Readiness Plan into Local Planning	Continue working with identified site hosts to develop and schedule charging station installations.	Number of additional stations installed	Ongoing, as appropriate	All
6	**Goal 4** EVI Affordability	Funding - Grants, Incentives, Credits	Identify and pursue PEV related grant funding opportunities (e.g., Carl Moyer program, HVIP, ARFVTP, CMAQ, FAST Act, Title XVII Clean Energy Loan Guarantees, and STBG).	$ awarded & # stations installed	As Appropriate	All
			Identify and pursue incentives (e.g., CVRP, California Hybrid and Zero emission Truck and Bus Voucher Incentive Project, Enhanced Fleet Modernization Program, Goods Movement Emission Reduction Program, and Place Program).	$ awarded & # stations installed	As Appropriate	All
			Take full advantage of Low Carbon Fuel Standard (LCFS) credits (accrue and monetize).	# LCFS credits	Quarterly to CARB	All
			Evaluate feasibility to utilize SCE's Charge Ready Program or Colton Electric's which provides funding to install Level 1 and 2 EVCS at nonresidential, long dwell-time (over 4-hours parking) sites.	# stations installed	Ongoing, Annual Reporting	All
			Utilize Rancho Cucamonga's Level 2 Charging Program, which offers up to a $4,000 rebate to install residential Level 2 chargers.	# stations installed	Ongoing, Annual Reporting	All
			Utilize Colton Electric's Charger Incentive Program, which offers commercial customers $5,000 for chargers on their own meter, or $2,500 for chargers installed on an existing meter.	# stations installed	Ongoing, Annual Reporting	All

Ongoing Recommended Strategies

Create and Maintain a Regional EVI Collaborative

It is recommended that SBCOG examine feasibility to develop a cross-jurisdictional/regional EVI Collaborative and invite the current Informal Working Group to participate and other community stakeholders to join. Additionally, SBCOG could evaluate partnering with existing regional collaboratives.

Integrate ZEV Readiness Plan into Local Planning

San Bernardino County local governments, employers, community-based organizations (CBOs) and other stakeholders that develop strategic plans may integrate ZEV Readiness Plan goals, recommendations, and metrics into relevant local planning documents and internal policies.

Utilize and Promote Funding Opportunities (Grants, Incentives, and LCFS)

SBCOG and its municipal partners may consider funding and hosting workshops and outreach events to promote available funding programs to regional stakeholder groups. Identifying the owners and managers of the properties identified through the siting analysis and specifically targeting them as workshop invitees may prove valuable in fostering awareness of available funding opportunities.

Workforce Training Program

San Bernardino County organizations that support workforce development and training (e.g., Chambers of Commerce, SBCOG member agencies, Community Action Partnership of San Bernardino, San Bernardino Community College District, Project Clean Air, Employer's Training Resource Center, San Bernardino Economic Development Foundation, etc.) may pursue grant funding to provide workforce development and training. Regional CBOs could provide workforce training specific to EVI deployment by partnering with vocational schools, community colleges and EVI technology providers to develop an EVI installation training program.

GHG Emissions Tracking & Reporting

Electrification of transportation can significantly reduce GHG emissions by replacing internal combustion engine vehicles with electric vehicles. It is recommended that GHG emission reduction metrics be calculated and shared with regional stakeholders periodically.

Table 26: Near-Term Recommended Strategies

Strategy No.	Implementation Goal	Area of Impact	Recommendations	Metric	Frequency	Stakeholder (lead)
7	**Goal 2** Transportation Infrastructure Readiness	Streamlined Permitting and Local EVI Ordinance	Develop expedited, streamlined permitting process for EVCS and training for permitting/inspection officials	% of Municipalities with Streamlined Permitting and/or Ordinance, # of officials trained	Term Period Reporting with Annual Tracking	Municipalities
8	**Goal 2** Transportation Infrastructure Readiness	Regional eVMT Travel Coverage (DCFC priority)	Install public DCFC EVCS at 50-mile intervals	# DCFC EVCS installed	Term Period Reporting with Annual Tracking	SBCOG and/or Municipalities
9	**Goal 3** EV/EVI Awareness and Increased Adoption	Regional EVI Expert and Technical Advisory Program	Seek and secure grant funding to develop a regional EV Expert & Technical Advisor program for direct assistance to regional stakeholders through outreach, education and workshops.	# consultations, # of EVCS installed	Annual	SBCOG
10	**Goal 3** EV/EVI Awareness and Increased Adoption	EV and EVI Outreach & Education	Seek and secure funding to develop a Regional EV/EVI outreach and awareness campaign(s) to educate consumers, residents, travelers, DACs about the environmental and financial benefits of ZEVs.	# of participants in outreach events, % of DAC participants, # events held	Term Period Reporting with Annual Tracking	SBCOG and/or municipalities
11	**Goal 4** EVI Affordability	CEC Phase II Funding Application	Submit list of 12+ EV charging sites to CEC for potential Phase II funding	$ awarded & # stations installed	Report in 2019/2020, depending on funding schedule	SBCOG and/or municipalities

Near-Term Strategies

Large Transit Agency Planning for Zero Emission Buses (ZEB)

Large transit agencies (per CARB Innovative Clean Transit Regulation these are operators with fleets of 65 or more buses operating at annual maximum service) are required by the State to develop a rollout plan to transition to a 100% zero-emission bus fleet by 2040. Large transit agencies must have the plan submitted to the California Air Resources Board in 2020.

Streamlined Permitting and Local EVI Ordinance

In accordance with AB 1236, jurisdictions should develop and adopt ordinances creating an expedited, streamlined permitting process for EVCS, including Level 2 and DCFC. It may be additionally helpful to produce informational brochures and/or flyers on the permitting process to offer for public consumption, either through targeted distribution, online publication, or on a walk-up basis.

Prioritize Investments in DCFC at 50-mile radius

Increasing the availability of DCFCs is a recommended pathway for improving BEV utility and accelerating market adoption. Utilizing a 50-mile charging radius (e.g. gaining 50 miles of charge in less than 30 mins of charging), additional DCFC stations are recommended in San Bernardino County to provide adequate range coverage to facilitate all intercounty/intra-county travel by PHEV/BEVs.

Regional EVI Expert and Technical Advisory Program

To help decision-makers with EVI deployment, SBCOG could seek funding to create an EVI expert and technical advisory program. San Diego Association of Governments (SANDAG) created a similar grant program as part of PEV readiness implementation and to date has conducted over 150 unique consultations resulting in over 500 EVCS installed.

EV and EVI Outreach and Education

Seek funding to develop an outreach and education campaign which may include convening a focus group (or series of focus groups) to deeply understand community barriers to EV/EVI adoption, especially in DACs where industry messaging typically does not penetrate as deeply as in other segments.

1. Engaging stakeholders and providing valuable materials will guide the implementation of the Plan and increase the understanding of PEV growth in the Region.

Recommendations

- Social Media: Promote development and ongoing updates relating to the San Bernardino County Zero Emission Vehicle Readiness and Implementation Plan on existing social media accounts.
- Local Officials: Further educating local elected officials on the financial benefits available to ZEV drivers (including incentives and fuel savings), as well as the public health benefits resulting from an increase in lower emission vehicles in their communities is a critical first step when encouraging PEV-friendly policies.
- Signage: Provide clear, visible EV signage that conforms with Federal Highway Administration Manual on Uniform Traffic Control Devices standards and/or interim approval.

2. Engage sectors in distributing information to facilitate Plan awareness.

Recommendations

- Promote and Share Plan: Utilize channels and target audience partners to promote and share Plan.
- Share information via partner social media accounts: Develop tweets and posts for sharing Plan content on partner social media accounts including Visitor Bureaus, County Partners, City Partners, and Resorts & Tourism Destinations.

3. Empower Plan Champions to guide implementation at the local level.

Recommendations

- Ongoing Informational Sharing: Annual report to Local Officials on EVI status and encourage municipalities to implement Plan recommendations at the local level.

4. Encourage Business Sector adoption of EVCS at commercial and retail workplaces.

Recommendations

- Business Sector Outreach: Contact local Chambers of Commerce and Business Associations to facilitate outreach to interested business owners.
- Business-specific Workshops: Host informational workshops designed to communicate business-specific considerations for EVCS, including economic business cases for installing charging, potential ancillary benefits, cost factors, and best practices.

5. Increase public awareness of ZEVs by implementing actions to increase visibility and market recognition.

Recommendations

- Marketing Campaign: educate low-income and rural communities on the benefits of ZEVs, with a focus on the relative low total cost of ownership using multilingual methods and materials, leveraging existing state and local incentives that promote vehicle affordability.
- Publicity Events: partner with local governments who plan to install EVCS to host visible events centered around the infrastructure, such as ribbon-cuttings, community celebrations, or EV ride-and-drives. Similar actions can be taken for municipal fleets that are being converted to ZEVs.
- Municipality-Utility Partnership: Encourage local governments to partner with their local utility to publicize available EV/EVCS incentives and rate structures through official channels, including social media.

Table 27: Mid-Term Recommended Strategies

Strategy No.	Implementation Goal	Area of Impact	Recommendation	Metric	Frequency	Stakeholder (lead)
12	**Goal 1** GHG Emissions Reduction	GHG Emissions Reductions – Renewable Energy	Determine feasibility with the goal of developing incentive program (e.g., reduced permitting cost, processing time) for projects that pair onsite renewable energy generation and EVI.	# paired installations, lbs. Carbon dioxide equivalent (CO2e) saved vs. energy mix	As appropriate	Municipalities
13	**Goal 1** GHG Emissions Reduction	Transit Fleet GHG Emissions	Develop a rollout plan for public transit agency transition to 100% zero-emission bus fleet by 2040.	% Plans completed by transit agency	Due 2023 for Small Transit Fleets	Transit Agencies
14	**Goal 2** Transportation Infrastructure Readiness	Develop Reach Codes for EVI	Research ability to adopt local EV charging infrastructure standards for new and existing buildings that go beyond the requirements of Title 24 and/or CALGreen.	% of Municipalities with Reach Codes	Annual	Municipalities
15	**Goal 2** Transportation Infrastructure Readiness	Update High-Impact Projects (HIP)	Identify new HIP and remove completed projects from list. Redistribute list to stakeholders.	# new HIPs	Complete by end of Year 5	SBCOG
16	**Goal 4** EVI Affordability	EV/EVI Marketing Campaign #2	Seek and secure funding to develop and run a second Regional EV/EVI awareness marketing campaign to educate consumers/residents/travelers about the environmental and financial benefit of PEVs.	# of participants in outreach events, # of DAC participants, # events held	Term Period Reporting with Annual Tracking	SBCOG and/or municipalities

Mid-Term Recommendations

Incentivize Renewables and EVI

During peak solar power generation (typically in summer and fall), solar power can provide most or all the midday generation, allowing EVs to potentially charge from GHG-free electricity. Municipalities may evaluate opportunities to provide incentives to EV project owners (e.g., reduced permitting cost/timeline) to encourage co-locating renewable energy generation with EVI.

Small Transit Agency ZEB Planning

Small transit agencies (per CARB Innovative Clean Transit Regulation, in the San Joaquin Valley, these are operators with fewer than 65 buses operating at annual maximum service) must develop a rollout plan to transition to 100% zero-emission bus fleets by 2040. Small transit agencies must have the rollout plan submitted to CARB in 2023.

Update High Impact Projects

SBCOG may consider updating the list of High Impact Projects to identify which have deployed EVI and if new sites have emerged that warrant outreach and/or advisory engagement.

EV and EVI Marketing Campaign #2

SBCOG and/or municipalities may conduct or sponsor a second Regional EV/EVI awareness marketing campaign to educate consumers/residents/travelers about the environmental and financial benefits of PEVs.

Table 28: Long-Term Recommended Strategies

Strategy No.	Implementation Goal	Area of Impact	Action	Metric	Frequency	Stakeholder (lead)
17	**Goal 1** GHG Emissions Reduction	Transit Fleet GHG Emissions	Begin phasing transit fleet to 100% zero-emission buses (new purchases) in 2025.	% of newly purchased buses are ZEB, % total ZEB in Fleet	Begin in 2025 if minimum number of ZEB purchased by end of 2021; otherwise begin 2023.	Public Transit Agencies
18	**Goal 2** Transportation Infrastructure Readiness	Autonomous Vehicles (AV) and Inductive Charging	Plan for emergence of AVs and inductive charging	# AVs, # inductive chargers	As appropriate	All

Long-Term Recommended Strategies

Transit Fleet ZEB Phasing

Under the California Air Resources Board Innovative Clean Transit (CARB ICT) regulation, all transit operators must begin phasing their fleets to 100% zero-emission buses (new purchases) in 2025 if minimum number of ZEBs were purchased by 2021; otherwise begin in 2023. Transit agencies will complete their ZEB rollout plans by 2040 in compliance with CARB ICT.

Autonomous Vehicles & Inductive Charging

Existing EV-ready infrastructure and/or EVCS infrastructure could be modified to support inductive (wireless) charging pads. While there is a potential energy loss in inductive transfer of power (up to 10%), there are significant benefits of inductive charging for AV, especially in fleets.

Funding and Incentives

Local Funding Opportunities

Southern California Edison (SCE)

SCE's Charge Ready Program is designed to help increase the availability of EV charging stations at locations where cars are typically parked for four hours or more. Nonresidential customers who own, lease or operate a site that provides long dwell-time parking, including workplaces, fleet, MUDs and other destination centers, such as sports venues or hotels, are eligible. The site owner must provide an easement grant to SCE and deliver proof of purchase of qualified charging equipment.

SCE will support the deployment of a minimum of 10 charging stations per site (five in disadvantaged communities). The actual number of charging stations approved through the program will be determined based on several criteria, including current and near-term EV adoption and the number of on-site parking spaces. The site owner procures charging stations among a broad selection of Level 1 (120V) and Level 2 (240V) charging stations but all charging stations must be installed on a new dedicated circuit deployed by SCE, separately from any existing panel, meter or service. The program covers all electric infrastructure costs related to the new circuit. SCE also offers a rebate to offset some or all the costs for the charging stations and their installation.

The utility is requesting approval for a $760 million second phase for their Charge Ready program (Charge Ready 2), which would help support 48,000 new EV plugs throughout its territory. This phase will include charging solutions for MUDs, workplaces, and other public locations.

South Coast Air Quality Management District

SCAQMD implements several incentive programs that can aid organizations and entities in converting their fleets to ZEVs or installing charging stations. SCAQMD implements the AB 2766 Carl Moyer, Clean

School Buses and Voucher Incentive Programs, among others. For more information, please visit aqmd.gov/nav/grants-bids/funding.

Mojave Desert Air Quality Management District

MDAQMD implements two primary incentives: the AB 2766 funding program and the Carl Moyer Program. For more information, please visit mdaqmd.ca.gov/grants.

State Funding Opportunities

Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP)

The California Legislature appropriated funds for the Low Carbon Transportation Program, which includes $125 million specifically allocated to the Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (CARB, 2018). HVIP provides clean truck and bus vouchers to help fleets reduce the initial costs of converting fleets to PHEVs and ZEVs and range from $8,000 to $45,000 per vehicle.

Alternative and Renewable Fuels and Vehicle Technology Program (ARFVTP)

The ARFVTP, a program of the CEC, provides annual investments for advanced transportation and fuel technologies (ARFVTP Overview, 2018), including EVCS. Available funding for the 2018-2019 investment cycle reached a total of $134.5 million, more than the average annual investment of $100 million. According to the 2018-2019 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program, policy goals for the investment include GHG reduction, petroleum reduction, low-carbon fuel standard, air quality and ZEV regulations (2018).

California Capital Access Program - EVCS (CALCAP-EVCS)

This program, administered by the CEC, provides small businesses (<1000 employees) with a private loan designed to cover the upfront cost of installing EV charging. At the end of the loan term/upon successful repayment, the state provides a rebate that may exceed the amount of interest paid on the loan.

California Electric Vehicle Infrastructure Program (CALeVIP)

CALeVIP offers financial incentives for eligible EVCS infrastructure installations and works with local governments and community partners to develop regional EV charging projects statewide. CSE manages the individual projects, distributes rebates, and provides outreach and informational materials to assist property owners and service providers. **As of August 2019, the program is currently fully subscribed for San Bernardino County**. Additional applicants will be placed on a waitlist in the order that applications are received, though there is no guarantee for future funding, and waitlist applications may be suspended due to demand.

Volkswagen Settlement Funding

Electrify America

The Electrify America program is a subsidiary of Volkswagen with the goal of investing $800 million into zero-emission vehicle projects between 2017 and 2027. This investment has typically been into public

Level 2 and DCFC infrastructure, but Cycle 2 of its California Investment Plan notes that residential charging may be able to be provided for no upfront cost, instead spreading the cost out over monthly fees. Communities can suggest locations, but the final decision is ultimately up to Volkswagen/Electrify America. In its Cycle 2 California Investment Plan, Electrify America additionally detailed plans to invest in charging stations dedicated to supporting ZEV bus fleets. These stations will be located at bus depots, layover points, and along key routes.

California Volkswagen Mitigation

The Volkswagen Environmental Mitigation Trust (EMT) provides approximately $423 million for California to mitigate the additional nitrogen oxide (NOx) emissions from diesel Volkswagen vehicles equipped with defeat devices. As part of this, $5 million will be allocated in a competitive solicitation for EV infrastructure buildout. The funding cycle will begin inviting solicitations in Q3/Q4 2019 with the goal of filling physical and funding gaps in installed EVCS.

Federal Funding Opportunities

Congestion Mitigation and Air Quality Improvement (CMAQ) Program

The FAST Act authorizes funding of $2.3 billion to $2.5 billion to the CMAQ program for apportionment to the states. States, local governments and transit agencies can use these funds to invest in transportation projects that support the Clean Air Act. Projects eligible for the funds include alternative fuel vehicles and infrastructure. A project supported with CMAQ funds must demonstrate that the project reduces emissions, is in or benefits an EPA designated nonattainment or maintenance area and is a transportation project (23 U.S.C. 149) (Federal Highway Administration, 2017). Projects located on FAST-designated corridors (including State Routes 14, 46, 58, and 99, as well as Interstate 5) receive funding priority over those not located on these corridors.

Low or No Emission Vehicle Program – 5339(c)

Implemented as another part of the Fixing America's Surface Transportation Act (FAST Act), the Low or No Emission Vehicle program (Low-No Program) may fund up to 85% of the cost but requires a 15% nonfederal cost share. The funding is apportioned to the State of California through the 5307 Urbanized Area Formula. Public information is available on the FAST Act website and FAST Act Section 5339 fact sheet (Federal Transit Administration, 2018).

Title XVII Clean Energy Loan Guarantees

Loan guarantees are available through the U.S. Department of Energy for investment in alternative fuel vehicles. Loan guarantees may cover up to 100% of the eligible project cost and may include infrastructure and networking projects. More information is available on the Loan Guarantee Program website and the Alternative Fuel Infrastructure fact sheet (Department of Energy, 2019). For more information, please see https://www.energy.gov/lpo/electric-vehicles-and-alternative-fuel-vehicles.

Surface Transportation Block Grant Program (STBG)

The FAST Act authorizes funding for the STBG program. Funding apportioned to a state for the STBG provide for the construction of electric vehicle charging stations associated with 1) construction of truck parking facilities (23 U.S.C. 133(b)(1)(E) and 2) fringe and corridor parking facilities (e.g., Park & Ride facilities) (23 U.S.C. 133 (b)(5)). Fringe and corridor parking facilities must meet specific requirements.

Incentives

General information on organizations that offer ZEV-related funding is useful in both plans and toolkits. Understanding different incentives that can reduce the cost of EVCS installation will help reduce barriers to infrastructure deployment. Butte County Association of Governments developed a table of different incentive programs for EV charging and PEV purchase costs and sorted them by funder. These are shown, along with local funding opportunities, in Table 29.

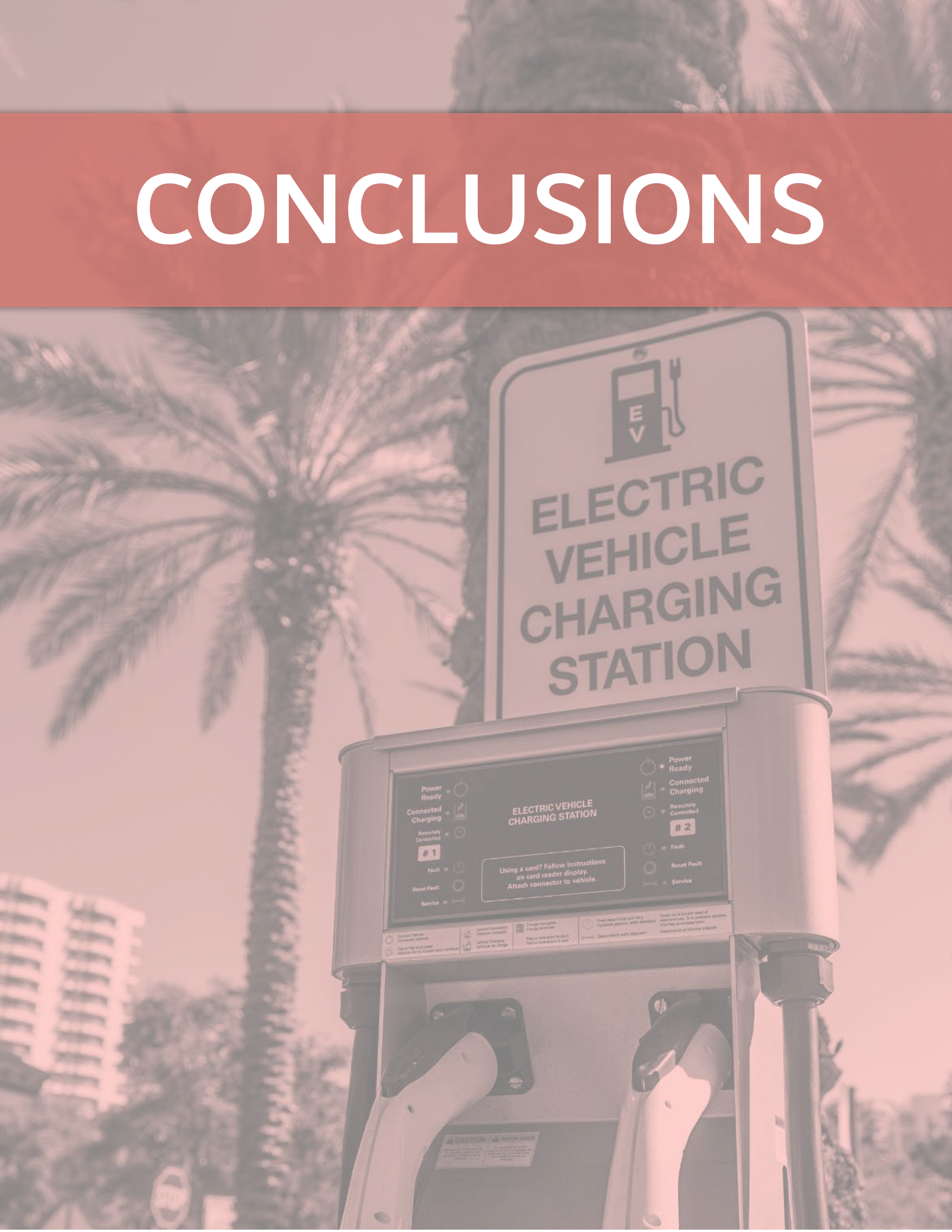
Table 29: Incentive Programs for EV Infrastructure and Electric Vehicles.

Programs	Description	Amount	Eligibility
Federal Programs			
Plug-in Electric Vehicle Tax Credit	A tax credit for the purchase or lease of a new PEV, ZEV, PHEV, zero-emission motorcycle, or neighborhood electric vehicle.	$2,500-$7,500 per vehicle	Individuals
Fuel Cell Vehicle Tax Credit	A tax credit for the purchase of a new light-duty FCEV; credits are based on vehicle weight.	$4,000-$40,000 per vehicle	Individuals
Low Speed, 2/3 Wheel PEVs Tax Credit	Tax credit for low-speed and 2/3-wheel plug-in vehicles.	10% of vehicle cost, up to $2,500 limit	Individuals
Employee Corporate Incentives	Private companies and organizations offering employees assistance with purchasing new ZEVs	$1,000-$5,000 per vehicle	Individuals
Alternative Fuel Vehicle Refueling Property Credit	A 30% tax credit is allowed for any qualified alternative fuel vehicle refueling property	$1,000-$30,000 per vehicle	Individuals/Property Owners
State Incentive Programs			
Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act			
Clean Vehicle Rebate Project (CVRP)	Available rebate for ZEVs, PHEVs, Neighborhood Electric Vehicle (NEVs) and Zero Emission Motorcycles (ZEMs).	$900-$2,500 per vehicles, with a limit of two rebates. For vehicles purchased or leased after 2015.	Individuals
California Hybrid and Zero-Emission Truck	Vouchers to help fleets reduce the initial costs of converting	$8,000-$110,000 per vehicle, including buses	Public/Private Fleets

Programs	Description	Amount	Eligibility
and Bus Voucher Incentive Project (HVIP)	fleets to PHEVs and ZEVs		
Hybrid Off-Road Equipment Pilot Project	Vouchers to integrate hybrid off-road construction vehicles into California	$28,500-$75,000 per vehicle	Public/Private Fleets
Air Resources Board Grant Programs			
Enhanced Fleet Modernization Program	Voluntary retirement of passenger or cargo trucks with a vehicle weight rating of 10,000 pounds or less.	$500-$1,500 per vehicle	Individuals/Private Fleets
Goods Movement Emission Reduction Program	CARB working with local agencies to reduce air pollution and health risks associated with heavy freight movement	Up to $50 million	Local Agencies

Source: Compiled by the Butte County Association of Governments (2018)

CONCLUSIONS



VI. Conclusions

This Plan outlines the path for San Bernardino County stakeholders to transition to electrified transportation with a holistic and futuristic view of regional transportation planning, consideration for disadvantaged communities, and meeting its share of the State of California's 2015 ZEV Action Plan goal.

Several barriers must be addressed to ease San Bernardino County's trajectory toward meeting these goals. Foremost is simplifying and standardizing the process of permitting and implementing EV charging stations by holding public guidance workshops to walk interested stakeholders through the process, standardizing the permitting process following guidance from the California Governor's Office of Business and Economic Development (GO-Biz), and improving awareness of financial incentives and/or assistance programs for installing EVCS. Secondary to improving infrastructure buildout should be ensuring that County residents are aware of the potential financial, environmental, and logistical benefits of electric vehicles, including reduced fuel and maintenance costs and reduced greenhouse gas emissions.

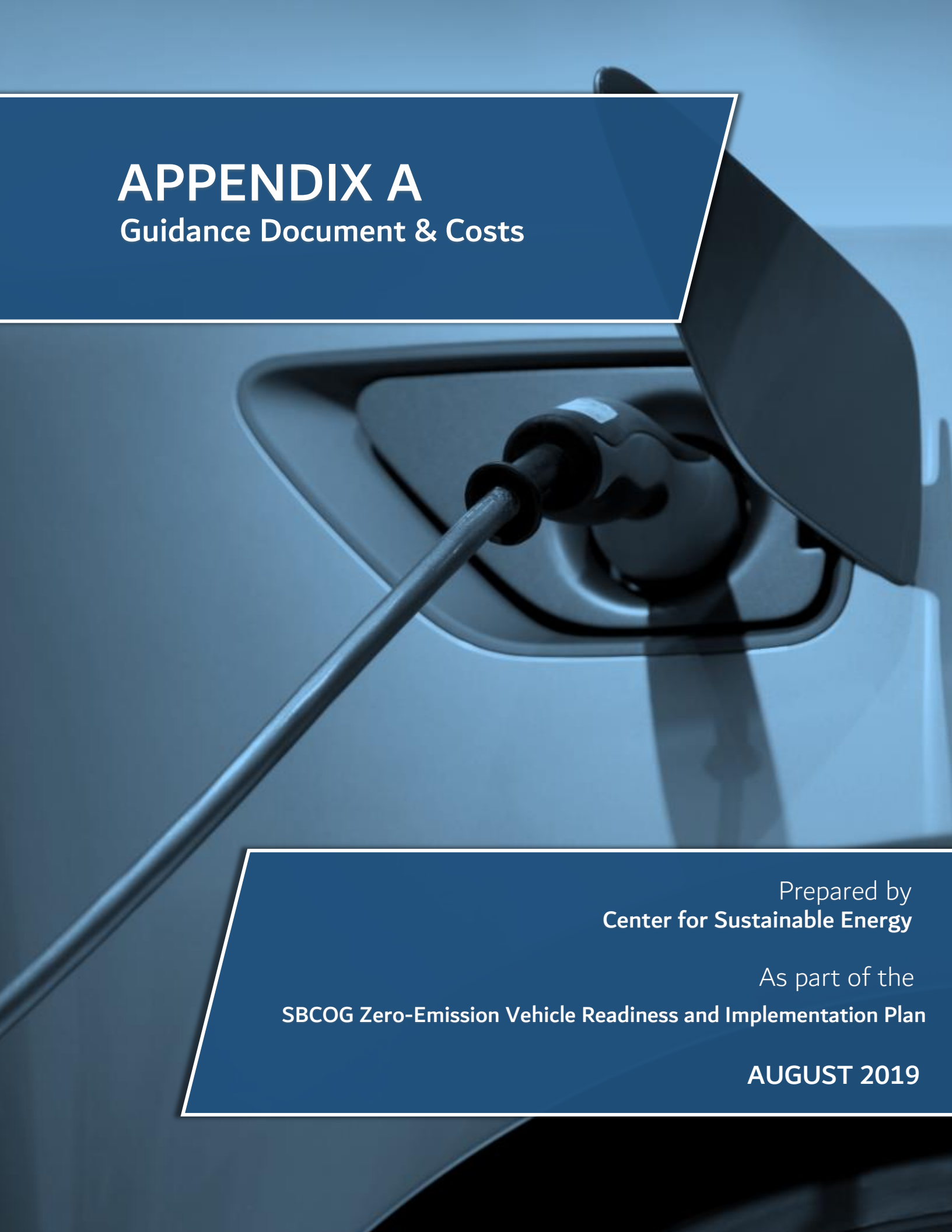
To meet the expected EV demand projections for 2020 and 2025 (21,894 and 44,846 EVs, respectively), the majority of EV infrastructure should continue to be sited in the heavily populated urban areas of the county. If increases in EV adoption are distributed equally among each of the municipalities, commensurate with their population, urban regions will require a minimum of 40 additional DCFC plugs, and 1,011 additional Level 2 plugs in 2020, and more than 400 new DCFCs and 3,500 Level 2 plugs in 2025. Excluding Tesla Supercharger infrastructure, rural portions of the county will require a minimum of six additional DCFC and 52 Level 2 plugs in 2020, increasing to 23 DCFC and 171 Level 2 plugs in 2025. Projections indicate that unincorporated regions will require up to 19 additional DCFC plugs (79 total DCFC plugs in 2025) and an additional 230 Level 2 chargers (664 total Level 2 plugs in 2025).

San Bernardino County should consider investing in publicly accessible Level 2 charging infrastructure at public institutions (e.g., city hall, courthouses, parks, schools, etc.), transit sites (e.g., Metrolink stations and Park& Ride lots), and within DACs. Because public infrastructure is geographically distributed through the region, siting EV charging infrastructure at these site types will ensure that EV charging infrastructure is available to multiple community stakeholders. Having a regional distribution of EVCS will not only benefit individual EV drivers (i.e., reducing range anxiety) but support visitor and inter-county driving. It will also have the added impact of reducing greenhouse gas emissions at a regional level.

Siting DCFC along heavily traveled corridors in the urban core and the high desert is recommended to facilitate long-range commuting, visitor travel, and inter-regional driving. Investing in a DCFC network that provides adequate charging (50-mile range) across the county is recommended. Desert destinations, such as Needles and Twentynine Palms, should evaluate siting both Level 2 EVCS and DCFC to meet demands of short dwell (less than 1-hour) and long-dwell (more than 1 hour) drivers.

Based on the low number of current FCEV vehicle registrations (64 FCEV) and limited regional FCEV infrastructure, near-term demand for FCEV infrastructure investment should be aligned with the needs of inter-county commuters. Investing in corridor FCEV charging station siting is warranted to ensure that travel to other regions is possible but also to provide inter-county drivers access to mountain and desert recreation areas and resort destinations (e.g., Las Vegas and Palm Springs).I-10 and I-15 should be evaluated for near-term corridor investment with Barstow and Victorville as targets for FCEV infrastructure based on population growth and proximity to aforementioned corridors.

This Plan recommends Implementation Strategies that can be pursued on an ongoing basis, near-term (0-2 years), mid-term (2-5 years), and long-term (5-10 years) intervals. San Bernardino County stakeholders should consider investing time and resources to deploy the Plan and implementing the recommended strategies to meet Implementation Goals, and track metrics and progress. Priority recommendations include developing public/private partnerships, streamlining permitting, identifying and pursing funding and incentives, developing a regional technical advisory service, deploying a marketing and outreach program for ZEV and ZEV infrastructure, and tracking and reporting on Plan progress. Near-term strategies are recommended to quickly remove the principal barriers to EVI adoption in San Bernardino County. At the end of each project phase (e.g., near-term, mid-term, long-term) SBCOG and key stakeholders (e.g., local chambers of commerce, the San Bernardino County Economic Development Agency, and the Inland Empire Economic Partnership) should evaluate progress against the EVI projections.



APPENDIX A
Guidance Document & Costs

Prepared by
Center for Sustainable Energy

As part of the
SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

Contents

Introduction

The goal for this section is to provide a useful guide to the EVCS siting process, starting with pre-construction permitting and considerations, moving into installation, then examining operational considerations and additional/miscellaneous portions of the construction process. Combined with the Implementation metrics outlined in Section V of the main body of the ZEV Readiness Plan, the list of potential EVCS sites in each community (Appendix B), and the appropriate toolkits outlined in Appendices C-E, municipalities and site hosts should be able to navigate the process of EVCS installation without requiring additional consultants.

Permitting and Codes

General Guidance

Permitting Process for Governments

A key step in the installation of PEV charging equipment is to obtain city or county permits and pass an inspection. Because regional infrastructure has been expanding rapidly, there are many opportunities to streamline permitting and inspection procedures and harmonize processes between jurisdictions. Making the permitting process easy, affordable, and less time consuming can help speed the roll out of charging infrastructure and make installations more straightforward.

Permit Streamlining Considerations

Jurisdictions should balance efforts to simplify permitting and inspection while maintaining quality and safety standards. The following practices can help jurisdictions increase efficiency while meeting standards and state requirements:

- Prepare combined informational materials providing all guidance on the permitting and inspection processes for residential, MUDs, and non-residential charging equipment installations
- Prepare all guidance, including a permitting and inspection checklist and application materials allowing for online submission to meet local and state requirements per AB 1236 as described on page 16
- Work with other local governments to make permitting and inspection procedures consistent between jurisdictions by using consistent guidelines and other shared standards
- Consider streamlining permitting for installations in single-family residences by reducing application material requirements; for example, eliminate site plan requirements and require installer to provide manufacturer specifications and approved equipment testing certification at the time of inspection, limit to one inspection, and set a fixed fee
- Work with local utilities to create a notification protocol for new charging equipment through the permitting process
- Train permitting and inspection officials in EV charging equipment installation

To provide permitting consistency between jurisdictions in the San Bernardino County region, it is also recommended that guidelines are developed for local governments on PEV charging systems for single-family and multi-family residences and commercial properties.

Assembly Bill 1236: Electric Vehicle Charging Stations

Recognizing the important role of permitting in the deployment of charging infrastructure, California legislators passed a law in 2015 requiring local governments to streamline the permitting process. AB 1236 required all communities under 200,000 people to adopt an ordinance that expedites the permitting process for PEV charging stations by September 30, 2017.

The required ordinance must include several streamlining elements. Local governments must provide a permitting checklist for which installation projects that meet all requirements must be eligible for expedited review. Cities and Counties can use the latest version of the "Plug-In Electric Vehicle Infrastructure Permitting Checklist" from the Zero-Emission Vehicles in California: Community Readiness Guidebook published by the Governor's Office of Planning and Research. An example checklist is also provided at the end of the document. Local jurisdictions can modify standards based on "unique climactic, geological, seismological, or topographical conditions." In addition to developing streamlined procedures, permitting offices must provide the permitting materials on the government's website and must allow for electronic submittal of the application materials online.

Americans with Disabilities Act (ADA)/California Building Code Compliance

Under the California Building Code (CBC), a portion of all chargers at MUDs and non-residential developments are required to be ADA-accessible. It is important to take these requirements into account when planning to install chargers because they impact the spatial needs, and potentially the cost, of installations. The first new charger constructed is required to be ADA-accessible and this is significantly wider than a typical parking space, and includes more space for adjacent access aisles. Property owners may have to sacrifice multiple standard parking spaces to build the first charging space.

When EVCS are installed in public parking garages and lots, it is important to note that under CBC Chapter 11B, Divisions 2 and 8:

- Installing EVCS changes the use of the space from parking to charging.
- Depending on the number of EVCS to be installed, a certain number and type of accessible EV spaces needs to accompany the EVCS installation (see Table 1 below)
- Accessible spaces need to be on an accessible path of travel to the main entrance of the facility which the EVCS serves.

ADA Requirements for Pre-Wired Charging Spaces at New Multi-Family Developments

CalGreen requires that multi-family residential developments with 17 or more parking spaces to have three percent of parking spaces, but in no case less than one space, pre-wired for a Level 2 charger. One in every 25 of these spaces, with a minimum of one space, is required to have an adjacent access aisle that is eight feet wide, though this can be reduced to five feet if the parking space is over 12 feet wide. These spaces are also required to be relatively flat.

ADA Requirements for New Public Charger Installations

The California Building Code requires roughly one of every 15 newly-installed chargers at public locations to be ADA-accessible, as shown in **Table A1**. Three design standards for ADA-accessible parking spaces are as follows:

- Ambulatory parking spaces designed for people with disabilities who do not require wheelchairs, but may use other mobility aids.
- Standard ADA-accessible spaces designed for people who use wheelchairs but can operate vehicles.
- Van-accessible spaces for vehicles carrying people who use wheelchairs who cannot operate vehicles.

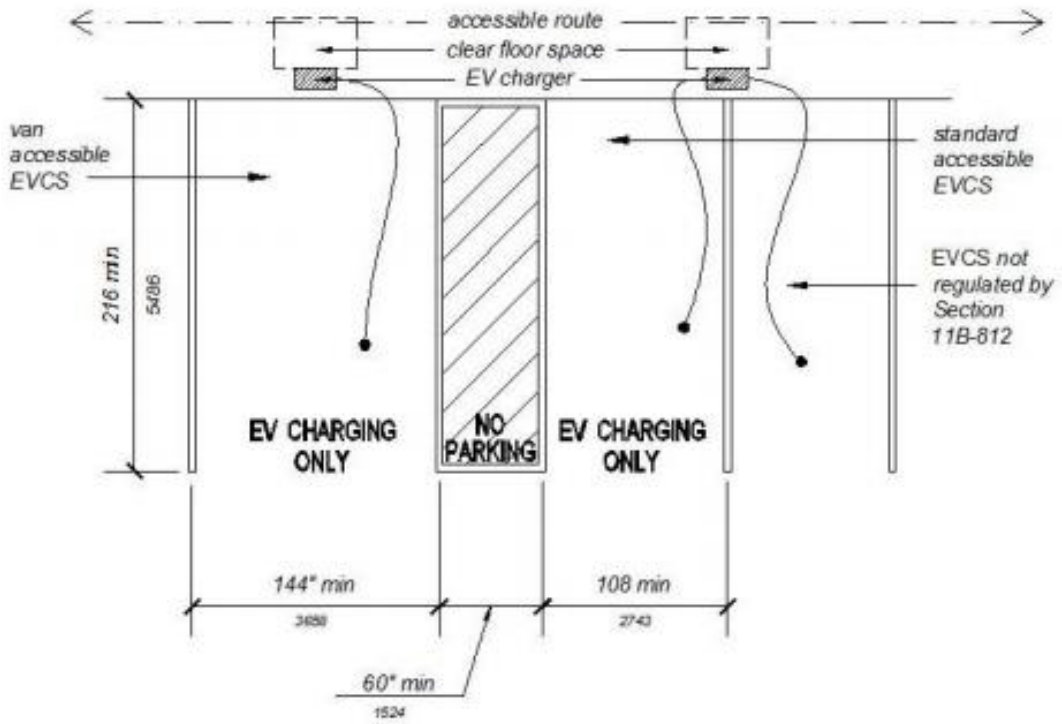


Figure A1. ADA accessible space on left with surface markings following CalGreen Building Code standards.
Source: California Building Standards Commission, 2016 California Building Standards Code Section 11B-812.9

Table A1: ADA-Accessible Chargers Required at Installations of New Public Charging Spaces

Total Chargers	Minimum Required Van Accessible Chargers	Minimum Required Standard Accessible Chargers	Minimum Required Ambulatory Chargers
1 – 4	1	0	0
5 – 25	1*	1	0
26 – 50	1*	1*	1
51 – 75	1*	2*	2
76 – 100	1*	3*	3
101+	1, plus 1 for each additional 300 spaces	3, plus 1 for each additional 60 spaces	3, plus 1 for each additional 50 spaces

** Must have at least one accessible space*
Source: California Building Standards Commission, 2016 California Building Standards Code, Section 11B-812

New Construction Guidance

The state of California has created requirements for pre-wiring charging spaces in new development and using signs to indicating chargers. **Table A2** summarizes these requirements as they apply to charging spaces in new development and newly constructed charging stations.

Table A2. New Development Requirements for PEV Charging Spaces and EVCS

	One- and Two-Family Residential	Multi-Family Residential	Non-Residential	Source
Number of pre-wired spaces required	1	3% of all spaces; at least 1 (increasing to 10% of spaces in 2020)	Approximately 1 in every 20, and 6% when over 100 spaces	CalGreen
Electrical requirements	Listed raceway to accommodate a 208/240-volt branch circuit	Listed raceway to accommodate a 208/240-volt branch circuit	Listed raceway to accommodate a 208/240-volt branch circuit	CalGreen; California Electrical Code, Article 625
Dimensions	N/A	9' x 18'	N/A	CalGreen
Signage Required?	No	Yes	Yes	CalGreen

Note: The requirements summarized above can be detailed and highly technical, so installers should always refer to source documents when conducting installations.

Local EVSE Guidance

Under California AB 1236, cities and counties were required to enact ordinances creating an expedited, streamlined permitting process for electric vehicle charging stations by September 30, 2017. A checklist of eligibility requirements for expedited review were required to be posted online, alongside the permitting documentation.

ZEV Readiness Scorecard

The Governor's Office of Business and Economic Development has established a ZEV readiness landing page (http://www.business.ca.gov/ZEVReadiness) that will be used to track station development streamlining, resulting in a shared resource of best practices, ordinances, and checklists. The site will initially focus on permit streamlining and voluntary building codes.

Permitting

The below "Permitting Electric Vehicle Charging Stations Scorecard" will serve as the foundation for assessing statewide compliance with California's electric vehicle charging station permit streamlining law (AB 1236, 2015).

Table A3: Permitting Electric Vehicle Charging Stations Scorecard:*

•	**Streamlining Ordinance** Ordinance creating an expedited, streamlined permitting process for electric vehicle charging stations (EVCS) including level 2 and direct current fast chargers (DCFC) has been adopted

•	**Permitting checklists covering Level 1, Level 2, and DCFC** Checklist of all requirements needed for expedited review posted on Authority Having Jurisdiction (usually a city or county) website
•	**Administrative approval of EVCS** EVCS projects that meet expedited checklist are administratively approved through building or similar non-discretionary permit
•	**Approval focused on Health and Safety Review** EVCS projects reviewed with the focus on health and safety
•	**EVCS are accessory features** EVCS projects do not trigger planning/zoning review
•	**One complete deficiency notice** Authority Having Jurisdiction (AHJ) commits to issuing one complete written correction notice detailing all deficiencies in an incomplete application and any additional information needed to be eligible for expedited permit issuance.
•	**Electric signatures accepted**. AHJ accepts electronic signatures on permit applications*
•	**EVCS not subject to association approval** EVCS permit approval not subject to approval of an association (as defined in Section 4080 of the Civil Code).

*Note –The requirements established by AB 1236, 2015 is the foundation of this scorecard. See Part 3 – Permitting, Table 2 for more information.

Cities and Counties that have met all the checklist parameters will be highlighted as "AB 1236 Compliant," and the GO-Biz ZEV Readiness website will point to the relevant ordinances and checklists for other jurisdictions to reference. Overall, jurisdictions will be scored using the following scale, with the objective creating a platform for collaboration to establish statewide compliance.

Permitting Status
Unknown
Not in Compliance with AB 1236
Compliance in Progress (or partial compliance)
AB 1236 Compliant

Cities and Counties that have not yet implemented ordinances streamlining the permitting process may refer to the end of this document, which contains model language sourced from the California Building Officials. The appendices also link to the appropriate toolkit for the municipality size (either >200,000 residents or <200,000 residents).

Table A4: Municipality compliance status under AB1236 mandate

Municipality	*Expedited Permitting Legislation?*	*Publicly Available Checklist?*
City of Adelanto	No	No
Town of Apple Valley	Municipal Code 8.39	Not officially implemented
City of Barstow	No	No
City of Chino	No	No
City of Chino Hills	Municipal Code Chapter 15.17	No
City of Colton	No	No
City of Fontana	No	No
City of Grand Terrace	No	No
City of Hesperia	No	No
City of Highland	Yes	Charger Installation Guidelines
City of Loma Linda	Ordinance	No
City of Montclair	Yes	Charger Installation Checklist
City of Needles	No	No
City of Ontario	Yes	Electric Vehicle Supply Equipment
City of Rancho Cucamonga	Yes	Plan Review Requirements
City of Redlands	Yes	Checklist for Permitting EVCS
City of Rialto	Not officially implemented	No
City of San Bernardino	No	No
County of San Bernardino	No	No
City of Twentynine Palms	Ordinance 280 pending adoption	No
City of Upland	No	No
City of Victorville	No	No
City of Yucaipa	Municipal Code 15.04.150	No
Town of Yucca Valley	No	No

Building Standards

Several communities have already adopted voluntary reach building codes. Similar to tracking permitting, the GO-Biz ZEV Readiness website will track progress using the following parameter, and jurisdictions will fall into one of three categories.

Voluntary Building Standard Adoption:

❑ **Voluntary reach codes**. Has the AHJ adopted voluntary reach building codes for EV charging?

Building Standards
State of California Standards
Voluntary reach code adoption in

progress
Some voluntary reach codes adopted
All Voluntary reach codes adopted

GO-Biz anticipates that the ZEV Readiness page will evolve and improve through time with stakeholder participation and feedback.

Inspection

Inspection is the last step in the permitting process. Ensuring that any uncertainties or time requirements are minimized is an important part of expediting the permitting process, and some municipalities nationwide guarantee inspections within a certain timeframe. In some cases, it is even on the same day.

Staff Training

Training and professional development are key factors to expedited inspection. While installations at single-family residences can be relatively simple and often do not require significant review by permitting staff, installation of commercial or public stations or stations at multi-family dwellings are more complex and require further oversight and review. Until more projects are implemented, most jurisdictions and installers do not have extensive, experience, if they have any, with these complicated, varied types of installations. Jurisdictions seeing or anticipating significant implementation of these types of projects may benefit from training their staff and by a list of professional electricians qualified to assist with PEV charging station installations.

Clean City's Electric Vehicle Infrastructure Training Program (EVITP) offers courses that train and certify electricians to install stations. It also sometimes works with local governments to customize classes to local needs and constraints. Alternatively, there may be local staff members from other jurisdictions with experience working on various projects who can provide a peer training workshop. Programs such EVITP address aspects of inspection as well, making sure the inspectors are familiar with EVCS equipment and requirements. EVITP-trained inspectors are informed and know who to contact if questions arise during installation.

Updates to Requirements

Unless local decision-makers have specifically directed staff to update plans, ordinances, or codes to increase charging opportunities, changes to charging station guidance will likely take place in the context of a comprehensive update to long-range planning documents, a complex process that happens relatively infrequently. Local governments should look for opportunities to incorporate policy language, incentives, or requirements into all updates to plans, ordinances, and codes, including adopting and enforcing the 2016 update to the building code with its pre-wiring requirements. Even if short-term actions do not include firm requirements or detailed language, they can set the stage for stronger changes in the future.

Local governments have little authority to create charging infrastructure at existing developments apart from offering funding to property owners for charger installation. It will only be worthwhile to modify building code and zoning ordinances in ways that exceed current pre-wiring requirements or focus charging in high need areas if there is enough new development to implement these changes. Otherwise, it may be easier and equally effective to enact policies that provide a basis for negotiating with developers to install EVCS as opportunities arise.

Installation

Pre-Installation

Permit Application Considerations for EVCS Installers

Application Requirements

Different jurisdictions will have varying requirements for PEV charging station projects, depending on each jurisdiction's process. Some permitting offices do not require site plans, especially for installations at single-family detached residences, but permit applications will often include the following:

1. Permit application
2. Plan for installation
3. Line drawings
4. Electrical load calculations
5. Permit and inspection fees
6. Site inspection guidelines

Permits for commercial or public stations are often more complex than those for residential installations and may require significant exchange between the installer and permitting staff. In some places, permit applications can be submitted online, while in other jurisdictions they must be handled in-person. It should be noted that AB 1236 requires jurisdictions to provide permit materials and allow submission of applications online. A permit from the regional planning agency may also be required in certain circumstances.

If an electrical panel needs to be upgraded or a new panel is being added, the installer needs to work with the electrical service provider to meet all of the utility requirements, which may include submitting an application, communicating with a utility representative, and scheduling an inspection. These steps may add significant time to the project, depending on the complexity of the service change. Burdensome and unnecessary permitting requirements should be eliminated because these demand more time of the electrician, thereby adding to installation costs.

Permitting Fees

EVCS permitting fees vary widely depending on a number of factors. National survey data from the EVCS installer firm SPX found fees ranging from $0 to $625[1]. Generally, these fees cover administrative and inspection costs for the jurisdiction. Fees vary widely: it is possible to find neighboring municipalities with similar processes, but vastly different fees. The method for determining and assessing fees varies as well. Fee standardization is desirable so that potential installers can estimate the full cost of installation.

Site-Specific Technical Studies

[1] https://energycenter.org/sites/default/files/docs/nav/transportation/plug-in-get-ready/presentations/2.EVITP%20Seminar%20Permitting%2CCA_Final%2C1-6-13.pdf

EVCS permitting typically requires confirmation that installation will not have adverse public health and safety impacts and that all state and local electrical code requirements are met. If city building officials determine potential impact to health and safety, they will issue a conditional use permit. See California 2015-6 Electrical Code, Article 625 and AB 1236 for details on state requirements.

Electric vehicle charging equipment is considered a "continuous load", meaning the maximum electrical current is expected to occur for three hours or more at a time. Electrical assessments require examining system capacity and electrical loads, system wiring, bonding and overcurrent protection, affected building infrastructure, and affected areas for parking and charging equipment. Conduit size, conductor sizing, trenching, circuit voltage drop along the length of the conductor and other requirements must be considered, particularly if future EVCS is planned. In locations that lack adequate electrical power, existing loads may be reduced through energy efficiency upgrades of lighting and heating, ventilation, and air conditioning (HVAC) systems. In some jurisdictions, an electrical plan check is not required if EVCS is rated below a certain capacity. For example, in Calaveras County, a permit for equipment rated below 400 amps can be granted from a building official over-the-counter (County of Calaveras Ord. No. 3077, Code of Ordinances 15.11.040).

Utility Coordination

As the number of PEVs on the road increases, so does the demand placed on electric utilities to supply them with the power they need. Vehicle charging can add substantial electrical load and changes how, when, and why electricity is used. Potential site hosts should coordinate with their utility on a number of different issues, including:

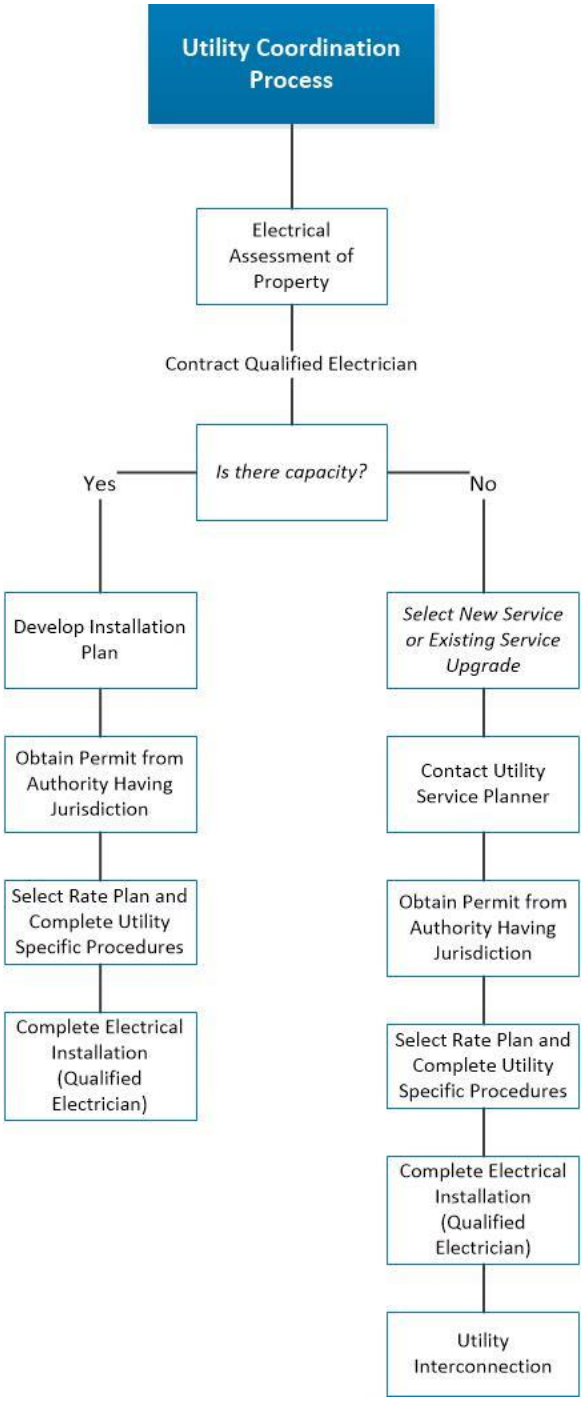
- **Participating in utility infrastructure program:** Some utilities offer programs that include funding installations for charging infrastructure or rebates for charging stations. Contact your utility provider to see if you qualify for any programs.
- **Upgrading your service:** You may need to expand your electrical service to support EV charging. Utility service planners will help determine the requirements for upgrading your service or establishing new service to support EV charging.
- **Changing your rate plan:** The traditional tiered rate structure is helpful in promoting energy conservation, but it offers no incentive for you to charge during off-peak hours. Check with your utility for rate plans that fit best with your EV charging schedule.
- **Exploring smart grid opportunities:** Utilities are piloting smart grid programs that may offer incentives for managing charging to reduce grid impacts.

Each utility has a different grid connection process and will follow different intake, review, estimating, and construction processes. However, there are also many commonalities between them. If you install stations in multiple service territories, it is important to become familiar with the similarities and differences across the utilities.

It is also important to communicate early with your utility about who will be responsible for the cost of each component of the installation. Often, the customer will be financially responsible for the electrical work between the station and the meter, while the utility will be financially responsible for work done

beyond the meter. When a service upgrade is necessary, utilities may cover some or all of the cost based on anticipated cost recovery from ratepayers. This may vary based on site-by-site conditions, the scale of a project, and other variables. A generalized flowchart of the utility coordination process follows in Figure 2.

Figure A2. Utility Coordination Process



Service Upgrades and Additional Service Drops

Additional communication with a site host's electric utility may be necessary based on the conditions and capacity of the site itself. Electrical systems, particularly in older buildings, were never designed to handle the current required for EV charging. For buildings without adequate existing electrical capacity for their planned EV charging loads, there are two main options to consider.

First is an electric service upgrade to the property. This may be costly and trigger requirements to bring the property up to current building code. This option may make the most sense as part of a larger electrical or other property rehabilitation project. Replacing a building's main service entrance and panel requires coordination between the property owner, the AHJ for a permit, and the Utility Provider.

A second option may be to add a second service drop to an existing site. Although the electrical code generally favors a single electrical connection point, exceptions exist for several situations. New services could support EV charging without requiring modifications to existing building supply. A new service entrance could be located close to the parking area where the power is needed and allow all charging to be segregated to its own utility meter, offering the freedom to choose the most suitable tariff for EV charging.

The SCE Charge Ready program uses the second service model, with the added benefit of providing SCE clear ownership of all the make-ready infrastructure connected to the new service. The Charge Ready program is available at non-residential sites, including workplaces, fleet centers, hotels, and MUD apartment complexes.

Individual Utilities

Southern California Edison (SCE)

Southern California Edison (SCE) routes electric vehicle charging station requests through their standard local planning districts and account managers. SCE estimates an average 6-12 months for a complete grid connection agreement and permission to operate letter. Engineering technical review is the most time-intensive part of the process.

The specific details of the SCE process are maintained on their Grid Interconnection page. This page has a wealth of information, many FAQ's and all of the forms needed to apply for interconnection, and readers are encouraged to refer to it when pursuing projects in SCE territory.

In addition to interconnection, SCE has placed special focus on developing ZEV rates. Access to these rates depends on how stations are metered, and is something station developers and site hosts should take into consideration when designing a project:

- For stations metered together with the existing facility load, SCE offers their full range of Time of Use (TOU) rates, which a facility can switch to by contacting their account manager or the general SCE call center.

- For separately metered stations, SCE offers designated electric vehicle charging rates, and intends to introduce further rate design options in 2019. The new rates are intended to alleviate demand charges for the first five years of service, and then phase demand charges back in over a five-year period, ultimately landing on lower rates than existing plug-in electric vehicle rates.

SCE offers a Business Rate Analysis Tool to help some business owners estimate their annual rates under different time-of-use plans. The tool currently only supports Level 1 and Level 2 charging installations at MUDs or workplaces.

City of Colton Utilities

The City of Colton owns and operates its own electrical utility and infrastructure. All EVSE stations within city limits are currently owned and maintained by the City utility company. Commercial EVSE station requests must first obtain electrical installation permits by contacting the City of Colton Development Services department at (909) 370-5079 or building@ci.colton.ca.us. Commercial applicants are eligible for a rebate of up to $5,000 for installing a networked, approved charger on its own meter, or up to $2,500 for installing a non-networked charger.

The City additionally offers a dedicated electric vehicle rate, raising the upper limit for Tier 2 consumption by 250 kWh after approving an application and verifying the ownership of an EV for personal or business use.

Best Practices for Streamlining Connection to the Grid

The state's major utilities have been trailblazers in bringing charging infrastructure to the state. As the market for charging continues to grow, utilities can continue to take leadership in addressing barriers to station development by providing transparent estimates for construction timing and connecting customers with the best rate options for each situation. Here are specific recommendations to streamline the process and provide greater transparency for all parties:

Share Service Maps with AHJs: AHJs and utilities should partner up as they plan for charging in their area by sharing and walking through maps of available service to help identify sites that would be easy to add charging. With a full picture of where charging could be easily added, AHJs can better plan for charging across their city or county, enabling station developers to minimize site development costs, and utilities will be better positioned to minimize the cost of grid connection.

Timeline Transparency: A lack of understanding of the timeline to add new electrical service can easily doom a project and frustrate the station developer and AHJ involved. By providing timely and realistic estimates of the timeline to develop a site and complete construction, utilities can help station developers plan and develop charging. Equally important is meeting those timelines in a realistic manner.

Dedicated Team for Plug-In Electric Vehicles: When practical, utilities can benefit by establishing a dedicated triage team for charging stations, who are equipped with technical expertise and familiar with the nuances of the process. Incorporating expert review into the process can help speed up the process for everyone.

Collaborate to Plan and Prepare to Meet Installation Demand: AJHs and utilities can share information about the number of installations anticipated in the near- and mid-future. This will help utilities get the right resources in place and better meet demand on time and on budget and ensure AHJs better understand upcoming grid upgrade implications and demand response needs.

Clear Rate and Demand Charge Structure: Unpredictable electricity costs charges can be one of the greatest obstacles to station deployment. Utilities can help address cost uncertainties by proactively educating AHJs and station developers on the range of electricity rate options, charges they can anticipate, and strategies to mitigate their impact.

Clear Understanding of Balance of Costs: It is not always clear to station developers which parts of the grid connection process the utility is responsible for and which the station developer is financially responsible for. Providing clear and up-front guidance would be helpful and allow station developers to better plan.

Implementation and Operation

Installation Costs

Basic charging infrastructure costs include hardware, permitting, and installation. Total costs vary by charging level, site characteristics, and equipment features. In workplace charging, fleet charging, and opportunity charging, there may be significant costs for trenching, concrete, and provision for ADA-accessibility.

Table A5. Approximate Costs for Non-Residential Single-Port EVCS

Cost data from Dept. of Energy (2015)

Cost Element	Level 1		Level 2		DC Fast Charge	
	Low	High	Low	High	Low	High
Hardware	$300	$1,500	$400	$6,500	$10,000	$40,000
Permitting	$100	$500	$100	$1,000	$500	$1,000
Installation	$0*	$3,000	$600	$12,700	$8,500	$51,000
Total	$400	$5,000	$1,100	$20,200	$19,000	$92,200

** Assumes site host is offering an outlet for PEV users to plug into for charging*

Table A6. Specific Installation Cost Considerations

Cost data from SANDAG (2016)

Cost Element	Cost
Conduit	$1.50-$2.50/ft
Trenching	$25-$100/ft
Concrete Patch	$14-$15/sq.ft
Asphalt Patch	$10-$11/sq.ft

The values presented in **Table A5** are based on the first charge port at each location. The marginal cost of the next charger installation for each level of charging infrastructure is lower. The charging equipment hardware is the only cost element that does decrease with greater number of installations. This is particularly relevant because the hardware represents a small fraction of the overall cost for Level 1 and Level 2 equipment. Even for DCFC equipment, there is potentially significant savings with more locations, with about 25-60 percent of the installed cost represented by the hardware.

Factors that affect the cost of electric vehicle charging infrastructure include:

- **Type of mounting:** Charging hardware is available as a wall-mounted or pedestal- mounted unit. Pedestal-mounted units typically cost $500-$700 more than wall-mounted due to material, manufacturing, and install construction costs.

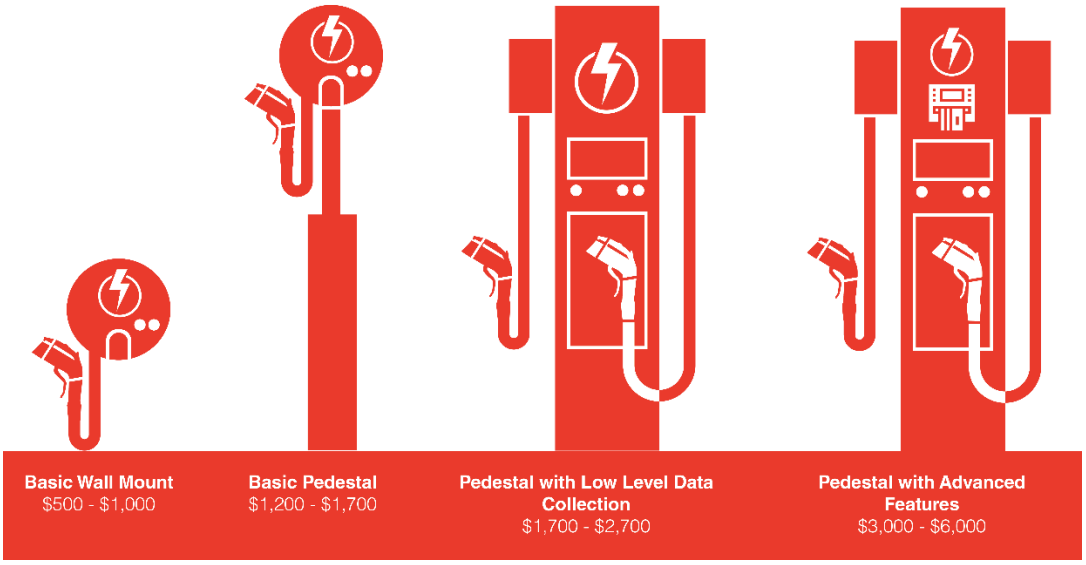


Figure A3. General Types of Level 2 Infrastructure

- **Technological features:** The simplest units (non-networked) provide a charging port and electricity, but many amenities and features can be included in hardware and subscriptions such as data collection, usage monitoring, user communication, and billing options.
- **Location:** The further away the charging station is from the electrical panel, the more it costs to install, as it becomes necessary to trench or bore long distances to lay electrical supply conduit from electrical panel to the charging location. A 2013 Electric Power Research Institute (EPRI) study[2] found that Level 2 sites that required special work such as trenching or boring were about 25 percent more costly than sites that did not need such work.
- **Electrical needs:** In most cases, charging stations need a dedicated circuit for each EVCS unit on the electrical panel, sufficient electrical capacity from the utility connection the electrical panel, and sufficient electrical capacity at the panel. If the selected site does not meet these three key electrical needs, then panel upgrades are required. The most common electrical upgrade for a Level 2 EV charging station is a re-organization of the panel to create space for a 40-amp circuit. More significant electrical work, such as a transformer upgrade, is more expensive.

Additional Costs

Network Fees

If a charging station has the ability to connect to a monitoring network, the station's operator will need to cover the cost of maintaining the cellular or internet network connection, as well as the network's technical support. These fees typically also provide for 24/7 customer service through the network provider, though each operator should consult with their network operator to ensure this is the case.

[2] http://eprijournal.com/wp-content/uploads/2015/07/Summer2013_Journal-low-3002001742.pdf

The U.S. Department of Energy (2015)[3] estimates that these network fees can range from $100-$900 annually, depending on the particular station and connection type.

Credit Card Reader

The City of Colton found that opting to equip each of their EVSE stations with a credit card reader carried an additional cost of approximately $5,000, though this will vary based on installation location, connection type, and network provider. This expense may be offset by the increased convenience and accessibility offered by a much-simplified charging experience, as the payment transaction is typically handled within the unit itself and no network account is required to utilize the chargers.

Operation and Maintenance

Operations and Logistics

The following best practices for station development, installation, and maintenance are recommended:

Network Expansion and Installation

- Consider station geography. Placing stations at highly trafficked locations, maximizing spatial coverage, and matching station charging speeds to anticipated driver dwell times play important roles in ensuring that chargers are well-utilized.
- Network charging stations. Subscribing to an EVCS networking service, provides a wide range of benefits. The services' online dashboards allow site hosts to monitor station status and respond to problems in real time, and can often fix issues before drivers experience any inconvenience. Station utilization and energy consumption can also be monitored over time, providing valuable information such as when charging events are common, the average charging event length, and the overall station utilization/plug occupancy rate.
- Investigate charging management options. This can take the form of device-side technology (load balancing to ensure equitable charge distribution), or electrical rates designed to incentivize off-peak charging.
- Consider site potential for co-siting EVCS with renewable energy. Coupling EV charging stations with solar energy can help minimize the cost of providing electricity to drivers.

Ongoing Actions

- Monitor EVSE Usage. An average plug occupancy rate of 50% is recommended as a target metric for identifying when more charging infrastructure is needed. This indicates that more than half of EV charging spaces are occupied and unavailable at any given time. Keeping some availability ensures drivers will always be able to find an open station to charge when they arrive at the site. As the number of stations increase, a higher metric could be put into place.
- Promote availability of charging to customers through website messaging, social media posts, signage at EV parking areas, and via the online parking reservation system.

[3] https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

- Actively claim, retain, and trade LCFS credits. Fueling vehicles with electricity accumulates credits under California's Low Carbon Fuel Standard, which can be sold and traded on a statewide market.

Short-Term Actions

- For organizations operating public or private fleets, adopt a formal Fleet Transition Policy. This sets a precedent for other organizations to follow. Adopting ZEVs within fleets can increase both internal employee and public exposure to ZEVs, decreases fuel and maintenance costs, and reduces operational GHGs. Fleets operating ZEVs may additionally be able to claim credits under California's LCFS program.
- Manage charging to maximize renewable energy utilization, minimize electricity cost, and provide fair charging distribution via the following:
    - *Strategy 1: Calibrate Level 2 Power Output to Vehicle Dwell Time* – Studies on EV driver habits indicate that most EV drivers, regardless of dwell time, do not typically charge to full capacity. Therefore, at sites with long dwell times, standard 6.6 kW power can be reduced to 3.3 kW to take advantage of long dwell times for range delivery.
    - *Strategy 2: Use Networked Equipment* – Networked equipment provides critical data that can be used to optimize operations and identify when further investment is needed.
    - *Strategy 3: Load Shifting* – If onsite renewable energy is present, program EVSE to charge vehicles between 10 am and 2 pm, when solar production is at its peak. If chargers are solely powered by the utility grid, subscribing to the utility's TOU rates can reduce electricity costs during times of low demand (typically midday on weekdays).

Long-Term Actions

- Plan for future changing modes (e.g., electrified buses, transportation network companies, taxis, etc.). As EV penetration increases, the likelihood of public charger utilization increases as well. Monitor developments in ZEV technology and changes in usage patterns to decide when to upgrade chargers to higher-powered units.

Ownership

There are three types of EVCS ownership and management.

1. Stations can be owned, operated and maintained by the property owner. This includes EVCS installed at a private residence, private business or a multi-unit housing development.
2. Stations can be owned by the EVCS manufacturer and service provider. In this case, management is normally performed by a charging site host or other third party. The EVCS provider compensates the site host or third party for use but maintains responsibility for equipment operations and maintenance.
3. EVCS can be owned by a public agency or property manager. In this case, EVCS is managed by a site host or other third party. The host or third party determines fees and receives all revenue but must pay for equipment operations and maintenance. See Table A7 for further differences among the ownership types.

Table A7: EVCS Ownership Models

Benefits	Considerations
Private	
Can determine users No additional fees beyond utility costs Ease of access Determines the fee for charging (if applicable) Keeps all revenue, perhaps recovering cost of electricity (if charging for a fee)	Must buy equipment Must pay construction costs Must manage payments Must properly maintain equipment
Public Agency or Property Manager	
Host dictates whether charging is free or fee-based Host determines the fee for charging (if applicable) Host keeps all revenue, perhaps recovering cost of electricity (if charging for a fee) Host can determine station users	Host must buy equipment Host must pay construction costs Host must manage payments Host must properly maintain equipment
Manufacturer and Service Provider	
No or limited equipment or installation cost to host electric vehicle service providers (EVSP) manages and maintains the station EVSP shares revenue from the station with host	Host usually remains customer of record on utility bill and must pay electricity costs upfront before electric EVSP pays host back PEV drivers need to have membership fees to use stations

Some charging infrastructure business models provide charging at no cost to the driver. Other business models charge access fees which generate revenue through the subscription method or pay-per-use (discussed in more detail below) and are expected to be imposed at most publicly available charging sites. In cases where the charging station provider owns the charging station, and therefore its revenue, two methods of dividing revenue are commonly used: the station provider may offer a percentage split with the host based upon negotiated terms with the charging station provider to encourage the host to maximize the utilization of the equipment, or may provide a fixed rate to the host to compensate for the costs associated with hosting the charging infrastructure and/or the use of the parking space. The balance of any revenue would be retained by the charging station provider.

Fees

Charging station owners often contract with EVSP or third-party operators who install, operate, and set the fees on charging equipment. However, if owners have the ability to set fees—either explicitly or implicitly through their choice of operator—goals may conflict. Owners often need to recoup the costs of installing, maintaining, and operating chargers, and may also wish to price vehicle charging to encourage turnover so chargers are available to more drivers. On the other hand, pricing vehicle charging so driving an electric vehicle is cheaper on a per-mile basis than a gasoline-powered vehicle creates an incentive for people to purchase electric vehicles or charge plug-in hybrids and use electricity

instead of gasoline. Lower charging costs at commercial centers can also create incentives for drivers to shop at those locations.

- Fixed fee: Each charging connection has a set cost, regardless of energy use or length of charging time. For example, the fixed fee may be assessed by an employer at a workplace or when charging is provided as part of a parking lot fee. It may be expected that the driver will be parked for a significant period in this location.
- Fixed rate: Fees may be charged per hour or other intervals for Level 2 charging and a per minute basis for DC fast charging. This rate is useful if high utilization and turnover of vehicles is desired.
- Pay per energy consumed: Fees are based on the cost of electricity to the host and they require measuring the energy delivered. A multiplier on this cost may be applied to recover other operational costs.
- Subscription: A fixed rate may be charged to the driver on a monthly basis for an unlimited number of connections or time connected at publicly available EVCS. Discounts on the fixed rate may be provided by membership program for a tiered membership fee. In most cases, a pay per use option is generally available although restrictions may apply based on the specific program.

When charging fees for usage, vehicles are less likely to remain parked after their charge is complete and other drivers are drawn to spaces that they know are more likely to be available. Over the long term, infrastructure owners should pilot innovative agreements with utilities to make charging cost-competitive with the price of gasoline. For the short term, infrastructure owners may need to establish higher fees to recuperate costs and encourage high levels of use. Various regional infrastructure owners should consider adopting the same fee schedules, particularly in high-demand locations, to create consistency throughout the region. Local governments looking to adopt a PEV charging fee may want to conduct a study to demonstrate the fee is necessary to cover costs and/or create a revenue-sharing agreement with private infrastructure operators.

Charging Time Limit

Time limits can help ensure turnover at chargers so they are available to more drivers. When setting time limits, charging station owners should consider how much time will be necessary to provide vehicles sufficient charge at a given location will likely need. For instance, in downtown Redlands, time limits apply mostly in commercial areas, as the trips that drivers take to these areas—for shopping, eating out, or socializing—tend to be relatively short. Most drivers traveling from home to the commercial center should be able to recharge from their trips in under two hours. Drivers running a series of errands over a larger area may need a more significant charge time.

Consistency with time limits for regular parking may also influence time limits on charging. Having longer time limits at charging spaces than at regular parking spaces may enable more EV drivers to achieve a significant charge and create incentives for PEV ownership, but it can also make enforcement challenging.

Enforcement

The California Vehicle Code (CVC) Section 2251 allows the owner of a space to remove a vehicle if it occupies that space in violation of posted regulations, including signs designating spaces for charging vehicles or time limits. For signs to be enforceable, governments must specify time limits, penalties, hours and other restrictions, and provide the necessary definitions. For example, the City of Sacramento posts a time limit of four hours for continuous charging in a parking space. Enforcement is key to making sure chargers are available for drivers who need them, but it can be challenging, potentially requiring increased funding for parking agents. The City of Los Angeles has adopted municipal code changes to enforce EV only charging. Instead of devoting resources to effective enforcement of time limits, it may be more effective to charge fees that escalate steeply after a certain time to encourage turnover at stations.

Maintenance

Normally there are relatively few EVCS maintenance requirements. The charging cord should be stored securely so it is not damaged, and the accessible EVCS parts should be checked periodically for wear or vandalism. The system should be kept clean using a damp cloth and detergent to wipe surfaces. A qualified electrician should conduct periodic inspections, testing, and preventative maintenance. Annual maintenance costs range from $25 to $50 per EVCS unit. Manufacturers also provide extended warranties to help reduce long-term maintenance and repair costs. Warranties may also be available for the labor. Level 1 and 2 EVCS have an expected useful life of approximately ten years. See the EVCS manufacturer's guidelines for specific requirements. The Plug-In Electric Vehicle (PEV) Handbook for Public Charging Station Hosts offers details on maintenance requirements (US DOE Clean Cities Technical Response).

For Level 1 EVCS, the commercial grade electrical outlet may need to be replaced periodically. This should cost no more than $100 for equipment and professional installation. Level 2 EVCS are modular and components can be replaced, if necessary, without installing a whole new unit. Networked EVCS with communications systems for data or payment may need more frequent maintenance that a local electrician should be able to perform. Technical troubleshooting may be covered in network subscription fees. DCFCs require more maintenance due to cooling systems, filters, and other components not found in Level 1 and 2 chargers. The chosen warranty and service plan should reflect expected usage and site-specific needs.

Some charging station hosts purchase, install and operate stations themselves. They receive all revenue from the unit and can contract regular maintenance to a third party. In other ownership models, a third party pays for station equipment, installation and maintenance costs, and manages logistics in return for lease payments or a share of the station's revenue. This model minimizes a host's upfront costs and administrative responsibilities.

Signage

Local jurisdictions may have adopted signage regulations and property owners will often have preferences for the look and function of signs. The goal should be clarity and consistency. A common visual identity will reduce confusion and increase public awareness of EVCS. Jurisdictions and designers will need to ensure their signs and systems comply with any applicable regulations.

Wayfinding Signs

The California Manual on Uniform Traffic Control Devices (MUTCD) provides specifications for wayfinding signs intended to aid drivers in locating and navigating to EV charging stations from freeway infrastructure. To qualify for wayfinding signs directing drivers to their station, businesses operating EV chargers must both:

- Be available to the public for at least 16 consecutive hours a day, 7 days a week, and
- Be located within 3 miles of a freeway interchange.

Compliant signage, such as the designs shown below in **Figure A4**, can be used in conjunction with directional arrows and mileage indicators to aid in guidance.

Figure 4. FHWA-approved descriptive wayfinding sign (D9-11bp, left) and symbolized EV wayfinding sign (D9-11b, right).

Regulatory Signs

Regulatory signs indicate who may park in a designated location. Common examples of regulatory signs include ADA parking designations, curb striping, and parking signs. Regulations can be communicated through a combination of text and design.

Vertical or pole-mounted signs are the most prevalent, but pavement markings, similar to those used at ADA-accessible parking spots, can be used to clearly designate the EV parking spaces. For ADA-accessible EV parking spots, additional pavement markings can indicate that ADA routes must be kept clear.

Other stipulations, such as charging cost or limitations on the length of parking can be indicated. For signs to be enforceable, governments must specify time limits, penalties, and other restrictions. Signs associated with DCFCs should indicate a time limit, for example up to one hour. Figure 5 illustrates sample regulatory signs from the MUTCD.

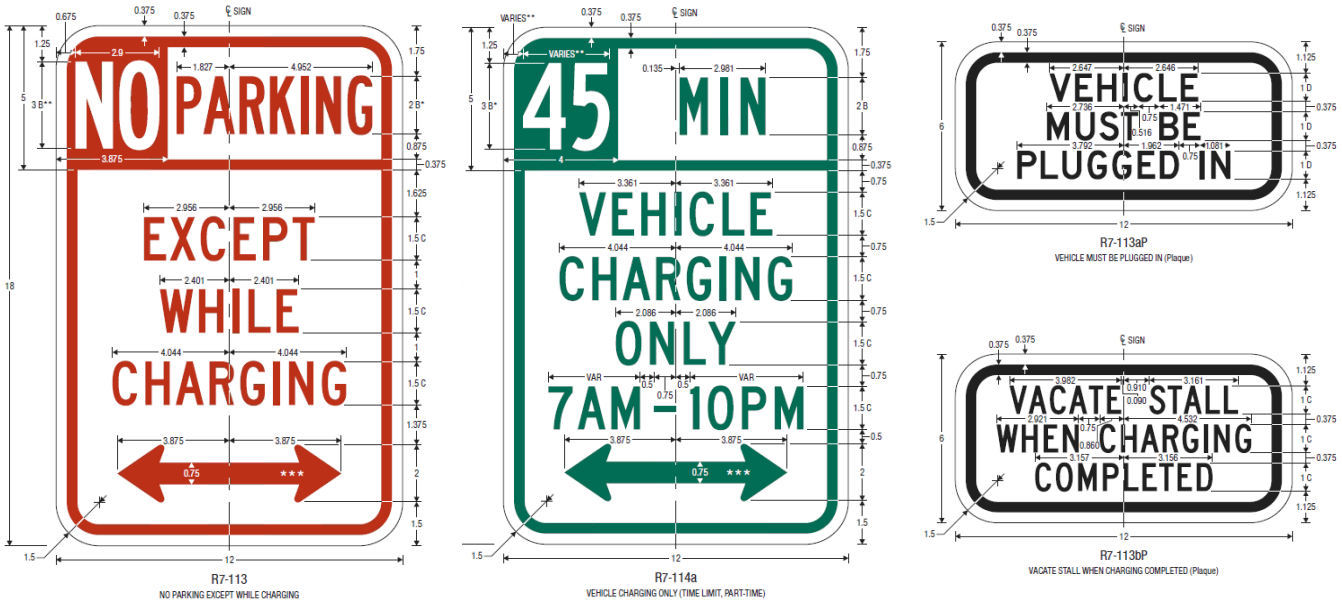


Figure A5. MUTCD interim standardized EV signage, illustrating the commonly accepted visual keys for prohibitive behaviors (left, red), time-limited parking (center, green), and informational signage (right, white/black).

Time limits will also require the participation of local authorities or parking managers to enforce the regulations stated on the sign.

Information on the charging station should also indicate voltage and amp levels and any fees or safety information. Electrical codes will ask hosts to indicate the date of installation, equipment type and mode, and owner contact information on the EVCS.

Color and Symbols

A variety of symbols, colors, and wording are used for EVCS and associated regulations. As such, signs can be confusing and may result in non-EV drivers using these spaces unintentionally. Color choice poses a communication problem as certain colors have been associated with particular uses: blue for ADA-accessibility, green for short-term parking, and red for prohibited parking. The previous Figure 5 illustrates signs that conform to the generally accepted color and symbol associations.

Language

Clear language is needed on all regulatory and wayfinding signs. Signs should use the term "charging" to eliminate confusion for drivers of hybrid electric vehicles, or EVs that do not need to charge. Language such as "No Parking Except for Electric Vehicle Charging" also encourages drivers to move their EVs once charging is complete. It is important to indicate the active use of the charging station for EVCS-designated parking stalls.

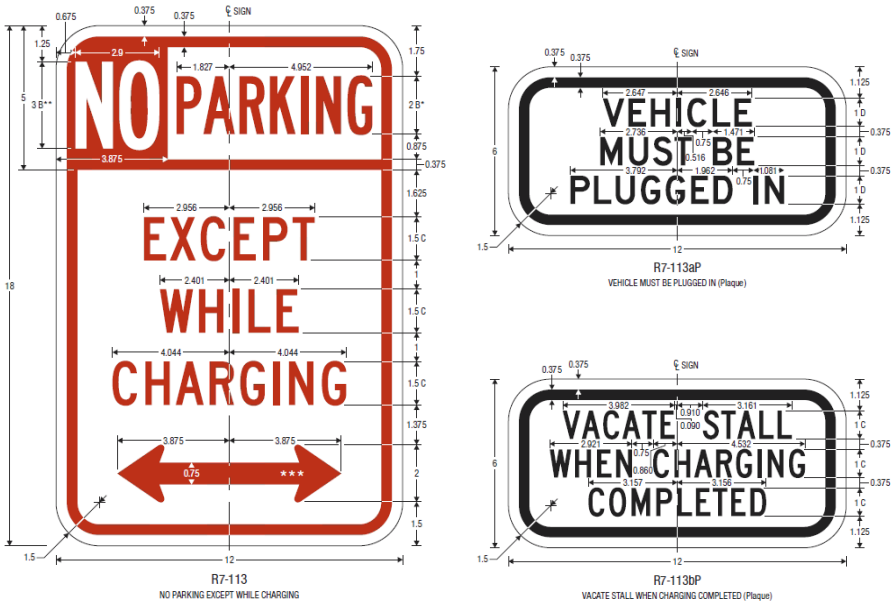


Figure A6. MUTCD interim approved signs illustrating the use of the "charging" phrase and the requirement for active charging.

Information and Advertising

The many surfaces of EVCS can be used to display information, such as how to use the machine or the level of power. Display screens may provide status information and communicate other information, such as advertisements and branding for the EVCS host or partners.

Surface street directional signage serves two important functions: it directs PEV users to the nearest public EVCS locations, and it educates non-PEV drivers about the availability of charging infrastructure in the community. This outreach element enables the community to show its support for PEVs. The CVC requires off-street PEV charging spots to be properly identified. The MUTCD has several example signs and markings that can be used to designate spaces for EV chargers. These can be used wherever applicable to develop consistent signage across communities.

Figure A7. Display screen of a charging station

Example Permit, Plan Review, and Installation Checklists

Permit Application and Plan Review Checklist for Electric Vehicle Charging Station

INSTRUCTIONS: This Checklist shall be used during a residential Electric Vehicle Charging Station (EVCS) installation permit application and plan review. If any discrepancies are found on the application and/or supplemental documentation, record the details of needed corrections on this sheet and provide to the applicant.

☐ **COMPLETED PERMIT APPLICATION:** Application must include project address, parcel number, builder/owner name, contractor name, valid contractor license number, phone numbers and any other requirements.

☐ ELECTRIC VEHICLE CHARGING STATION MANUFACTURER'S SPECIFICATIONS

Check One	Charging Station(s) Proposed	Associated Power Levels (proposed circuit rating)
☐	Level 1	110/120 volt alternating current (VAC) at 15 or 20 Amps
☐	Level 2 - 3.3 kilowatt (kW) (low)	208/240 VAC at 20 or 30 Amps
☐	Level 2 - 6.6kW (medium)	208/240 VAC at 40 Amps
☐	Level 2 - 9.6kW (high)	208/240 VAC at 50 Amps
☐	Level 2 - 19.2kW (highest)	208/240 VAC at 100 Amps
☐	Other (provide detail)	

☐ ELECTRIC VEHICLE CHARGING STATION INSTALLATION GUIDELINES

☐ COMPLETED ELECTRICAL LOAD CALCULATIONS PER CEC[4] 220

[4] 2016 California Electrical Code. Article 220 Branch-Circuit, Feeder, and Service Calculations

1) Based on the load calculation worksheet, is a new electrical service panel upgrade required[5]? Yes ☐ No ☐

If new service or upgrade is required, plans and the utility work order must be included with submittal.

2) Is the charging circuit appropriately sized for a continuous load (125%)? Yes ☐ No ☐
3) If charging equipment proposed is a Level 2 - 9.6kW station with a circuit rating of 50 amps or higher, is a completed circuit card with electrical calculations included with the single-line diagram? Yes ☐ No ☐ Not Applicable ☐

☐ SITE PLAN & SINGLE LINE DRAWING

Site Plan must be fully dimensioned and drawn to scale showing the following:

a. Location, size, and use of all structures
b. Location of electrical panel to charging system
c. Type of mounting for charging system

1) Is a site plan and electrical plan with a single-line diagram included with the permit application?
   Yes ☐ No ☐
2) If mechanical ventilation requirements are triggered for indoor venting requirements (CEC 625.50(B)), is a mechanical plan included with the permit application?
   Yes ☐ No ☐ Not Applicable ☐

COMPLIANCE WITH 2016 CALIFORNIA ELECTRICAL CODE (TITLE 24, PART 3)

1) Does the electrical plan identify the amperage and location of existing electrical service panel? Yes ☐ No ☐
   a. Does the existing panel schedule show room for additional breakers? Yes ☐ No ☐
   b. Are sizes for the conduit and conductor included? Yes ☐ No ☐
2) Is the charging unit rated more than 60 amps or more than 150V to ground? Yes ☐ No ☐
   a. If rated >60 amps, are disconnecting means provided in a readily accessible location in line of site and within 50' of EVCS? (CEC 625.42) Yes ☐ No ☐
3) Does the charging equipment have a Nationally Recognized Testing Laboratory (NRTL) approved listing mark? (UL 2202/UL 2200) Yes ☐ No ☐
4) If trenching is required, is the trenching detail called out? Yes ☐ No ☐
   a. Is the trenching in compliance with electrical feeder requirements from structure to structure? (CEC 225) Yes ☐ No ☐
   b. Is the trenching in compliance of minimum cover requirements for wiring methods or circuits? (18" for direct burial per CEC 300) Yes ☐ No ☐

[5] **Load Calculation Worksheet review instructions:** The size of the existing service MUST be equal to or larger than the Minimum Required Size of main service breaker. If the existing service panel is **smaller** than the minimum required size of existing electrical services, then **a new upgraded electrical service panel must be installed** in order to handle the added electrical load from the proposed EVCS.

COMPLIANCE WITH 2016 California Green Building Standards Code (CALGreen) FOR NEW CONSTRUCTION[6] (TITLE 24, PART 11)

1) Is this project considered new construction? Yes ☐ No ☐
   If yes, plans must include installation of a listed raceway, adequate panel capacity and identification as "EV Capable" in compliance with Section 4.106.4.1 &4.106.4.1.1)

[6] 2016 California Green Buildings Standards Code. Title 24, Part 11, Section 4.106.4.1 &4.106.4.1.1 *One- and two- family dwellings*

Permit Application and Plan Review Checklist for Multi-unit Dwellings and Commercial Electric Vehicle Charging Stations

INSTRUCTIONS: This checklist shall be used during a multi-unit dwelling and commercial Electric Vehicle Charging Station (EVCS) installation permit application and plan review. If any discrepancies are found on the application and/or supplemental documentation, record the details of needed corrections on this sheet and provide to the applicant.

Check type of Electric Vehicle Charging Station Proposed:

☐ MUD EVCS ☐ COMMERCIAL EVCS

☐ COMPLETED PERMIT APPLICATION

1) Application must include project address, parcel number builder/owner name, contractor name, valid contractor license number phone numbers and any other requirement.

Check One	Charging Station(s) Proposed	Associated Power Levels (proposed circuit rating)	Typical Non-Residential Charging Locations
☐	Level 1	110/120 volt alternating current (VAC) at 15 or 20 Amps	• Commercial office building
☐	Level 2 - 3.3kW (low)	208/240 VAC at 20 or 30 Amps	• Multi-unit dwellings (MUD) • Commercial office building • Public access
☐	Level 2 - 6.6kW (medium)	208/240 VAC at 40 Amps	
☐	Level 2 - 9.6kW (high)	208/240 VAC at 50 Amps	
☐	Level 2 - 19.2kW (highest)	208/240 VAC at 100 Amps	
☐	DC Fast Charging	440 or 480 VAC	• Public access • Large commercial office buildings or parks • Hospitality & recreation
☐	Other (provide detail)		

☐ ELECTRIC VEHICLE CHARGING STATION MANUFACTURER'S SPECS & INSTALLATION GUIDELINES

☐ COMPLETED ELECTRICAL LOAD CALCULATIONS PER CEC[7] 220

[7] 2013 California Electrical Code. Article 220 Branch-Circuit, Feeder, and Service Calculations

1) Based on the load calculation worksheet, is a new electrical service panel upgrade required[8]? Yes ☐ No ☐

If new service or upgrade is required, plans and the utility work order must be included with submittal.

2) Is the charging circuit appropriately sized for a continuous load (125%)? Yes ☐ No ☐
3) If charging equipment proposed is a DC Fast Charging station or a Level 2 - 9.6kW station with a circuit rating of 50 amps or higher, is a completed circuit card with electrical calculations included with the single-line diagram? Yes ☐ No ☐ Not Applicable ☐

☐ SITE PLAN & SINGLE LINE DRAWING

3) If mechanical ventilation requirements are triggered for indoor venting requirements (CEC 625.50(B)), is a mechanical plan included with the permit application?
   Yes ☐ No ☐ Not Applicable ☐
4) Site Plan must be fully dimensioned and drawn to scale showing the following:
   a. Location, size, and use of all structures
   b. Location of electrical panel to charging system
   c. Type of mounting for charging system
   d. Parking and circulation areas

PLAN COMPLIANCE WITH 2016 CALIFORNIA ELECTRICAL CODE (TITLE 24, PART 3)

1) Does the electrical plan identify the amperage and location of existing electrical service panel? Yes ☐ No ☐
   a. If yes to Q2, does the existing panel schedule show room for additional breakers? Yes ☐ No ☐
   b. Are sizes for the conduit and conductor included? Yes ☐ No ☐
2) Is the charging unit rated more than 60 amps or more than 150V to ground? Yes ☐ No ☐
   a. If yes to Q3, are disconnecting means provided in a readily accessible location in line of site and within 50' of EVCS? (CEC 625.23) Yes ☐ No ☐
3) Does the charging equipment have a Nationally Recognized Testing Laboratory (NRTL) approved listing mark? (UL 2202/UL 2200) Yes ☐ No ☐
4) If trenching is required, is the trenching detail called out? Yes ☐ No ☐
   a. Is the trenching in compliance with electrical feeder requirements from structure to structure? (CEC 225) Yes ☐ No ☐
   b. Is the trenching in compliance of minimum cover requirements for wiring methods or circuits? (18" for direct burial per CEC 300) Yes ☐ No ☐

[8] **Load Calculation Worksheet review instructions:** The size of the existing service MUST be equal to or larger than the Minimum Required Size of main service breaker. If the existing service panel is **smaller** than the minimum required size of existing electrical services, then **a new upgraded electrical service panel must be installed** in order to handle the added electrical load from the proposed EVCS.

PLAN COMPLIANCE WITH 2016 MANDATORY CALGREEN CODE FOR NEW CONSTRUCTION AND CHAPTER 11B ACCESSIBILITY REQUIREMENTS

2016 CALGreen Mandatory EVCS Requirements for New Construction[9]

1) For **MUD EVCS,** do CALGreen EV Readiness installation requirements apply? Yes ☐ No ☐
    a. Do the plans demonstrate conformance with mandatory measures for 3% of total parking spaces, but no less than one, for new multifamily dwellings with 17+ units that must be EV capable per Section 4.106.4.2? Yes ☐ No ☐
2) For **Commercial EVCS**, do CALGreen EV Readiness installation requirements apply to this project? Yes ☐ No ☐
    a. Do the plans demonstrate conformance with mandatory measures of 3% of parking spaces in lots with 51+ spaces being EV capable per Section 5.106.5.3? Yes ☐ No ☐

2016 Chapter 11B Accessibility Requirements for Public and Common Use EVCS[10]

1) Is there at least 1 EVCS parking stall out of 4 EVCS parking stalls that meet Chapter 11B accessibility dimension requirements for a van accessible parking space (144 inches wide with an adjacent access aisle)? Yes ☐ No ☐
   Access aisles shall comply with Section 11B-302.
2) For parking stalls with 5 to 25 EVCS, is there 1 EVCS parking stalls that meets Chapter 11B accessibility dimension requirements for a van accessible parking space (144 inches wide with an adjacent access aisle) and 1 EVCS parking stall that meets the standard accessible parking space (108 inches wide with an adjacent access aisle)? Yes ☐ No ☐
3) Is the path of travel to the EVCS from the accessible parking stall demonstrated to be unobstructed? Yes ☐ No ☐
4) Is the accessible path of travel from the EVCS parking stall demonstrated to be with 200 feet of a main building entrance? Yes ☐ No ☐

[9] 2016 California Green Buildings Standards Code. Title 24, Part 11, Section 4.106.4.2 *Multi-family dwellings and* Section 5.106.5.3 *Electric Vehicle (EV) Charging*

[10] 2016 California Building Code. Title 24, Part 2, Chapter 11B Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Publicly Funded Housing, Section 228.3 Electric Vehicle Chargers

Installation Checklist: Residential Electric Vehicle Changing Station

Installations must be completed by a licensed electrical contractor (C-10). (Local Regulations, California Electrical Code CEC Article 625) Plans must show conformance with the California Electrical Code Title 24, Part 3, the California Building Code (Volume 1 and 2), Title 24, Part 2, and other applicable local municipal codes.

Submittal Documents required*

- ☐ Permit Application
    a. Include job address (a unique address for the EVCS installation that is used for billing), parcel number, existing use, description of work, name, address, and contact information of the applicant and the owner.
- ☐ Plan Sets (Number, size of plans)
    a. Site/Plot Plan
        i. Show the proposed location of the EVCS.
    b. Electrical Plan
        i. Provide a complete electrical single line drawing showing the main service, sub panels, and proposed EVCS.
        ii. Include size of overcurrent protection devices (in amperes) for main service, sub panels, disconnects and EVCS circuit supply.
        iii. Show conduit sizes and types, and conductor sizes and types.
        iv. If trenching is required, provide a trenching detail and call out trench work in scope of work. Trenching may result in a structural plan review if conduit trenches undermine foundations.
        v. Note electrical feeder requirements when trenching structure to structure (CEC 225). The feeder from structure to structure should be noted in the scope of work. Verify that trenching is in compliance of minimum cover requirements for wiring methods or circuits (18” for direct burial per CEC 300).
        vi. Provide EVCS manufacturer's specification sheets showing Nationally Recognized Testing Laboratory (NRTL) approved listing mark for indoor or outdoor (UL 2202/UL 2200).
- ☐ Electrical Load Calculation Worksheet
    a. Include existing and proposed load to estimate if existing electrical service will handle the new load from EVCS and wiring methods. Note: Unless electrical service equipment is 100% rated, the calculated load demand on the main service shall not exceed 80% of the nameplate rating of the main service over-current protection device (OCPD). (CEC 625.40)

*All plans and documents listed above must be provided for residential EVCS at time of permit submittal prior to issuance.

Pre-Installation Work

1. Determine EVCS unit to be installed. Follow all manufacturer specifications for installation. Must be NRTL listed and suitable for the location, indoor or outdoor.
2. Conduct site assessment and submit quote to customer for approval of work, including utility upgrades or separate meter service, if applicable. Assess the site for:
    i. All electrical system elements (main service, sub-panels, disconnecting means, etc.)
    ii. Current electrical code deficiencies
    iii. Existing electrical load
    iv. Proper safe mounting for the selected EVCS
    v. If applicable, new possible meter location
3. If applicable, contact local utility provider for service work order for utility upgrades/notification of new service, and file Service and Meter Request Form.
4. Ensure utility work order is approved. Any work on the utility side of the electric service requires a work order and disconnect/re-connect.
5. Complete permit application from local jurisdiction and electrical load calculation. Prepare plans required by local jurisdiction. Construction plans indicate types of wiring and installation methods. Show compliance with requirements of Chapters 1-4 of the CEC, except as superseded by CEC Article 625.
    i. Mandatory requirements for new construction in one and two family dwellings and townhouses with attached private garages to be EV Capable. (CALGreen Code Section 4.106.4.2)
6. Following utility approval, permit is approved, and issued.

Equipment and Scheduling

7. Schedule all necessary contract work for pulling wires from electric panel to garage/carport/driveway:
    i. Indoor-rated EVCS can be installed in a garage (CEC 625.50)
    ii. Outdoor installations require outdoor-rated EVCS (CEC 625.50)
8. If trenching operation is included in project scope, coordinate with the utility for markings of existing power lines, gas lines or other infrastructure is complete and utilize “call before you dig” services (Call 811), service upgrade, new service/meter pull.

Installation

9. Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc.). Prepare mounting surface prior to installation.
10. Install rough electrical conduit, boxes and fittings, subpanels etc. in walls, ceilings, floors and trenches to be covered.
11. Request a rough inspection from the building inspection office prior to covering any rough electrical installations.
12. Install charging unit(s) per manufacturer instructions and permitted construction plans. (CEC 110.3)

i. Install individual branch circuit for the EVCS and branch circuit wiring. Securely fasten wiring to the structure. Branch circuit and feeders must be sized 125% of nameplate current. (CEC 300.11, CEC 625.21, 31; CEC 100; CEC 210.19(A)(1); CEC 215.2(A), CEC 110.3(B); CEC 310.15(B)).
ii. Identify and install properly sized equipment grounding conductor with the branch circuit. Connect at the EVCS and panelboard or service. (CEC 250.110, 112, 114, 119, 120, 122; CEC 300.3(B)).
iii. Bring grounded conductor to the service disconnect and bond to the enclosure. (CEC 250.24 (C))
iv. Install overcurrent protection for any newly installed service equipment and conductors. (CEC 230.90, 91)
v. Install disconnect in proper readily accessible location for EVCS that is rated more than 60 amperes or more than 150 Volts to ground (CEC 625.23) If additional service disconnects are installed, verify that they are grouped and do not exceed the maximum number of service disconnects (CEC 230.71, 72).
vi. Identify branch circuit device and disconnects (CEC 408.4 (A); CEC 110.22(A)).
vii. Install properly sized supply-side bonding jumpers (CEC 250.50, 104(A) and (B)).

13. Perform finish work to repair existing surfaces, infrastructure, and landscaping (if applicable).
14. Make electrical connection and schedule for inspection with local jurisdiction Building Inspector.

Installation Checklist: Multi-unit Dwelling Electric Vehicle Charging Station

Installations must be completed by a licensed electrical contractor (C-10). (Local Regulations, California Electrical Code CEC Article 625) Plans must show conformance with the California Electrical Code Title 24, Part 3, the California Building Code (Volume 1 and 2), Title 24, Part 2, and other applicable local municipal codes.

Submittal Documents required*

- ☐ Permit Application
    i. Include job address (a unique address for the EVCS installation that is used for billing), parcel number, existing use, description of work, name, address, and contact information of the applicant and the owner.
- ☐ Plan Sets (Number, size of plans)
    a. Site/Plot Plan
        i. Show full property extent (property lines, parking areas, structures, etc.).
        ii. List relevant property information, such as existing parking counts and ratios.
        iii. Provide a detailed site plan showing where the charging unit is located within the parking garage or lot, and any necessary accessibility improvements.
        iv. As required by type of EVCS, installation mounting method, and local jurisdiction requirements provide necessary structural details.
    b. Electrical Plan
        i. Provide a complete electrical single line drawing showing the main service, sub panels, and proposed EVCS.
        ii. Include size of overcurrent protection devices (in amperes) for main service, sub panels, disconnects and EVCS circuit supply.
        iii. Show conduit sizes and types, and conductor sizes and types.
        iv. Provide a trenching detail and call out trench work in the scope of work on the plan if trenching is required. Trenching may result in a structural plan review if conduit trenches undermine foundations.
        v. Note electrical feeder requirements when trenching structure to structure (CEC 225). The feeder from structure to structure should be noted in the scope of work. Verify that trenching complies with minimum cover requirements for wiring methods or circuits (18” for direct burial per CEC 300).
        vi. Provide EVCS manufacturer's specification sheets showing Nationally Recognized Testing Laboratory (NRTL) approved listing mark for indoor or outdoor (UL 2202/UL 2200).
- ☐ Electrical Load Calculation Worksheet
    i. Include existing and proposed load to estimate if existing electrical service will handle the new load from EVCS and wiring methods. Note: Unless electrical service equipment is 100% rated, the calculated load demand on the main

service shall not exceed 80% of the nameplate rating of the main service over-current protection device (OCPD). (CEC 625.40)

*All plans and documents listed above must be provided for multi-unit dwelling electric vehicle charging stations at time of permit submittal prior to issuance.

Pre-Installation Work

1. Determine units to be installed. Follow all manufacturer specifications for installation. Must be NRTL listed and suitable for the location, indoor or outdoor.
2. Conduct site assessment and submit quote to customer for approval of work and utility upgrades or new service if applicable. Assess the site for:
    i. All electrical system elements (main service, sub-panels, disconnecting means, etc.)
    ii. Current electrical code deficiencies
    iii. Existing electrical load
    iv. Wet and dry utility locations (affecting trench paths for electrical)
    v. Presence of corrosive conditions (e.g. salt air, etc.) affecting recommended equipment
    vi. Water drainage (to avoid locating EVCS in areas with possible standing water)
    vii. Site accessible parking, and / or accessibility of proposed EVCS
        1. Site slope at proposed EVCS location
        2. Surface conditions
        3. Access path(s) connectivity to on-site uses
    viii. Visibility of proposed EVCS from uses on site, and/or from public rights-of-way (safety)
    ix. Site lighting for use of EVCS and general safety
    x. Placement of EVCS to serve only one versus multiple parking stalls (dependent on hosts intended use of the EVCS)
    xi. EVCS protection from vehicle damage through proper placement, and then physical protection (e.g. wheel stops, bollards)
        1. EVCS orientation
        2. Facilitating ease of human interface
        3. Minimizing sun exposure on digital screens
        4. Facilitating ease of cable management
    xii. Placement and/or screening of electrical support equipment (e.g. transformers, meter pedestals/cabinets, etc.) as it relates to site aesthetics
    xiii. Need for signage and / or stenciling at the EVCS location(s), and / or as directional signage on large sites
3. Complete permit application from local jurisdiction and electrical load calculation for proposed stations (Include load calculations for EVCS):
    i. Mandatory requirements for new construction in new multifamily dwellings of 17 or more units to be EV Capable. 3% of the total parking spaces, but not less than one, shall be capable for supporting future EVCS. (CALGreen Code Section 4.106.4.2).

4. Contact local utility provider for service work order for utility upgrades/notification of new service. File appropriate Service and Meter Request Form.
    i. Ensure utility work order is approved. Any work on the utility side of the electric service requires a work order and disconnect/re-connect.
    ii. Following utility approval, permit is approved, issued and appropriately posted.
5. Construction plans indicate how requirements for types of wiring and installation siting. Show compliance with requirements of NFPA 70, CEC Article 625.
6. Construction plans show compliance with the California Building Code Title 24, Part 2, Section 11B-812 and Section 11B-228.
    i. Signage for EVCS (International Symbol of Accessibility (ISA) signage for ADA accessible spots be provided in compliance with Section 11B-812.8).
    ii. For a facility for public and common use, minimum number of EVCS required to comply with Section 11B-812.

Equipment and Scheduling

7. Schedule all necessary contract work for installation of new service (if applicable), and pulling wires from electric panel(s) / meter pedestals to parking structure(s) or lot(s):
    i. Boring, trenching, concrete and/or paving restoration if these operations are included in project scope.
    ii. Indoor-rated EVCS can be installed in a garage (CEC 625.50).
    iii. Outdoor installations require outdoor-rated EVCS (CEC 625.50).
    iv. Coordinate with property manager, Homeowners Association, property owner(s), and/or tenants for scheduling installation.
8. Coordinate with the utility for markings of existing power lines, gas lines or other infrastructure is completed and utilize “call before you dig” services (811), service upgrade, new service/meter pull.

Installation

9. Secure the construction area appropriately (e.g. temporary fencing, barriers and signage) for safe working conditions. Prepare mounting surface prior to installation.
10. Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc.).
11. Install rough electrical conduit, boxes and fittings, subpanels etc. in walls, ceilings, floors and trenches to be covered.
12. Request a rough inspection from the building inspection office prior to covering any rough electrical installations.
13. Install charging unit(s) per manufacturer instructions and permitted construction plans. (CEC 110.3)
    i. Install circuit conductors of appropriate size to comply with rating of the overcurrent protection. Securely fasten wiring to the structure. (CEC 300.11, CEC 210.19, CEC 215.2(A), CEC 110.3(B); CEC 310.15(B); CEC 625.40).
    ii. Identify and install properly sized equipment grounding conductor with the branch circuit. Connect at the EVCS and panelboard or service. (CEC 250.110, 112, 114, 119, 120, 122; CEC 300.3(B)).

iii. Bring grounded conductor to the service disconnect and bond to the enclosure. (CEC 250.24 (C))
iv. Install overcurrent protection for any newly installed service equipment and conductors. (CEC 230.90, 91)
v. Install disconnect in proper readily accessible location for EVCS that is rated more than 60 amperes or more than 150 Volts to ground. (CEC 625.23) If additional service disconnects are installed, verify that they are grouped and do not exceed the maximum number of service disconnects. (CEC 230.71, 72)
vi. Identify branch circuit device and disconnects. (CEC 408.4 (A); CEC 110.22(A))
vii. Install properly sized supply-side bonding jumpers. (CEC 250.50, 104(A) and (B))

14. Install wheel blocks/safety bollards as needed, and per approved plans. (CEC 110.27(B))
15. Perform finish work to repair existing surfaces, infrastructure, and landscaping, and parking lot striping (if applicable).
16. Make electrical connection and schedule for inspection with local jurisdiction Building Inspector.

Installation Checklist: Non-Residential Electric Vehicle Charging Station

Installations must be completed by a licensed electrical contractor (C-10). (Local Regulations, California Electrical Code CEC Article 625) Plans must show conformance with the California Electrical Code Title 24, Part 3, the California Building Code (Volume 1 and 2), Title 24, Part 2, and other applicable local municipal codes.

Submittal Documents Required*

- ☐ Permit Application
    a. Include job address (a unique address for the EVCS installation that is used for billing), parcel number, existing use, description of work, name, address, and contact information of the applicant and the owner.
- ☐ Plan Sets (Number, size of plans)
    a. Site/Plot Plan
        i. Show full property extent (property lines, parking areas, structures, etc.).
        ii. List relevant property information, such as existing parking counts and ratios.
        iii. Provide a detailed site plan showing where the charging unit is located within the parking garage or lot, and any necessary accessibility improvements.
        iv. As required by type of EVCS, installation mounting method, and local jurisdiction requirements provide necessary structural details.
    b. Electrical Plan
        i. Provide a complete electrical single line drawing showing the main service, sub panels and proposed EVCS.
        ii. Include size of overcurrent protection devices (in amperes) for main service, sub panels, disconnects and EVCS circuit supply.
        iii. Show conduit sizes and types, and conductor sizes and types.
        iv. Provide a trenching detail and call out trench work in the scope of work on the plan if trenching is required. Trenching may result in a structural plan review if conduit trenches undermine foundations.
        v. Note electrical feeder requirements when trenching structure to structure (CEC 225). The feeder from structure to structure should be noted in the scope of work. Verify that trenching is in compliance of minimum cover requirements for wiring methods or circuits (18” for direct burial per CEC 300).
        vi. Provide EVCS manufacturer's specification sheets showing Nationally Recognized Testing Laboratory (NRTL) approved listing mark for indoor or outdoor. (UL 2202/UL 2200).
- ☐ Electrical Load Calculation Worksheet
    a. Include existing and proposed load to estimate if existing electrical service will handle the new load from EVCS and wiring methods Note: Unless electrical service equipment is 100% rated, the calculated load demand on the main service shall not

exceed 80% of the nameplate rating of the main service over-current protection device (OCPD). (CEC 625.40)

*All plans and documents listed above must be provided for non-residential electric vehicle charging stations at time of permit submittal prior to issuance.

Pre-Installation Work

1. Determine unit to be installed. Follow all manufacturer specifications for installation. Must be NRTL listed and suitable for the location, indoor or outdoor.
2. Conduct site assessment and submit quote to customer for approval of work and utility upgrades or new service if applicable. Assess the site for:
    i. All electrical system elements (main service, sub-panels, disconnecting means, etc.)
    ii. Current electrical code deficiencies
    iii. Existing electrical load
    iv. Wet and dry utility locations (affecting trench paths for electrical)
    v. Presence of corrosive conditions (e.g. salt air, etc.) affecting recommended equipment
    vi. Water drainage (to avoid locating EVCS in areas with possible standing water)
    vii. Site accessible parking, and / or accessibility of proposed EVCS
        1. Site slope at proposed EVCS location
        2. Surface conditions
        3. Access path(s) connectivity to on-site uses
    viii. Visibility of proposed EVCS from uses on site, and/or from public rights-of-way (safety)
    ix. Site lighting for use of EVCS and general safety
    x. Placement of EVCS to serve only one versus multiple parking stalls (dependent on hosts intended use of the EVCS)
    xi. EVCS protection from vehicle damage through proper placement, and then physical protection (e.g. wheel stops, bollards)
    xii. EVCS orientation
        1. Facilitating ease of human interface
        2. Minimizing sun exposure on digital screens
        3. Facilitating ease of cable management
    xiii. Placement and/or screening of electrical support equipment (e.g. transformers, meter pedestals/cabinets, etc.) as it relates to site aesthetics
    xiv. Need for signage and/or stenciling at the EVCS location(s), and / or as directional signage on large sites
3. Complete permit application from local jurisdiction and electrical load calculation for proposed stations:
    i. Mandatory requirements for new construction to be EV Capable. 3% of spaces in lots of 51+ spaces must be capable of supporting future charging. (CALGreen Code Section 4.106.4 and 5.106.5.3)
    ii. Comply with zoning setbacks and easements. (Local Regulations)

4. Contact local utility provider for service work order for utility upgrades/notification of new service. File appropriate Service and Meter Request Form.
    i. Ensure utility work order is approved. Any work on the utility side of the electric service requires a work order and disconnect/re-connect.
    ii. Following utility approval, permit is approved, issued and appropriately posted.
5. Construction plans show compliance with the California Building Code Title 24, Part 2, Section 11B-812 and Section 11B-228:
    i. Signage for EVCS (International Symbol of Accessibility (ISA) signage for accessible spots be provided in compliance with Section 11B-812.8).
    ii. For a facility for public and common use, minimum number of EVCS required to comply with Section 11B-812.
6. Construction plans must show compliance with requirements of NFPA 70, CEC Article 625.

Equipment and Scheduling

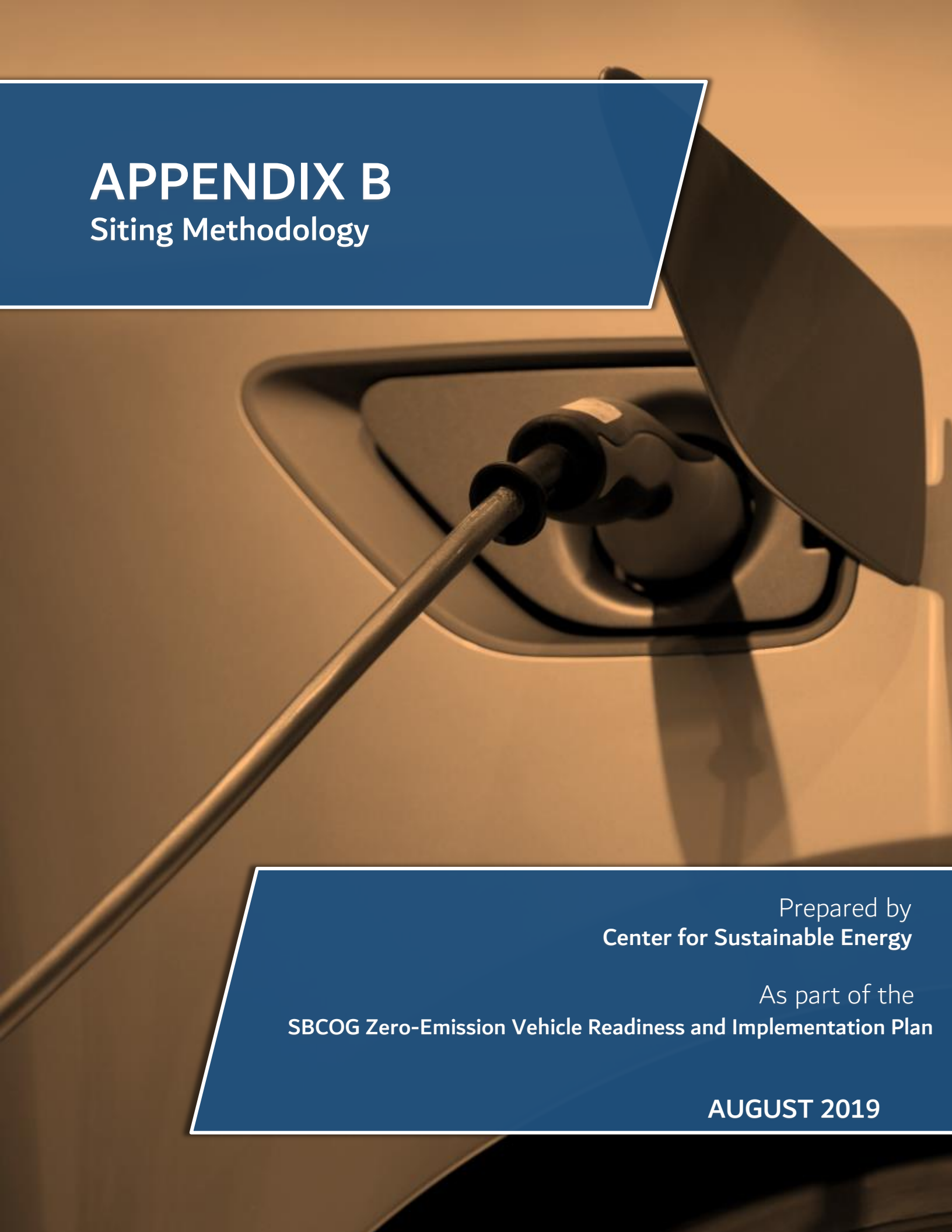
7. Schedule all necessary contract work for installation of new service (if applicable), and pulling wires from electric panel/meter pedestal to parking structure or lot:
    i. Boring, trenching, concrete and/or paving restoration
    ii. Coordinate with building managers, tenants and/or property owner(s) for scheduling installation, including site cleanup/closeout
8. Coordinate with the utility for markings of existing power lines, gas lines or other infrastructure is completed and utilize “call before you dig” services (811), service upgrade, new service/meter pull.

Installation

9. Secure the construction area appropriately (e.g. temporary fencing, barriers and signage) for safe working conditions. Prepare mounting surface prior to installation.
10. Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc.).
11. Install rough electrical conduit, boxes and fittings, subpanels etc. in walls, ceilings, floors and trenches to be covered.
12. Request a rough inspection from the building inspection office prior to covering any rough electrical installations.
13. Install charging unit(s) per manufacturer instructions and permitted construction plans. (CEC 110.3)
    i. Install circuit conductors and wiring of appropriate size to comply with rating of the overcurrent protection. Securely fasten wiring to the structure. (CEC 300.11, CEC 210.19, CEC 215.2(A), CEC 110.3(B); CEC 310.15(B))
    ii. Identify and install properly sized equipment grounding conductor with the branch circuit. Connect at the EVCS and panelboard or service. (CEC 250.110, 112, 114, 119, 120, 122; CEC 300.3(B))
    iii. Bring grounded conductor to the service disconnect and bond to the enclosure. (CEC 250.24 (C))
    iv. Install overcurrent protection for any newly installed service equipment and conductors. (CEC 230.90, 91)

v. Install disconnect in proper readily accessible location for EVCS that is rated more than 60 amperes or more than 150 Volts to ground. (CEC 625.23) If additional service disconnects are installed, verify that they are grouped and do not exceed the maximum number of service disconnects. (CEC 230.71, 72)
vi. Identify branch circuit device and disconnects. (CEC 408.4 (A); CEC 110.22(A))
vii. Install properly sized supply-side bonding jumpers. (CEC 250.50, 104(A) and (B))

14. Install wheel blocks/safety bollards as needed, and per approved plans. (CEC 110.27(B))
15. Perform finish work to repair existing surfaces, infrastructure, and landscaping, and parking lot striping (if applicable).
16. Make electrical connection and schedule for inspection with local jurisdiction Building Inspector.



APPENDIX B
Siting Methodology

Prepared by
Center for Sustainable Energy

As part of the
SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

APPENDIX B: METHODOLOGY

The siting analysis is a quantitative exercise that utilizes regional travel data, land parcel data, existing station locations, vehicle registration data and site-specific factors to identify high-impact project locations for EV infrastructure investment. The overarching goal of the siting analysis is to ensure that future EV charging station deployment is highly utilized, provides adequate range for regional/interregional drivers and reduces greenhouse gas emissions associated with internal combustion engine (ICE) vehicle travel. It should be noted that in addition to quantitative analysis, final EV station siting also requires multiple qualitative factors (e.g., property owner readiness, values alignment, risk tolerance, etc.) be overcome, which is not specifically addressed in this quantitative siting analysis. The value of investing in quantitative siting analysis, however, has been proven through an Idaho National Laboratory study conducted in Oregon, which measured the utilization of charging stations deployed as part of a planning process versus siting in unplanned locations. Results indicated charging station deployment within areas identified as part of a planning process experienced nearly 90% greater utilization (measured in charging events per week) than stations deployed in unplanned locations.

This section describes the methodology that CSE followed to generate a list of high-impact projects, with considerations for DACs and incorporating Working Group input.

Table B-1: Site Suitability Analysis Methodology

Criterion	Step	
Quantitative Site Suitability Analysis	1	Developed a spatial database of San Bernardino County parcel information.
	2	Dropped all parcels corresponding to “agricultural”, “vacant land” and “single family residence” as indicated by tax accessor use codes.
	3	Assigned parcels to four groups based on their use code: Workplace, MUD, Destination, and Public.
	4	Merged parcel data with several other datasets to develop a final database that included parcel information and relevant inputs: Land Net Value, Distance to Level 2 Charger, Distance to DCFC, Number of BEVs per parcel, Number of PHEVs per parcel, BEV Percent of Total Vehicles per Parcel, PHEV Percent of Total Vehicles per Parcel, Total Population per Parcel, Number of Places of Employment per Parcel, Number of Places of Office Employment per Parcel, Number of Places of Retail Employment per Parcel, and Number of Trips in Parcel.
	5	Calculated the percentile rank for each data input category. For example, the largest value of a category was classified as 100%, the median value per category was classified as 50% and the lowest value was classified as 0%.
	6	Applied the Multi-Attribute Decision Making (MADM) method, Weighted Linear Combination (WLC) method, and the Analytical Hierarchy Process (AHP) technique to appropriately weight the level of importance of each input category. For reference, the scale and associated weights are shown in Tables 10 and 11. The weighting methods we used were based on the research article *Spatial Planning of Electric Vehicle Infrastructure for Belo Horizonte, Brazil. Costa, E., Paiva, A., Seixas, J., Costa, G., Baptista, P., & Gallachóir, B. Ó. (2018).*

Criterion	Step	
Quantitative Site Suitability Analysis	7	The weights are assigned based on the level of importance for each criteria in the four categories: MUD, Destination, Public, and Workplace. A complete justification for each weight assigned to a criteria is located in Tables 14-17.
	8	The following equations were used to identify a composite score for each parcel: Public: [1 * (net value) + 1 * (DAC) + 2 * (d_ev2_chrg) + 2 * (d_dcfc_chrg) + 5 * (#trips) = Total Composite Parcel Score] Workplace: [3 * (net value) + 1 * (DAC) + 3 * (d_ev2_chrg) + 2 * (d_dcfc_chrg) + 3 * (#emp) + 3 * (#office emp) + 5 * (#trips) = Total Composite Parcel Score] MUD: [3 * (net value) + 1 * (DAC) + 3 * (d_ev2_chrg) + 1 * (d_dcfc_chrg) + 2 * (#bev) + 2 * (#phev) + 3 * (%BEV) + 3 * (%PHEV) + 1 * (tot_pop) + 5 * (#trips) = Total Composite MUD Parcel Score] Destination: [3 * (net value) + 1 * (DAC) + 5 * (d_ev2_chrg) + 5 * (d_dc_chrg) + 7 * (#trips) = Total Composite Parcel Score]
	9	Removed: County, State of California, Incorporated Cities, USA, Cemetery, and Landing Strip (Aircraft) from the [Description] column of the Publics dataset.
	10	Removed: Auto Repair/Service Garages from Workplace dataset.
	11	Removed: Small MUD and MUD 5-9 from the [type] column of the MUD dataset.
	12	The highest scores in the Top Destination, MUD, Public Institution, and Workplace analysis show the most suitable site for EVI infrastructure.
	13	Created a corridor analysis of top public and destination parcels within .10 miles of the State Highway Network for the entire San Bernardino County region as well as with- in the 11 member municipalities.
Qualitative Shovel-Ready Verification Analysis	14	Identified top [5] scoring sites in each city by category [MUD, Destination, Workplace, Public] and created list for desktop verification of site. The higher the score, the more suitable the site.
	15	Visualized each criterion in ArcMap. Maps included: % BEV, % PHEV, All Corridor, Existing Charging, City Map, Corridor by City, DAC, Distance to DCFC, Distance to Level 2 Charger, Dwell Time, Net Value, Top Destination Scores, Top MUD Scores, Top Public Institution Scores, Top Workplace Scores, Total Employment, Total Population, and Total Trips.

Table B-2: Criteria Description

Criteria	Description
net value	Assessed net value
DAC	Disadvantaged Community
d_ev2_chrg	Distance to nearest EV Level 2 public charging station (miles)
d_dcfc_chrg	Distance to nearest DCFC public charging station (miles)
#bev	Count of BEV in zipcode
#pev	Count of PHEV in zipcode
%BEV	Percent of vehicles that are BEVs in zipcode
%PHEV	Percent of vehicles that are PHEVs in zipcode
tot_pop	Total population residing in corresponding travel analysis zone (TAZ)
#emp	Total number of employees that work in TAZ
#office emp	Total number of office employees that work in TAZ
#trips	Total number of trips to/from TAZ

Table B-3: Multi-Attribute Decision Making (MADM) Scoring

Criteria	Publics Weight
1	Equal Importance
2	Midpoint
3	Moderate Importance
4	Midpoint
5	Strong Importance
6	Midpoint
7	Very Strong Importance
8	Midpoint
9	Extreme Importance

Table B-4: Assigned Weights by Criteria

Criteria	Publics Weight	Workplace Weight	MUD Weight	Destination Weight
net value	1	3	3	3
DAC	1	1	1	1
d_ev2_chrg	2	3	3	5
d_dcfc_chrg	2	2	1	5
#bev	0	0	2	0
#pev	0	0	2	0
%BEV	0	0	3	0
%PHEV	0	0	3	0
tot_pop	0	0	1	0
#emp	0	3	0	0
#office emp	0	3	0	0
#trips	5	5	5	7

Table B-5: Public Parcel Assigned Weight Justification

Criterion	Weight	Justification
net value	1	Although important, net value is not a significant factor when assessing Public parcels. Public parcels include several parking lots. Parking lots are a viable site option for EVSE but are not often a high net land value.
DAC	1	The DAC field is either a yes or no (1 or 0). It is important and automatically carries a higher weight than other categories and is therefore weighted at a '1' scale.
d_ev2_chrg	2	Distance to an EV Level 2 charger has a weight of 2 to show significance in siting charging stations at public locations that do not currently have access to charging.
d_dcfc_chrg	2	Distance to a DCFC has a weight of 2 to show significance in siting charging stations at public locations that do not currently have access to charging.
#bev	0	#bev criteria only applies to MUD analysis
#pev	0	#phev criteria only applies to MUD analysis
%BEV	0	%BEV criteria only applies to MUD analysis
%PHEV	0	%PHEV criteria only applies to MUD analysis
tot_pop	0	tot_pop criteria only applies to MUD analysis
#emp	0	#emp criteria is most significant in Workplace analysis
#office emp	0	#office emp criteria is most significant in Workplace analysis
#trips	5	Number of trips to and from a parcel is always significant and weighted higher than other inputs.

Table B-6: Workplace Parcel Assigned Weight Justification

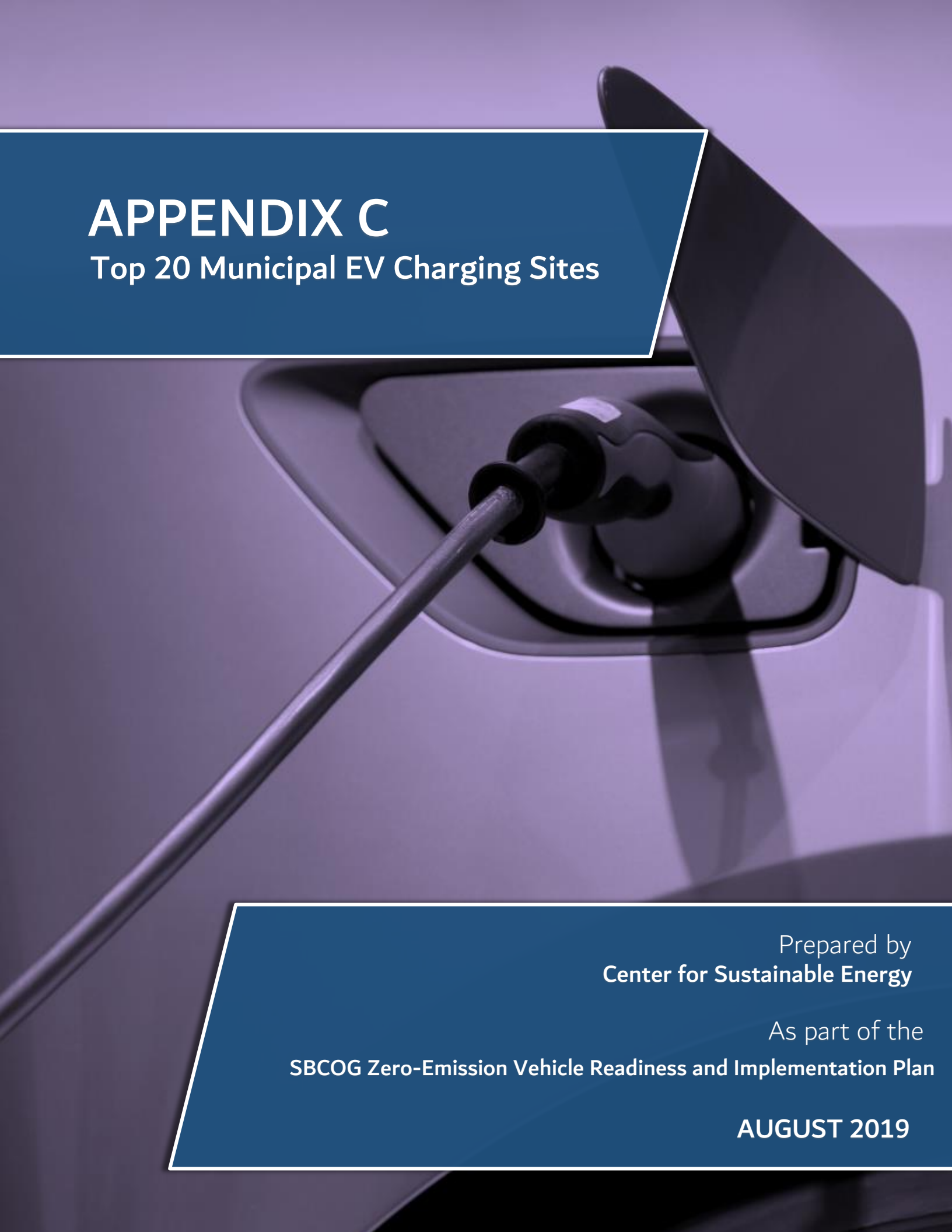
Criterion	Weight	Justification
net value	3	Land Net Value is a significant factor when assessing Workplace parcels. A Workplace with a higher value indicates the financial ability to fund and install infrastructure.
DAC	1	The DAC field is either a yes or no (1 or 0). It is important and automatically carries a higher weight than other categories and is therefore weighted at a '1' scale.
d_ev2_chrg	3	Distance to a Level 2 charger is more significant than other categories in Work- place analysis. Parcels at a further distance from charging may benefit more from charging installation at a workplace.
d_dcfc_chrg	2	Distance to a DCFC is more significant than other categories in Work- place analysis. Parcels at a further distance from charging may benefit more from charging installation at a workplace.
#bev	0	#bev criteria only applies to MUD analysis
#pev	0	#phev criteria only applies to MUD analysis
%BEV	0	%BEV criteria only applies to MUD analysis
%PHEV	0	%PHEV criteria only applies to MUD analysis
tot_pop	0	tot_pop criteria only applies to MUD analysis
#emp	3	Number of employment locations at a Workplace parcel can identify that parcel as an optimal destination for charging due to the ability to serve a multitude of employees
#office emp	3	Number of office employment locations at a Workplace parcel can identify that parcel as an optimal destination for charging due to the ability to serve a multitude of employees
#trips	5	Number of trips to and from a parcel is always significant and weighted higher than other inputs.

Table B-7: MUD Parcel Assigned Weight Justification

Criterion	Weight	Justification
net value	3	Land Net Value is a significant factor when assessing MUD parcels. A MUD with a higher value indicates the financial ability to fund and install infra-structure.
DAC	1	The DAC field is either a yes or no (1 or 0). It is important and automatically carries a higher weight than other categories and is therefore weighted at a '1' scale.
d_ev2_chrg	3	Distance to an EV Level 2 charger indicates whether the MUD parcel has close proximity for residents to charge at a destination or public location. MUDs far from charging benefit the most from installing charging in the complex.
d_dcfc_chrg	1	Distance to an EV DCFC is important, but is not significantly more important than other categories.
#bev	2	MUD parcels reflect the people that live in the parcel. Therefore, a higher number of BEVs indicates need for charging.
#pev	2	MUD parcels reflect the people that live in the parcel. Therefore, a higher number of PHEVs indicates need for charging.
%BEV	3	MUD parcels reflect the people that live in the parcel. Therefore, a higher percentage of BEVs indicates need for charging. Percentage of BEVs is weighted higher than number of BEVs to show the adoption rate in each parcel.
%PHEV	3	MUD parcels reflect the people that live in the parcel. Therefore, a higher percentage of PHEVs indicates need for charging. Percentage of BEVs is weighted higher than number of PHEVs to show the adoption rate in each parcel.
tot_pop	1	Population has a relevant significance for MUD parcel analysis due to the population residing in the parcel but is more significant than other criterion in this category.
#emp	0	#emp criteria is most significant in Workplace analysis
#office emp	0	#office emp criteria is most significant in Workplace analysis
#trips	5	Number of trips to and from a parcel is always significant and weighted higher than other inputs.

Table C-8: Destination Parcel Assigned Weight Justification

Criterion	Weight	Justification
net value	3	Land Net Value is a significant factor when assessing Destination parcels. A Destination with a higher value indicates the financial ability to fund and install infrastructure.
DAC	1	The DAC field is either a yes or no (1 or 0). It is important and automatically carries a higher weight than other categories and is therefore weighted at a '1' scale.
d_ev2_chrg	5	Distance to an EV Level 2 charger indicates whether the Destination parcel has close proximity for visitors to charge at a destination or public location. Destinations far from charging benefit the most from installing charging in the complex. Charging at a Destination can encourage visitors to travel to that destination.
d_dcfc_chrg	5	Distance to a DCFC indicates whether the Destination parcel has close proximity for visitors to charge at a destination or public location. Destinations far from charging benefit the most from installing charging in the complex. Charging at a Destination can encourage visitors to travel to that destination. Dwell times vary at destinations. DCFC may provide greater benefit at short dwell time locations including those along travel corridors.
#bev	0	#bev criteria only applies to MUD analysis
#pev	0	#phev criteria only applies to MUD analysis
%BEV	0	%BEV criteria only applies to MUD analysis
%PHEV	0	%PHEV criteria only applies to MUD analysis
tot_pop	0	tot_pop criteria only applies to MUD analysis
#emp	0	#emp criteria is most significant in Workplace analysis
#office emp	0	#office emp criteria is most significant in Workplace analysis
#trips	7	Number of trips to and from a parcel is always significant and weighted higher than other inputs.



APPENDIX C

Top 20 Municipal EV Charging Sites

Prepared by

Center for Sustainable Energy

As part of the

SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

Top 20 Municipal Sites

Appendix C details the top 20 identified sites for each established city within San Bernardino County, as identified by a combination of client feedback and internal Center for Sustainable Energy (CSE) siting methodology (detailed in the main body of the document). These site recommendations are not meant to replace a detailed analysis of site considerations, such as vehicle dwell time and turnover, vehicle access, electrical infrastructure adequacy, or site demand for charging. Rather, they should be viewed as a high-level assessment of properties that have potential to be well-suited for electric vehicle (EV) charging. Taken in combination with the main body of this document and the toolkits in the following appendices, this is intended to provide a preliminary list of sites with which to begin the analysis process.

ADELANTO

Type	Street Address	City	State	Zip	Score
DESTINATION	6731 SAXON RD	ADELANTO	CA	92301	79.64
DESTINATION	10474 RANCHO RD	ADELANTO	CA	92301	78.66
DESTINATION	16880 SPORTSMAN CENTER DR	ADELANTO	CA	92301	76.97
DESTINATION	12011 AIR EXPRESSWAY	ADELANTO	CA	92301	76.94
DESTINATION	16898 SPORTSMAN CENTER DR	ADELANTO	CA	92301	76.46
DESTINATION	11965 CACTUS RD	ADELANTO	CA	92301	76.30
DESTINATION	11678 RANCHO RD	ADELANTO	CA	92301	75.78
DESTINATION	12130 RANCHO RD	ADELANTO	CA	92301	75.65
DESTINATION	17664 ADELANTO RD	ADELANTO	CA	92301	73.09
DESTINATION	15440 FREMONTIA RD	ADELANTO	CA	92301	71.99
WORKPLACE	10171 APACHE RD	ADELANTO	CA	92301	70.85
WORKPLACE	16681 BELLFLOWER ST	ADELANTO	CA	92301	70.55
WORKPLACE	10875 RANCHO RD	ADELANTO	CA	92301	70.47
WORKPLACE	17499 ADELANTO RD	ADELANTO	CA	92301	70.32
INSTITUTION	9330 COMMERCE	ADELANTO	CA	92301	69.52
INSTITUTION	10250 RANCHO RD	ADELANTO	CA	92301	68.80
INSTITUTION	10400 RANCHO RD	ADELANTO	CA	92301	68.80
INSTITUTION	10450 RANCHO RD	ADELANTO	CA	92301	68.80
DESTINATION	2620 EL MIRAGE RD	ADELANTO	CA	92301	65.69
DESTINATION	17537 MONTEZUMA ST	ADELANTO	CA	92301	65.58

Apple Valley

Type	Street Address	City	State	Zip	Score
DESTINATION	13656 NAVAJO RD	APPLE VALLEY	CA	92308	86.98
DESTINATION	13534 NAVAJO RD	APPLE VALLEY	CA	92308	82.45
DESTINATION	21675 YUCCA LOMA RD	APPLE VALLEY	CA	92307	82.29
DESTINATION	13540 NAVAJO RD	APPLE VALLEY	CA	92308	81.55
DESTINATION	20834 BEAR VALLEY RD	APPLE VALLEY	CA	92308	81.30
DESTINATION	20754 BEAR VALLEY RD	APPLE VALLEY	CA	92308	81.17
DESTINATION	21601 YUCCA LOMA RD	APPLE VALLEY	CA	92308	80.70
DESTINATION	20878 BEAR VALLEY RD	APPLE VALLEY	CA	92308	80.45
DESTINATION	12123 CENTRAL RD	APPLE VALLEY	CA	92308	79.62
DESTINATION	13601 APPLE VALLEY RD	APPLE VALLEY	CA	92308	79.32
DESTINATION	20610 BEAR VALLEY RD	APPLE VALLEY	CA	92308	79.26
DESTINATION	21602 BEAR VALLEY RD	APPLE VALLEY	CA	92308	78.45
DESTINATION	21640 BEAR VALLEY RD	APPLE VALLEY	CA	92308	78.33
DESTINATION	25556 KEATOR RD	APPLE VALLEY	CA	92307	77.75
DESTINATION	22095 HWY 18	APPLE VALLEY	CA	92307	77.36
DESTINATION	21580 BEAR VALLEY RD	APPLE VALLEY	CA	92308	77.28
DESTINATION	21630 BEAR VALLEY RD	APPLE VALLEY	CA	92308	77.26
DESTINATION	21550 BEAR VALLEY RD	APPLE VALLEY	CA	92308	77.26
DESTINATION	13685 JOHN GLENN RD	APPLE VALLEY	CA	92307	77.11

Type	Street Address	City	State	Zip	Score
DESTINATION	13553 NOMWAKET	APPLE VALLEY	CA	92307	77.00

Barstow

Type	Street Address	City	State	Zip	Score
DESTINATION	1890 MAIN ST	BARSTOW	CA	92311	79.57
DESTINATION	1380 BARSTOW RD	BARSTOW	CA	92311	78.65
DESTINATION	2056 MAIN ST	BARSTOW	CA	92311	78.30
DESTINATION	2250 MAIN ST	BARSTOW	CA	92311	78.10
DESTINATION	1300 MAIN ST	BARSTOW	CA	92311	77.48
DESTINATION	471 RIMROCK RD	BARSTOW	CA	92311	77.05
DESTINATION	1720 MAIN ST	BARSTOW	CA	92311	76.86
DESTINATION	1906 MAIN ST	BARSTOW	CA	92311	76.83
DESTINATION	1460 MAIN ST	BARSTOW	CA	92311	76.55
DESTINATION	1230 MAIN ST	BARSTOW	CA	92311	76.26
DESTINATION	1500 MAIN ST	BARSTOW	CA	92311	75.90
DESTINATION	1628 MAIN ST	BARSTOW	CA	92311	75.88
DESTINATION	2420 MAIN ST	BARSTOW	CA	92311	75.81
DESTINATION	491 ARMORY RD	BARSTOW	CA	92311	75.80
DESTINATION	2100 MAIN ST	BARSTOW	CA	92311	75.76
DESTINATION	481 ARMORY RD	BARSTOW	CA	92311	75.46
DESTINATION	1580 MAIN ST	BARSTOW	CA	92311	75.38
DESTINATION	1520 MAIN ST	BARSTOW	CA	92311	75.04
DESTINATION	2046 MAIN ST	BARSTOW	CA	92311	74.97
DESTINATION	1550 MAIN ST	BARSTOW	CA	92311	74.82

Big Bear Lake

Type	Street Address	City	State	Zip	Score
DESTINATION	42825 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	95.30
DESTINATION	42825 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	95.30
DESTINATION	42770 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	95.18
DESTINATION	42150 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	94.96
DESTINATION	42136 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	94.60
DESTINATION	42900 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	93.83
DESTINATION	42185 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	93.71
DESTINATION	42167 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	93.70
DESTINATION	42142 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	93.59
DESTINATION	42138 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	93.22
DESTINATION	43100 CLUB VIEW DR	BIG BEAR LAKE	CA	92315	92.99
DESTINATION	43100 CLUB VIEW DR	BIG BEAR LAKE	CA	92315	92.99
DESTINATION	42137 BIG BEAR BLVD	BIG BEAR LAKE	CA	92315	92.84
DESTINATION	43100 CLUB VIEW DR	BIG BEAR LAKE	CA	92315	92.71
DESTINATION	43100 CLUB VIEW DR	BIG BEAR LAKE	CA	92315	92.71
DESTINATION	43100 CLUB VIEW DR	BIG BEAR LAKE	CA	92315	92.71

Type	Street Address	City	State	Zip	Score
DESTINATION	42172 MOONRIDGE RD	BIG BEAR LAKE	CA	92315	92.48
DESTINATION	42106 BIG BEAR LAKE BLVD	BIG BEAR LAKE	CA	92315	92.40
DESTINATION	650 FAIRWAY BLVD	BIG BEAR LAKE	CA	92314	92.38
DESTINATION	337 BIG BEAR BLVD	BIG BEAR LAKE	CA	92314	92.24

Chino Hills

Type	Street Address	City	State	Zip	Score
MUD	5685 PARK DR	CHINO HILLS	CA	91709	89.56
MUD	2400 RIDGEVIEW DR	CHINO HILLS	CA	91709	88.25
MUD	16675 SLATE DR	CHINO HILLS	CA	91709	88.22
MUD	16301 BUTTERFIELD RANCH RD	CHINO HILLS	CA	91709	83.16
MUD	16301 BUTTERFIELD RANCH RD	CHINO HILLS	CA	91709	82.33
MUD	13439 PEYTON DR	CHINO HILLS	CA	91709	81.13
MUD	15920 POMONA RINCON RD	CHINO HILLS	CA	91709	78.41
MUD	15773 HIGH KNOLL DR	CHINO HILLS	CA	91709	75.03
MUD	15773 HIGH KNOLL DR	CHINO HILLS	CA	91709	73.78
MUD	3100 CHINO HILLS PKWY	CHINO HILLS	CA	91709	72.22
MUD	3100 CHINO HILLS PKWY	CHINO HILLS	CA	91709	71.17
MUD	15101 FAIRFIELD RANCH RD	CHINO HILLS	CA	91709	68.64
MUD	4200 VILLAGE DR	CHINO HILLS	CA	91709	65.17
DESTINATION	6510 BUTTERFIELD RANCH RD	CHINO HILLS	CA	91709	61.13
DESTINATION	2140 GRAND AVE	CHINO HILLS	CA	91709	60.16
DESTINATION	2120 GRAND AVE	CHINO HILLS	CA	91709	59.64
DESTINATION	6750 BUTTERFIELD RANCH RD	CHINO HILLS	CA	91709	59.26
DESTINATION	2130 GRAND AVE	CHINO HILLS	CA	91709	59.18
DESTINATION	2130 GRAND AVE	CHINO HILLS	CA	91709	59.18
DESTINATION	5215 GREEN RIVER DR	CHINO HILLS	CA	91709	58.68
DESTINATION	5215 GREEN RIVER DR	CHINO HILLS	CA	91709	58.68
MUD	14901 FROST AVE	CHINO HILLS	CA	91709	58.67
WORKPLACE	5867 PINE AVE	CHINO HILLS	CA	91701	58.46
WORKPLACE	5871 PINE AVE	CHINO HILLS	CA	91701	58.25

Chino

Type	Street Address	City	State	Zip	Score
MUD	1601 MEADOWHOUSE AVE	CHINO	CA	91710	100.00
WORKPLACE	13980 MAGNOLIA AVE	CHINO	CA	91710	85.31
MUD	11401 CENTRAL AVE	CHINO	CA	91710	84.25
MUD	11475 CENTRAL AVE	CHINO	CA	91710	83.40
WORKPLACE	14020 CENTRAL AVE	CHINO	CA	91710	83.00
MUD	2851 BEDFORD LN	CHINO	CA	91709	82.99
MUD	13316 WOODSORREL RD	CHINO	CA	91709	81.45
MUD	11838 CENTRAL AVE	CHINO	CA	91710	81.45
MUD	16250 HOMECOMING DR	CHINO	CA	91708	81.07

Type	Street Address	City	State	Zip	Score
MUD	11435 CENTRAL AVE	CHINO	CA	91710	81.04
WORKPLACE	13801 OAKS AVE	CHINO	CA	91710	80.72
WORKPLACE	13760 MAGNOLIA AVE	CHINO	CA	91710	80.61
WORKPLACE	13770 MAGNOLIA AVE	CHINO	CA	91710	80.35
MUD	0	CHINO	CA	91710	80.05
MUD	5207 FRANCIS AVE	CHINO	CA	91710	79.72
MUD	12957 RAMONA AVE	CHINO	CA	91710	78.39
WORKPLACE	13901 YORBA AVE	CHINO	CA	91710	77.59
MUD	11902 CENTRAL AVE	CHINO	CA	91710	77.53
WORKPLACE	5171 EDISON AVE	CHINO	CA	91710	76.26
WORKPLACE	14125 TELEPHONE AVE	CHINO	CA	91710	75.59
MUD	12831 YORBA AVE	CHINO	CA	91710	75.52

Colton

Type	Street Address	City	State	Zip	Score
MUD	2270 CAHUILLA ST	COLTON	CA	92324	64.78
MUD	1333 RECHE CANYON RD	COLTON	CA	92324	64.53
WORKPLACE	1231 LINCOLN ST	COLTON	CA	92324	60.46
MUD	2656 ROSEDALE AVE	COLTON	CA	92324	59.89
MUD	1316 MEADOW LN	COLTON	CA	92324	100.00
DESTINATION	859 RANCHO AVE	COLTON	CA	92324	58.27
DESTINATION	833 VALLEY BLVD	COLTON	CA	92324	58.21
DESTINATION	223 RANCHO AVE	COLTON	CA	0	58.10
DESTINATION	774 VALLEY BLVD	COLTON	CA	92324	58.00
MUD	1699 WASHINGTON ST	COLTON	CA	92324	57.90
WORKPLACE	151 FOGG ST	COLTON	CA	0	57.78
DESTINATION	834 VALLEY BLVD	COLTON	CA	92324	57.61
DESTINATION	756 VALLEY BLVD	COLTON	CA	92324	57.23
DESTINATION	875 RANCHO AVE	COLTON	CA	92324	57.16
DESTINATION	354 7TH ST	COLTON	CA	92324	56.99
WORKPLACE	926 EIGHTH ST	COLTON	CA	92324	56.74
WORKPLACE	424 8TH ST	COLTON	CA	92324	55.75
DESTINATION	789 COOLEY DR	COLTON	CA	92324	54.73
DESTINATION	837 VALLEY BLVD	COLTON	CA	92324	54.67
DESTINATION	855 ASHLEY WAY	COLTON	CA	92324	54.60

Fontana

Type	Street Address	City	State	Zip	Score
DESTINATION	15258 SUMMIT AVE 100	FONTANA	CA		100.00
DESTINATION	8353 SIERRA AVE	FONTANA			100.00
DESTINATION	8453 SIERRA AVE	FONTANA			100.00
WORKPLACE	10837 COMMERCE	FONTANA	CA	92335	100.00
WORKPLACE	10700 BEECH AVE	FONTANA	CA	92335	88.07

Type	Street Address	City	State	Zip	Score
WORKPLACE	11090 ALMOND AVE	FONTANA	CA	92337	83.66
WORKPLACE	10375 BEECH AVE	FONTANA	CA	92335	83.62
WORKPLACE	10712 LIVE OAK AVE	FONTANA	CA	92337	82.91
WORKPLACE	14770 SLOVER AVE	FONTANA	CA	92337	81.82
WORKPLACE	14798 SLOVER AVE	FONTANA	CA	92335	81.52
WORKPLACE	10466 REDWOOD AVE	FONTANA	CA	92335	80.59
WORKPLACE	14407 SLOVER AVE	FONTANA	CA	92335	79.27
WORKPLACE	15998 SLOVER AVE	FONTANA	CA	92335	76.86
WORKPLACE	14490 SLOVER AVE	FONTANA	CA	92335	75.58
DESTINATION	14577 SANTA ANA AVE	FONTANA	CA	92335	73.20
DESTINATION	10917 CHERRY AVE	FONTANA	CA	92335	73.07
WORKPLACE	13992 SLOVER AVE	FONTANA	CA	92335	72.95
DESTINATION	15033 SLOVER AVE	FONTANA	CA	92337	71.30
DESTINATION	16111 VALLEY AVE	FONTANA	CA	92335	70.95
DESTINATION	14355 SANTA ANA AVE	FONTANA	CA	92337	70.76

Grand Terrace

Type	Street Address	City	State	Zip	Score
DESTINATION	22795 BARTON ROAD	GRAND TERRACE	CA		100.00
MUD	22491 DE BERRY ST	GRAND TERRACE	CA	92324	67.88
MUD	22822 PALM AVE	GRAND TERRACE	CA	92324	62.07
MUD	12044 PRESTON ST	GRAND TERRACE	CA	92324	60.43
DESTINATION	12071 MOUNT VERNON AVE	GRAND TERRACE	CA	92313	55.87
DESTINATION	22045 BARTON RD	GRAND TERRACE	CA	92324	55.46
DESTINATION	22201 BARTON RD	GRAND TERRACE	CA	92313	55.39
DESTINATION	11980 MOUNT VERNON AVE	GRAND TERRACE	CA	92313	55.19
DESTINATION	22203 BARTON AVE	GRAND TERRACE	CA	92313	55.00
DESTINATION	22456 BARTON RD	GRAND TERRACE	CA	92324	54.72
DESTINATION	22483 BARTON RD	GRAND TERRACE	CA	92313	54.70
DESTINATION	22257 BARTON RD	GRAND TERRACE	CA	92313	54.64
DESTINATION	22219 BARTON RD	GRAND TERRACE	CA	92313	54.23
DESTINATION	22085 COMMERCE WAY	GRAND TERRACE	CA	92324	100.00
DESTINATION	22488 BARTON RD	GRAND TERRACE	CA	92324	100.00
DESTINATION	22400 BARTON RD	GRAND TERRACE	CA	92324	53.65
DESTINATION	12490 MICHIGAN AVE	GRAND TERRACE	CA	92324	53.26
MUD	11750 MOUNT VERNON AVE	GRAND TERRACE	CA	92313	53.11
DESTINATION	22080 COMMERCE WAY	GRAND TERRACE	CA	92324	53.08
DESTINATION	12081 MOUNT VERNON AVE	GRAND TERRACE	CA	92313	52.90

Hesperia

Type	Street Address	City	State	Zip	Score
DESTINATION	8701 HWY 395	HESPERIA	CA	92344	89.46
DESTINATION	12078 THREE FLAGS CT	HESPERIA	CA	92345	88.20

Type	Street Address	City	State	Zip	Score
DESTINATION	8205 CALIENTE RD	HESPERIA	CA	92344	88.03
DESTINATION	8685 HWY 385	HESPERIA	CA	92344	86.73
DESTINATION	12791 MAIN ST	HESPERIA	CA	92345	86.54
DESTINATION	12795 MAIN ST	HESPERIA	CA	92345	86.48
DESTINATION	12543 MAIN ST	HESPERIA	CA	92345	86.45
DESTINATION	12771 MAIN ST	HESPERIA	CA	92345	86.39
DESTINATION	12779 MAIN ST	HESPERIA	CA	92345	85.99
DESTINATION	12750 MAIN ST	HESPERIA	CA	92345	85.68
DESTINATION	12845 MAIN ST	HESPERIA	CA	92345	85.58
DESTINATION	12135 SCARBROUGH CT	HESPERIA	CA	92344	85.38
DESTINATION	12821 MAIN ST	HESPERIA	CA	92345	85.33
DESTINATION	12680 MAIN ST	HESPERIA	CA	92345	85.06
DESTINATION	12727 MAIN ST	HESPERIA	CA	92345	84.68
DESTINATION	12745 MAIN ST	HESPERIA	CA	92345	84.56
DESTINATION	12720 MAIN ST	HESPERIA	CA	92345	84.41
DESTINATION	12731 MAIN ST	HESPERIA	CA	92345	83.59
DESTINATION	12715 MAIN ST	HESPERIA	CA	92345	83.31
DESTINATION	12728 MAIN ST	HESPERIA	CA	92345	82.97

Highland

Type	Street Address	City	State	Zip	Score
DESTINATION	27215 BASELINE STREET	HIGHLAND	CA	92346	100.00
DESTINATION	7863 CENTRAL AVE	HIGHLAND	CA	92346	100.00
DESTINATION	7793 CENTRAL AVE	HIGHLAND	CA	92346	100.00
DESTINATION	2442 HIGHLAND AVE	HIGHLAND	CA	92346	71.68
DESTINATION	2536 HIGHLAND AVE	HIGHLAND	CA	92346	68.67
DESTINATION	26492 HIGHLAND AVE	HIGHLAND	CA	92346	66.25
DESTINATION	2574 HIGHLAND AVE	HIGHLAND	CA	92346	65.21
DESTINATION	26454 HIGHLAND AVE	HIGHLAND	CA	92346	64.78
DESTINATION	2544 HIGHLAND AVE	HIGHLAND	CA	92346	64.26
MUD	7405 STERLING AVE	HIGHLAND	CA	92346	60.57
DESTINATION	3704 HIGHLAND AVE	HIGHLAND	CA	92346	60.41
DESTINATION	2592 HIGHLAND AVE	HIGHLAND	CA	92346	60.17
MUD	26660 9TH ST	HIGHLAND	CA	92346	59.39
MUD	6601 VICTORIA AVE	HIGHLAND	CA	92346	58.96
DESTINATION	3702 HIGHLAND AVE	HIGHLAND	CA	92346	58.79
DESTINATION	3708 HIGHLAND AVE	HIGHLAND	CA	92346	58.45
MUD	26674 WARD ST	HIGHLAND	CA	92346	57.71
DESTINATION	4010 HIGHLAND AVE	HIGHLAND	CA	92346	56.86
DESTINATION	4070 HIGHLAND AVE	HIGHLAND	CA	92346	55.73
MUD	27070 BASELINE ST	HIGHLAND	CA	92346	55.55
MUD	28807 BASE LINE ST	HIGHLAND	CA	92346	54.93
MUD	7862 LANKERSHIM ST	HIGHLAND	CA	92346	53.95
MUD	7320 VALARIA DR	HIGHLAND	CA	92346	53.63

Type	Street Address	City	State	Zip	Score

Loma Linda

Type	Street Address	City	State	Zip	Score
MUD	26630 BARTON RD	LOMA LINDA	CA	92354	75.12
MUD	25701 VAN LEUVEN ST	LOMA LINDA	CA	92354	71.86
MUD	25590 PROSPECT AVE	LOMA LINDA	CA	92354	71.76
MUD	25675 PROSPECT AVE	LOMA LINDA	CA	92354	70.44
MUD	25421 COLE ST	LOMA LINDA	CA	92354	69.79
MUD	25356 COLE ST	LOMA LINDA	CA	92354	69.04
MUD	25973 REDLANDS BLVD	LOMA LINDA	CA	92354	68.66
MUD	26230 REDLANDS BLVD	LOMA LINDA	CA	92354	66.91
MUD	10558 MOUNTAIN VIEW AVE	LOMA LINDA	CA	92354	66.28
MUD	11171 OAKWOOD DR	LOMA LINDA	CA	92354	65.31
DESTINATION	26780 BARTON RD	LOMA LINDA	CA	92354	63.82
MUD	25246 BARTON RD	LOMA LINDA	CA	92354	63.82
MUD	10664 MOUNTAIN VIEW AVE	LOMA LINDA	CA	92354	63.67
DESTINATION	26526 BARTON RD	LOMA LINDA	CA	92354	63.56
MUD	25276 BARTON RD	LOMA LINDA	CA	92354	62.90
MUD	24530 UNIVERSITY AVE	LOMA LINDA	CA	92354	62.03
DESTINATION	11245 CALIFORNIA ST	LOMA LINDA	CA	92354	61.94
DESTINATION	11201 CALIFORNIA ST	LOMA LINDA	CA	92354	61.23
DESTINATION	11221 CALIFORNIA ST	LOMA LINDA	CA	92354	61.15
MUD	24570 STEWART ST	LOMA LINDA	CA	92354	60.81

Montclair

Type	Street Address	City	State	Zip	Score
DESTINATION	5566 ARROW HWY	MONTCLAIR	CA	91763	65.64
INSTITUTION	9160 MONTE VISTA AVE	MONTCLAIR	CA	91763	65.58
DESTINATION	8710 CENTRAL AVE	MONTCLAIR	CA	91763	65.43
DESTINATION	8660 CENTRAL AVE	MONTCLAIR	CA	91763	64.59
DESTINATION	8780 CENTRAL AVE	MONTCLAIR	CA	91763	64.42
DESTINATION	8750 CENTRAL AVE	MONTCLAIR	CA	91763	64.28
DESTINATION	8801 CENTRAL AVE	MONTCLAIR	CA	91763	63.80
DESTINATION	5280 ARROW HWY	MONTCLAIR	CA	91763	63.66
DESTINATION	8790 CENTRAL AVE	MONTCLAIR	CA	91763	63.58
DESTINATION	5160 ARROW HWY	MONTCLAIR	CA	91763	63.16
DESTINATION	8720 CENTRAL AVE	MONTCLAIR	CA	91763	62.75
DESTINATION	5225 ARROW HWY	MONTCLAIR	CA	91763	62.71
DESTINATION	8960 CENTRAL AVE	MONTCLAIR	CA	91763	62.64
MUD	4961 ARROW HWY	MONTCLAIR	CA	91763	62.61
DESTINATION	5436 ARROW HWY	MONTCLAIR	CA	91763	62.48
DESTINATION	5454 MORENO DR	MONTCLAIR	CA	91763	62.39
DESTINATION	8891 CENTRAL AVE	MONTCLAIR	CA	91763	62.16

Type	Street Address	City	State	Zip	Score
DESTINATION	180 CENTRAL AVE	MONTCLAIR	CA	91763	61.83
DESTINATION	8950 CENTRAL AVE	MONTCLAIR	CA	91763	61.72
DESTINATION	9040 BENSON AVE	MONTCLAIR	CA	91763	61.59

Needles

Type	Street Address	City	State	Zip	Score
DESTINATION	900 BROADWAY	NEEDLES	CA	92363	81.73
DESTINATION	1040 BROADWAY ST	NEEDLES	CA	92363	81.64
DESTINATION	1100 BROADWAY	NEEDLES	CA	92363	80.49
DESTINATION	1008 BROADWAY ST	NEEDLES	CA	92363	78.73
DESTINATION	1005 BROADWAY	NEEDLES	CA	92363	75.10
DESTINATION	810 BROADWAY	NEEDLES	CA	92363	73.63
DESTINATION	916 BROADWAY	NEEDLES	CA	92363	73.57
DESTINATION	204 BAZOOBUTH ST	NEEDLES	CA	92363	72.67
DESTINATION	917 BROADWAY	NEEDLES	CA	92363	72.66
DESTINATION	600 SAN CLEMENTE	NEEDLES	CA	92363	72.47
DESTINATION	409 BROADWAY	NEEDLES	CA	92363	72.45
DESTINATION	1401 BAILEY AVE	NEEDLES	CA	92363	72.36
DESTINATION	138990 BROADWAY	NEEDLES	CA	92363	71.66
DESTINATION	1201 THIRD ST	NEEDLES	CA	92363	71.55
DESTINATION	318 SAN CLEMENTE ST	NEEDLES	CA	92363	70.99
MUD	1601 LILYHILL DR	NEEDLES	CA	92363	70.37
DESTINATION	5156 NATIONAL OLD TRAILS HWY	NEEDLES	CA	92363	70.22
DESTINATION	1500 J ST	NEEDLES	CA	92363	70.18
DESTINATION	701 BROADWAY	NEEDLES	CA	92363	70.11
DESTINATION	641 FRONT ST	NEEDLES	CA	92363	69.90

Ontario

Type	Street Address	City	State	Zip	Score
MUD	11385 CENTRAL AVE	ONTARIO	CA	91710	81.01
WORKPLACE	3787 GUASTI RD	ONTARIO	CA	91761	80.27
WORKPLACE	1505 DUPONT AVE	ONTARIO	CA	91764	77.59
MUD	1110 PHILADELPHIA	ONTARIO	CA	91761	77.54
WORKPLACE	3200 GUASTI RD	ONTARIO	CA	91761	76.18
WORKPLACE	5450 FRANCIS ST	ONTARIO	CA	91761	75.47
WORKPLACE	3110 GUASTI RD	ONTARIO	CA	91764	75.44
WORKPLACE	820 ETIWANDA AVE	ONTARIO	CA	91761	75.10
MUD	2550 RIVERSIDE DR	ONTARIO	CA	91761	74.11
WORKPLACE	3281 GUASTI RD	ONTARIO	CA	91761	72.86
MUD	2346 CUCAMONGA AVE	ONTARIO	CA	91761	72.68
WORKPLACE	3210 GUASTI RD	ONTARIO	CA	91764	72.19
WORKPLACE	3919 GUASTI RD	ONTARIO	CA	91761	71.63
WORKPLACE	1228 HOLT BLVD	ONTARIO	CA	91761	69.87

Type	Street Address	City	State	Zip	Score
WORKPLACE	1819 EXCISE AVE	ONTARIO	CA	91761	69.29
MUD	3303 ARCHIBALD AVE	ONTARIO	CA	91761	68.35
WORKPLACE	8605 SCHAEFER AVE	ONTARIO	CA	91761	68.26
DESTINATION	13130 HAMNER AVE	ONTARIO	CA	91761	68.02
WORKPLACE	3105 GUASTI RD	ONTARIO	CA	91761	67.85
DESTINATION	3000 ARCHIBALD AVE	ONTARIO	CA	91761	67.84

Rancho Cucamonga

Type	Street Address	City	State	Zip	Score
MUD	9997 FERON BLVD	RANCHO CUCAMONGA	CA	91730	85.34
MUD	9400 FAIRWAY VIEW PL	RANCHO CUCAMONGA	CA	91730	79.00
MUD	11201 5TH ST	RANCHO CUCAMONGA	CA	91730	78.37
MUD	9200 MILLIKEN AVE	RANCHO CUCAMONGA	CA	91730	78.13
MUD	9181 FOOTHILL BLVD	RANCHO CUCAMONGA	CA	91730	77.10
Destination	12201 HIGHLAND AVE	RANCHO CUCAMONGA	CA	91701	73.37
Destination	8283 GROVE AVE	RANCHO CUCAMONGA	CA	91730	70.87
Destination	8241 FOOTHILL BLVD	RANCHO CUCAMONGA	CA	91730	68.59
Destination	7170 DAY CREEK BLVD	RANCHO CUCAMONGA	CA	91739	64.24
Workplace	9483 HAVEN AVE	RANCHO CUCAMONGA	CA	91730	63.40
Workplace	8885 HAVEN AVE	RANCHO CUCAMONGA	CA	91730	62.69
Destination	12335 BASELINE AVE	RANCHO CUCAMONGA	CA	91739	62.53
Workplace	9337 MILLIKEN AVE	RANCHO CUCAMONGA	CA	91730	60.71
Institution	6001 MILLIKEN AVE	RANCHO CUCAMONGA	CA	91737	59.91
Workplace	9333 FAIRWAY VIEW PL	RANCHO CUCAMONGA	CA	91730	59.36
Workplace	10760 4TH ST	RANCHO CUCAMONGA	CA	91730	59.27
Institution	8629 HELLMAN AVE	RANCHO CUCAMONGA	CA	91730	47.54
Institution	9791 ARROW ROUTE	RANCHO CUCAMONGA	CA	91730	33.74
Institution	10435 ASHFORD ST	RANCHO CUCAMONGA	CA	91730	32.93
Institution	9494 HAVEN AVE	RANCHO CUCAMONGA	CA	91730	32.66

Redlands

Type	Street Address	City	State	Zip	Score
MUD	475 CYPRESS AVE	REDLANDS	CA	92373	81.84
MUD	528 HIBISCUS DR	REDLANDS	CA	92373	81.19
MUD	1400 BARTON RD	REDLANDS	CA	92373	80.19
MUD	11 TENNESSEE	REDLANDS	CA	92373	78.42
MUD	92 KANSAS ST	REDLANDS	CA	92373	77.87
MUD	631 CHURCH ST	REDLANDS	CA	92373	77.70
MUD	1125 PINE ST	REDLANDS	CA	92373	76.00
WORKPLACE	754 CITRUS ST	REDLANDS	CA	92373	75.98
WORKPLACE	300 STATE ST	REDLANDS	CA	92373	75.65
MUD	460 FERN AVE	REDLANDS	CA	92373	75.18
MUD	512 LA VERNE ST	REDLANDS	CA	92373	75.17

Type	Street Address	City	State	Zip	Score
WORKPLACE	112 11TH ST	REDLANDS	CA	92373	74.96
MUD	1076 BROOKSIDE AVE	REDLANDS	CA	92373	74.10
MUD	312 CAJON ST	REDLANDS	CA	92373	74.05
MUD	900 SALEM DR	REDLANDS	CA	92373	73.56
MUD	1905 ORANGE AVE	REDLANDS	CA	92373	73.56
MUD	416 THE TERRACE	REDLANDS	CA	92373	73.04
WORKPLACE	412 STATE ST	REDLANDS	CA	92373	72.66
MUD	30 ASH ST	REDLANDS	CA	92373	72.40
WORKPLACE	108 8TH ST	REDLANDS	CA	92373	72.00

Rialto

Type	Street Address	City	State	Zip	Score
DESTINATION	2281 CASMALIA ST	RIALTO	CA	92377	67.99
WORKPLACE	3009 LAUREL AVE	RIALTO	CA	92376	65.69
WORKPLACE	2015 STONE HURST AVE	RIALTO	CA	92376	63.29
DESTINATION	475 CEDAR AVE	RIALTO	CA	92376	56.11
DESTINATION	1355 RENAISSANCE PKWY	RIALTO	CA	92377	53.74
DESTINATION	1335 RENAISSANCE PKWY	RIALTO	CA	92377	53.47
MUD	1150 WILLOW AVE	RIALTO	CA	92376	53.12
DESTINATION	1130 RENAISSANCE PKWY	RIALTO	CA	92377	52.27
DESTINATION	1248 MERRILL AVE	RIALTO	CA	92376	51.21
DESTINATION	913 FOOTHILL BLVD	RIALTO	CA	92376	49.96
DESTINATION	3356 RIVERSIDE AVE	RIALTO	CA	92376	49.62
MUD	175 JAMES ST	RIALTO	CA	92376	48.87
DESTINATION	290 CONTRA RD	RIALTO	CA	92376	48.70
DESTINATION	1310 BASELINE AVE	RIALTO	CA	92376	48.46
DESTINATION	7359 MILLIKEN AVE	RIALTO	CA	91739	48.46
MUD	925 RIVERSIDE AVE	RIALTO	CA	92376	48.25
DESTINATION	688 BASELINE RD	RIALTO	CA	92376	48.01
DESTINATION	1276 BASELINE BLVD	RIALTO	CA	92376	47.94
DESTINATION	3180 INDUSTRIAL DR	RIALTO	CA	92376	47.93
DESTINATION	120 BASELINE AVE	RIALTO	CA	92376	47.89

San Bernardino

Type	Street Address	City	State	Zip	Score
WORKPLACE	24621 OLIVE ST	SAN BERNARDINO	CA	0	79.18
WORKPLACE	1175 THIRD ST	SAN BERNARDINO	CA	92410	78.96
WORKPLACE	755 NINTH ST	SAN BERNARDINO	CA	92410	77.76
DESTINATION	2383 STERLING AVE	SAN BERNARDINO	CA	92404	76.16
WORKPLACE	799 RIALTO AVE	SAN BERNARDINO	CA	92408	75.26
WORKPLACE	688 ARROWHEAD	SAN BERNARDINO	CA	92401	74.32
WORKPLACE	323 SEVENTH ST	SAN BERNARDINO	CA	92401	74.24
WORKPLACE	670 ARROWHEAD AVE	SAN BERNARDINO	CA	92401	73.88

Type	Street Address	City	State	Zip	Score
WORKPLACE	0 ARROWHEAD AVE	SAN BERNARDINO	CA	92401	73.69
DESTINATION	2222 HIGHLAND AVE	SAN BERNARDINO	CA	92404	73.56
WORKPLACE	150 LENA RD	SAN BERNARDINO	CA	92408	73.23
WORKPLACE	880 MILL ST	SAN BERNARDINO	CA	92408	73.13
WORKPLACE	600 ARROWHEAD AVE	SAN BERNARDINO	CA	92401	73.07
WORKPLACE	660 E ST	SAN BERNARDINO	CA	92410	72.83
WORKPLACE	645 D ST	SAN BERNARDINO	CA	92401	72.80
WORKPLACE	646 D ST	SAN BERNARDINO	CA	92401	72.71
DESTINATION	2002 HIGHLAND AVE	SAN BERNARDINO	CA	92404	72.50
MUD	6155 PALM AVE	SAN BERNARDINO	CA	92407	72.30
WORKPLACE	370 6TH ST	SAN BERNARDINO	CA	92410	72.16

Twentynine Palms

Type	Street Address	City	State	Zip	Score
DESTINATION	"PROJECT PHOENIX"	29 PALMS	CA		100.00
DESTINATION	3744 ADOBE RD	29 PALMS	CA	92277	80.33
DESTINATION	4082 ADOBE RD	29 PALMS	CA	92277	79.92
DESTINATION	3668 ADOBE RD	29 PALMS	CA	92277	79.54
DESTINATION	3713 ADOBE RD	29 PALMS	CA	92277	79.20
DESTINATION	3787 ADOBE RD	29 PALMS	CA	92277	78.73
DESTINATION	71727 29 PALMS HWY	29 PALMS	CA	0	77.74
DESTINATION	71737 29 PALMS HWY	29 PALMS	CA	92277	77.51
DESTINATION	71707 TWENTYNINE PALMS HWY	29 PALMS	CA	92277	76.48
DESTINATION	4920 ADOBE RD	29 PALMS	CA	92277	75.83
DESTINATION	3733 ADOBE RD	29 PALMS	CA	92277	75.45
DESTINATION	4225 SELBY RD	29 PALMS	CA	92277	75.30
DESTINATION	73561 RARICK WAY	29 PALMS	CA	92277	74.96
DESTINATION	4949 ADOBE RD	29 PALMS	CA	92277	74.12
DESTINATION	71478 SAMARKAND AVE	29 PALMS	CA	92277	73.94
DESTINATION	72253 29 PALMS HWY	29 PALMS	CA	92277	73.84
DESTINATION	3424 MESQUITE SPRINGS RD	29 PALMS	CA	92277	73.84
DESTINATION	71717 TWENTYNINE PALMS HWY	29 PALMS	CA	92277	73.63
DESTINATION	3950 UTAH TRL	29 PALMS	CA	92277	73.46
DESTINATION	71617 TWENTYNINE PALMS HWY	29 PALMS	CA	92277	73.42
DESTINATION	4004 ADOBE RD	29 PALMS	CA	92277	73.34

Upland

Type	Street Address	City	State	Zip	Score
MUD	0 TANGLEWOOD AVE	UPLAND	CA	91784	83.73
MUD	1351 SUNNYFIELD CIR	UPLAND	CA	91784	80.73
MUD	1587 MEDINAH CIR	UPLAND	CA	91784	78.94
MUD	1413 SAN BERNARDINO RD	UPLAND	CA	91786	75.31
MUD	1334 FOOTHILL BLVD	UPLAND	CA	91786	75.13

Type	Street Address	City	State	Zip	Score
MUD	859 MOUNTAIN AVE	UPLAND	CA	91786	75.04
MUD	569 11TH ST	UPLAND	CA	91786	74.77
MUD	260 3RD AVE	UPLAND	CA	91786	73.51
MUD	1265 9TH ST	UPLAND	CA	91786	73.03
MUD	1400 CHAFFEE ST	UPLAND	CA	91786	72.52
MUD	1335 SPRINGFIELD ST	UPLAND	CA	91786	72.08
MUD	532 WASHINGTON BLVD	UPLAND	CA	91786	71.19
MUD	510 CENTRAL AVE	UPLAND	CA	91786	70.58
MUD	1662 ARROW RTE	UPLAND	CA	91786	70.10
DESTINATION	150 FOOTHILL BLVD	UPLAND	CA	91786	69.53
MUD	2100 ARROW RTE	UPLAND	CA	91786	69.31
DESTINATION	40 FOOTHILL BLVD	UPLAND	CA	91786	69.30
MUD	708 MESA CT	UPLAND	CA	91786	69.20
MUD	880 FOURTH AVE	UPLAND	CA	91786	68.90
DESTINATION	318 FOOTHILL BLVD	UPLAND	CA	91786	68.60

Victorville

Type	Street Address	City	State	Zip	Score
INSTITUTION	25326 YATES RD	VICTORVILLE	CA	92395	100.00
INSTITUTION	15011 CIRCEL DR	VICTORVILLE	CA	92395	96.76
INSTITUTION	14554 7TH	VICTORVILLE	CA	92392	93.89
WORKPLACE	18350 GEORGE BLVD	VICTORVILLE	CA	92394	89.41
WORKPLACE	17496 TURNER RD	VICTORVILLE	CA	92394	88.18
WORKPLACE	17540 TURNER RD	VICTORVILLE	CA	92394	87.93
WORKPLACE	15609 11TH ST	VICTORVILLE	CA	92395	84.59
DESTINATION	9222 GOSS RD	VICTORVILLE	CA	92392	83.20
DESTINATION	15201 11TH ST	VICTORVILLE	CA	92392	82.70
DESTINATION	15203 11TH ST	VICTORVILLE	CA	92395	81.97
DESTINATION	15237 11TH ST	VICTORVILLE	CA	92395	81.45
WORKPLACE	14075 HESPERIA RD	VICTORVILLE	CA	92395	81.02
DESTINATION	13728 HESPERIA RD	VICTORVILLE	CA	92395	81.00
DESTINATION	17721 TURNER RD	VICTORVILLE	CA	92394	80.46
DESTINATION	12925 HESPERIA RD	VICTORVILLE	CA	92395	80.30
DESTINATION	12890 HESPERIA RD	VICTORVILLE	CA	92395	79.79
DESTINATION	14335 HESPERIA RD	VICTORVILLE	CA	92395	79.28
DESTINATION	12932 HESPERIA RD	VICTORVILLE	CA	92395	79.05
DESTINATION	15145 7TH ST	VICTORVILLE	CA	92395	78.86
DESTINATION	12199 HESPERIA RD	VICTORVILLE	CA	92395	78.79

Yucaipa

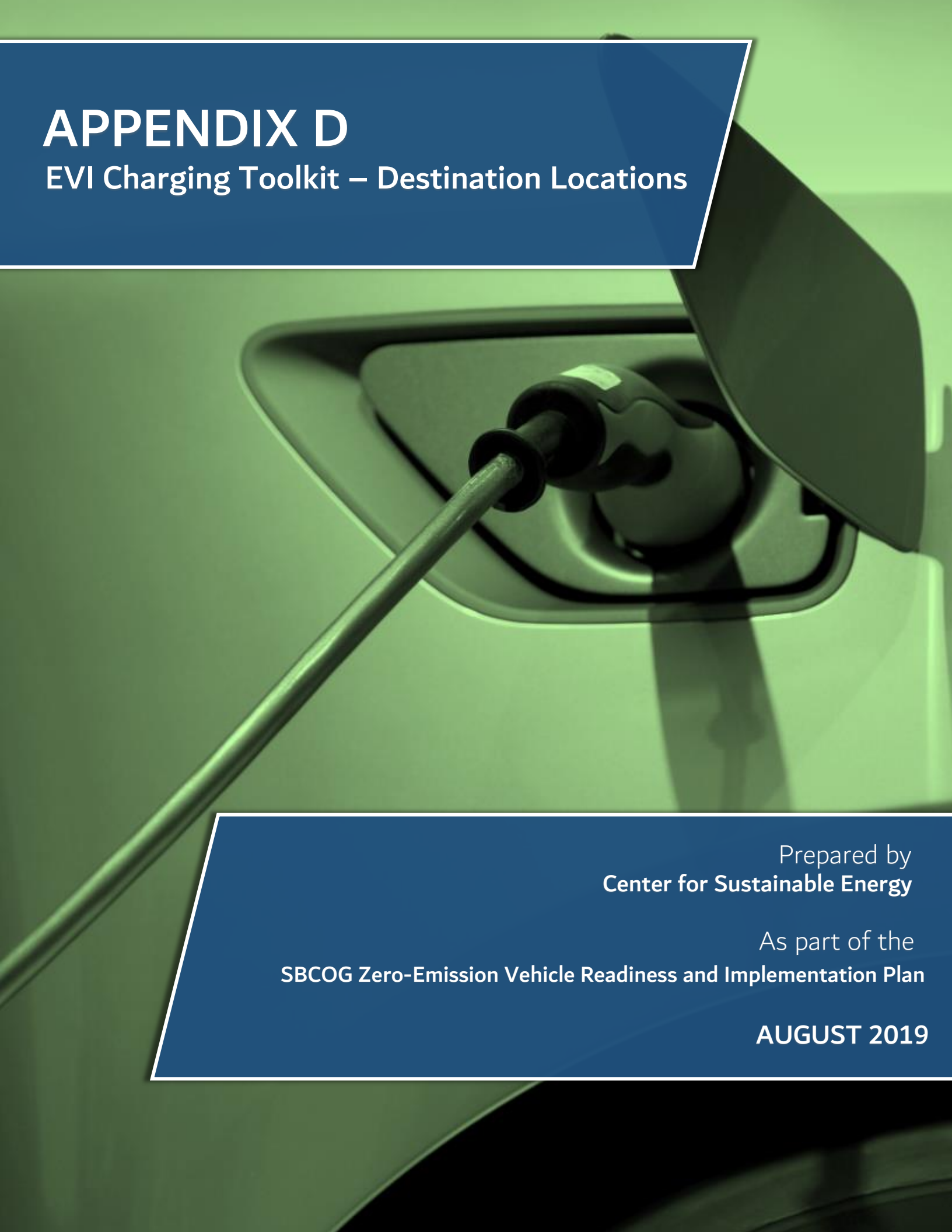
Type	Street Address	City	State	Zip	Score
MUD	32021 AVE E	YUCAIPA	CA	92399	82.09
MUD	12175 13TH ST	YUCAIPA	CA	92399	80.14

Type	Street Address	City	State	Zip	Score
MUD	31836 YUCAIPA BLVD	YUCAIPA	CA	92399	79.33
MUD	12250 17TH ST	YUCAIPA	CA	92399	79.06
DESTINATION	11352 BRYANT ST	YUCAIPA	CA	92399	74.80
MUD	10800 BRYANT ST	YUCAIPA	CA	92399	73.05
DESTINATION	11368 BRYANT ST	YUCAIPA	CA	92399	73.02
DESTINATION	33725 CHAPMAN HEIGHTS RD	YUCAIPA	CA	92399	72.48
MUD	33800 CHAPMAN HEIGHTS RD	YUCAIPA	CA	92399	72.24
DESTINATION	33644 YUCAIPA BLVD	YUCAIPA	CA	92399	71.81
DESTINATION	34454 YUCAIPA BLVD	YUCAIPA	CA	92399	71.76
DESTINATION	12013 5TH ST	YUCAIPA	CA	92399	71.73
DESTINATION	11834 BRYANT ST	YUCAIPA	CA	92399	71.29
DESTINATION	34420 YUCAIPA BLVD	YUCAIPA	CA	92399	71.08
DESTINATION	33616 YUCAIPA BLVD	YUCAIPA	CA	92399	71.08
DESTINATION	33478 YUCAIPA BLVD	YUCAIPA	CA	92399	70.93
DESTINATION	33540 YUCAIPA BLVD	YUCAIPA	CA	92399	70.93
DESTINATION	34488 YUCAIPA BLVD	YUCAIPA	CA	92399	70.76
DESTINATION	34000 YUCAIPA BLVD	YUCAIPA	CA	92399	70.11
DESTINATION	33700 YUCAIPA BLVD	YUCAIPA	CA	92399	70.01

Yucca Valley

Type	Street Address	City	State	Zip	Score
DESTINATION	58501 TWENTYNINE PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	58705 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57701 TWENTYNINE PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57796 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57744 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57084 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	56865 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57075 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	58060 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	57090 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	57271 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	7600 SAGE AVENUE	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	7050 LA CONTENTA	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	58001 ONAGA TRAIL	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	7601 HOPI TRAIL	YUCCA VALLEY	CA	92284	100.00
INSTITUTION	56357 PIMA TRAIL	YUCCA VALLEY	CA	92284	100.00
MUD	57545 YUCCA TRL	YUCCA VALLEY	CA	92284	100.00
MUD	7239 CHEROKEE TRL	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57185 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
DESTINATION	57125 TWENTYNINE PALMS HWY	YUCCA VALLEY	CA	92284	100.00
WORKPLACE	57090 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
WORKPLACE	58501 TWENTYNINE PALMS HWY	YUCCA VALLEY	CA	92284	100.00
WORKPLACE	58705 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00

Type	Street Address	City	State	Zip	Score
WORKPLACE	7600 SAGE AVENUE	YUCCA VALLEY	CA	92284	100.00
WORKPLACE	7050 LA CONTENTA	YUCCA VALLEY	CA	92284	100.00
WORKPLACE	57075 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00
WORKPLACE	58060 29 PALMS HWY	YUCCA VALLEY	CA	92284	100.00



APPENDIX D

EVI Charging Toolkit – Destination Locations

Prepared by
Center for Sustainable Energy

As part of the
SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

EVI Charging Toolkit - Destination Locations

Why Install Electric Vehicle Charging?

Electric vehicle (EV) adoption is experiencing rapid growth. In 2018, nearly 8% of new car sales in California were EVs. The number of Plug-In Electric Vehicles (PEV) in San Bernardino County is projected to reach roughly 45,000 vehicles by 2025. California policy, such as Governor Brown's 2018 Executive Order (EO) B-48-18, sets ambitious targets for EV adoption and supportive infrastructure. Destinations visited by regional residents and tourists play a crucial part of transforming the County's transportation sector to zero emission vehicles (ZEVs).

Hydrogen fuel infrastructure is not currently planned to be widely deployed in the San Bernardino County Region. Hydrogen fuel cell vehicles may be a suitable solution for a very limited number of destinations, but the high cost and limited infrastructure likely is not realistic in the near-term; as a result, this toolkit will focus on EV infrastructure.

Benefits of EV Charging

Attract Visitors	**Reduce Local Emissions**	**Longer Stays = More Spending**	**Enhance Property Value**	**Positive Environmental Image**

Site Owner EV Charging Checklist

While each installation is unique, many property owners have similar questions and challenges when planning EV charging stations (EVCS). This document summarizes common steps to help you consider options and understand how and when to engage the experts – your local utility, licensed contractors and EVCS vendors. The toolkit provides general information and helpful resources to guide you through each step of the checklist provided below.

While this checklist is presented in a linear format, the process of installing EVCS will be dynamic, with various interrelated considerations. Steps 1-4 will be preliminary explorations of issues that can be revisited with expert help once you've decided to move forward and contacted your utility and/or EVCS vendors. Actions listed are from the perspective of the project lead for your site. Your utility, vendors, and contractors will guide you through actual installation steps and more detailed considerations.

STEP 1: Estimate Demand

- ☐ **1.** Check availability of existing EVCS nearby using PlugShare.
- ☐ **2.** Contact customers/visitors to gauge interest; survey to quantify charging needs.
- ☐ **3.** Estimate average visitor dwell time - how many visits are suitable for EV charging?

STEP 2: Consider EVCS Options

- ☐ **4.** Consider appropriate charging equipment types based on estimated demand, visitor dwell time (Level I typically suit low mileage & long dwell, Level II mid/long mileage & mid/long dwell, and DCFC for short dwell)
- ☐ **5.** Examine physical siting constraints (e.g., access to electrical infrastructure, American Disabilities Act (ADA), visibility etc.).
- ☐ **6.** Weigh EVCS ownership models - tenant, property owner, or third-party vendor?
- ☐ **7.** Determine if you want to measure EVCS use and charge users (paid vs. free model).
- ☐ **8.** Consider increasing installation size to account for growing demand, reducing future capital costs.

STEP 3: Estimate Capital Costs

- ☐ **9.** Determine the number and type of EVCS you want to install onsite.
- ☐ **10.** Measure distance to EVCS location from power point of connection to estimate Make-Ready costs (e.g., trenching and conduit installation).
- ☐ **11.** Determine if your electrical service/panel requires an upgrade (engage utility or technology provider).
- ☐ **12.** Have technology provider estimate operations & maintenance costs (e.g., electricity use, demand charges, networking fees).

STEP 4: Evaluate Cost Recovery Options

- ☐ **13.** Research available incentive and funding programs (e.g., SCE's Charge Ready Program) You can find additional resources and websites on the last page of this toolkit.
- ☐ **14.** Consider contracting with EVCS network provider to recover ongoing charging costs.
- ☐ **15.** Look into vendors offering free charging for advertising space.

STEP 5: Contact Utility to Conduct Site Evaluation

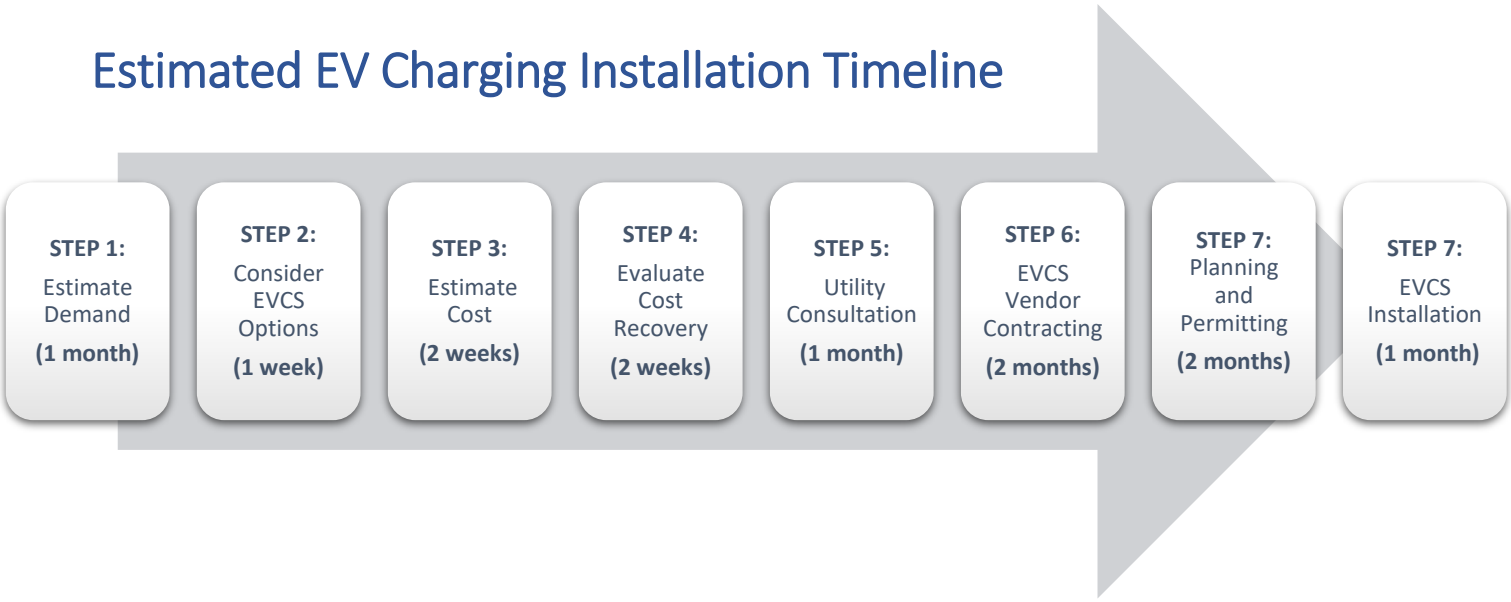
STEP 6: Contract with Vendors - Choose from offered equipment and service contracts

STEP 7: Hire Installers - Work with utility, vendors to plan, permit, and install EV charging

STEP 8: Implement Management Policies

- ☐ **16.** Ensure compliance with ADA regulations, consider general parking and traffic flow issues
- ☐ **17.** Contact insurer regarding potential liability issues
- ☐ **18.** Consider installing signage guiding visitors to EV charging
- ☐ **19.** Communicate with site tenants/stakeholders regarding installation and use of EVCS
- ☐ **20.** Set schedule to review EVCS usage and contracts with third parties to consider adjustments

Estimated EV Charging Installation Timeline



EV Charging Resources

STEP 1. Estimate Demand

What is your current EV charging need, and how will it grow into the future? Weighing the need for EVCS at your commercial destination will require reaching out to stakeholders at your site and researching existing EV charging locations nearby. A simple first step is to contact each tenant or property stakeholder at the site to inquire about EV charging interest or their employees or visitors. A key question will be evaluating the typical vehicle dwell times at your site to consider the appropriate charging speed.

Tool 1: EV Charging Demand Sample Survey

The U.S. Department of Energy (U.S. DOE) has prepared a sample survey for workplaces to gather information on employee EVCS demand. This can be adapted to evaluate visitor or customer travel to your site: https://afdc.energy.gov/files/u/publication/WPCC_sample_employee_survey_0816.pdf

Tool 2: EV Charging Location Maps

Use these maps to see where nearby chargers are located, how many chargers are available, and their rates and access rules. Keep in mind that demand will continue to grow. PlugShare: https://www.plugshare.com/. U.S. DOE: https://afdc.energy.gov/stations/#/find/nearest.

STEP 2. Consider EVCS Options

What charging speeds, controls and billing capabilities do you require? You will want to consider the demand and dwell times of visitors to your location to select appropriate charging equipment. The table below provides a summary of EVCS types. Levels 1-3 offer increasing charging speed but with added cost and complexity. Level 2 and Level 3 (DCFC) are typically the most appropriate for standard retail or other commercial locations.

Tool 3: EV Charging Information

The U.S. Department of Energy maintains a clearinghouse of information and resources for alternative fuels, including EV charging: https://afdc.energy.gov/fuels/electricity.html

	Level 1	Level 2	Level 3 (DCFC)
Charging Speed	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
Typical Locations	Single-family homes Townhomes Multi-family dwellings Office buildings	One and two-family homes Townhomes Multi-family dwellings Office buildings	Public access Retail shops Highway corridors Hospitality & recreation facilities
Equipment Description	Standard 120 Volt Alternating Current (VAC) outlet and cord set charger that typically comes with EV Metering and billing not available	240 VAC outlet and wall-mounted or bollard style charging port Networked units available, allowing for advanced controls, billing options	Commercial-grade 208, 440 or 480 VAC converted into direct current (DC) through large standing unit Often requires upgrades to a site's electrical service Not all EVs can utilize

An important consideration is the number of EVCS that you will install at your location. For retail shops, you want to provide enough EVCS that potential customers are frequently able to charge while shopping, but not so many that the EVCS are underutilized. For stand-alone stores and smaller strip malls, this can mean 2 – 4 Level 2 EVCS, and for

shopping malls anywhere between 6 – 20 Level 2 EVCS. For state & national parks, visitors will tend to have a larger dwell time (exceeding 2-4 hours) so Level 2 EVCS are typically a good solution with limited DC Fast Charging stations located onsite for short-dwell visitors or long-mileage visitors. Due to the rapid adoption of EVs, and the fact that EVCS have an expected useful life of at least 10 years, you may want to consider increasing the size of your planned installation to meet future demand.

Another consideration when installing EV charging at a destinations is who will own the EVSE and how the purchase and installation costs will be covered. This is often dictated by which party initiates the installation of EV charging.

STEP 3: Estimate Cost

The cost of installing EV charging varies considerably based on specific site requirements. Aside from the actual cost of the EV charging equipment typical installation costs include trenching for electrical conduit and upgrades to the site's electrical service.

Tool 4: EV Charging Cost Report

The U.S. Department of Energy has prepared a report on average equipment and installation costs for non-residential EV charging projects:
https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

The table below provides a simplified estimation tool based primarily on costs provided in the Department of Energy report. It includes average potential costs that may or may not apply to every project. Early consultations with your utility and EVCS providers will help refine these estimates.

EVCS Installation Cost Estimator

Cost Driver	Average Costs	Example
Installation Costs		**2x Dual Port (4 Ports)**
Equipment – Level 2 (Non- Networked)	$500 - $2,000 x Ports	=
Equipment – Level 2 (Networked)	$1,500-$6,000 x Ports	= *$3,000 x 4 Ports*
Equipment – DC Fast Charging Equipment	10,000-$40,000 x Units	=
Installation – Level 2 Equipment	$3,000 - $6,000 x Ports	= *$3,800 x 4 Ports*
Installation – DC Fast Charging Equipment	$8,500 - $51,000 x Units	=
Trenching for Electrical Conduit	$100 x Feet	= *$100 x 45 feet*
Transformer Upgrade	$10,000-$25,000	=
	Total Estimated Cost:	= *$31,700*

Additionally, site hosts must consider the ongoing costs of EV charging. These consist primarily of the cost of electricity and any other impacts to utility bills, such as increased service or demand charges, but may also include monthly or annual payments to network service providers.

STEP 4. Evaluate Cost Recovery

Installing EV charging will often require a considerable up-front capital expenditure. While a retail shop may recover these costs through increased sales, and a property manager may recover them through increased rent and lower tenant turnover, this section describes additional ways to either decrease or recover the up-front investment.

Site hosts may wish to recover the costs of installation and ongoing use from tenants and visitors based on individual usage, incorporate these costs into rent or lease terms, or elect to absorb the cost themselves and provide EV charging as a free amenity. No matter what cost recovery strategy you choose, there are additional resources that can provide funding for eligible EV charging installation projects, as listed below.

Tool 5: CALeVIP Incentive

The California Electric Vehicle Infrastructure Project (CALeVIP) is a California Energy Commission-funded project that provides incentives for Level 2 and DC fast charging in select locations throughout the state: https://calevip.org/

Tool 6: DriveClean Incentive Search Tool

The California Air Resources Board's DriveClean.ca.gov website provides a search tool to help you find incentives for EVs and charging infrastructure: https://www.driveclean.ca.gov/Calculate_Savings/Incentives.php

Tool 7: Add Solar photovoltaics to EV infrastructure

The National Renewable Energy Laboratory created a summary of considerations for adding distributed solar photovoltaic (PV) with EV charging: https://www.nrel.gov/docs/fy14osti/62366.pdf. Solar Sage provides an easy online calculator for estimating solar panel costs based on electricity demand.

STEP 5. Contact Utility

Once you taken time to consider the items listed in Steps 1-4 of the checklist, you'll be well prepared to begin speaking with your utility, EV service providers and electrical contractors who will be able to recommend solutions suited to the needs and constraints of your location. These experts can also help refine cost estimates and potential recovery strategies. The utility specifically can help walk you through any necessary electrical service upgrades, potential electricity bill impacts, and other technical aspects of the project.

Tool 8: Utility EVCS Resources

Explore your local utility's EVCS-related programs and resources. Contact your account representative for additional support.

STEPS 6 & 7: Contract with Vendors & Hire Installers

EVCS equipment and network providers offer a variety of products, services, and unit ownership arrangements. Speaking with several vendors and reviewing case studies and past projects is an important step before finalizing a contract with your chosen provider.

Tool 9: CALeVIP Connects

CALeVIP Connects is provided as part of the CALeVIP incentive program. It is a free online directory that allows you to connect directly with EV service providers and request information for potential EV charging projects. https://calevip.org/find-an-evsp

STEP 8: Implement Management Policies

Once your EVCS is operational, you will want to take steps to ensure it is well utilized and enhances your site. Communication with property stakeholders, staff and visitors will be key to success. Distributing a written use and management policy to tenants and installing signage to direct potential users to charging units are two important steps. You may also want to set a schedule to review utilization and ongoing costs to decide whether your current EVCS and services are still serving your needs.

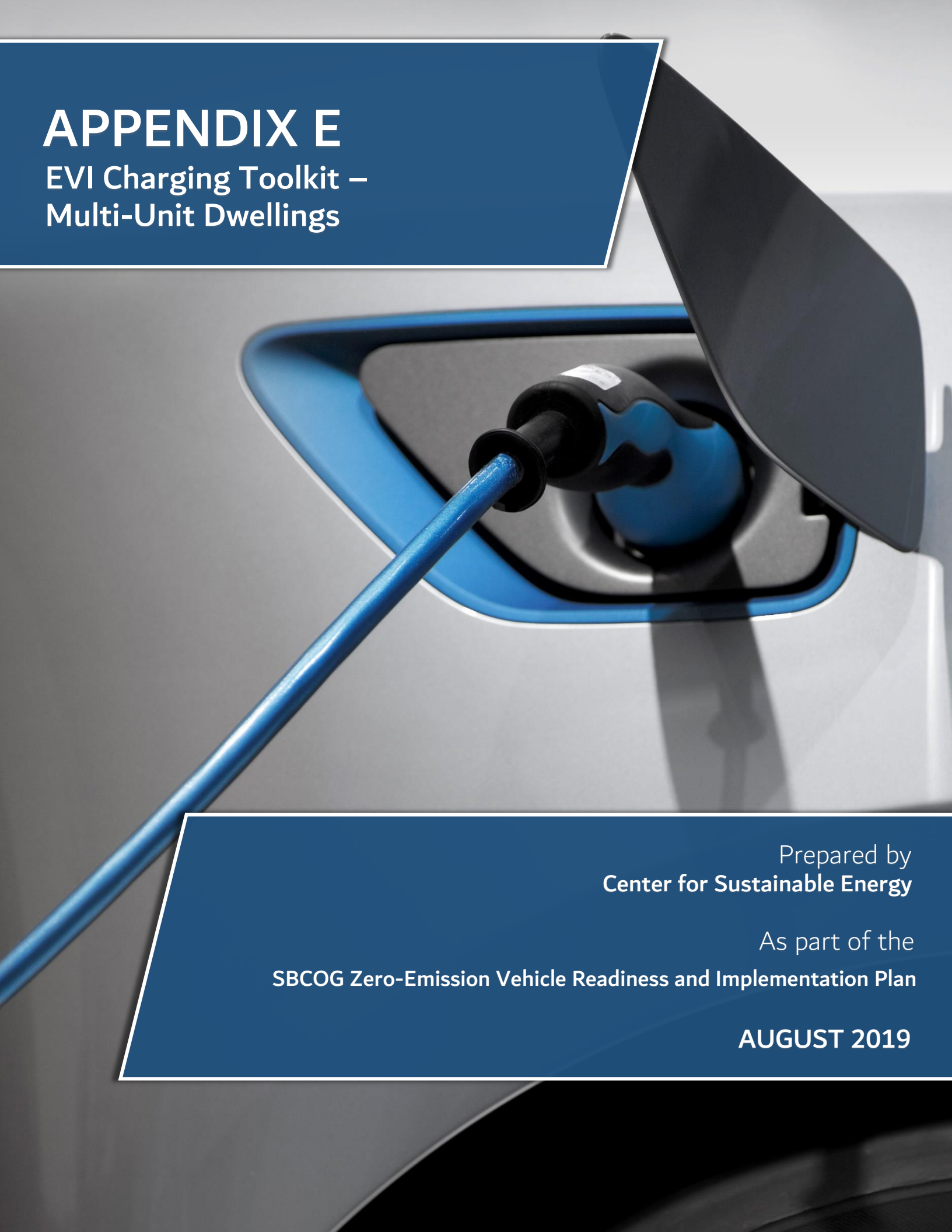
Tool 10: Veloz Accessibility and Signage Guide

Veloz provides a number of EVCS-related resources on its website, including a report with recommendations on parking management, accessibility and signage. https://www.veloz.org/resource/accessibility-signage-for-pev-charging-infrastructure/

Additional Resources

Alternative Fuels Data Center (AFDC) – The U.S. Department of Energy's AFDC is an information clearinghouse with useful resources like case studies, an EV charging locator and a list of relevant laws and incentives. https://afdc.energy.gov/fuels/electricity.html

Veloz/PEV Collaborative – Veloz provides many useful resources including case studies, templates and fact sheets on their website. https://www.veloz.org/veloz-resources/



APPENDIX E

EVI Charging Toolkit – Multi-Unit Dwellings

Prepared by
Center for Sustainable Energy

As part of the
SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

EVI Charging Toolkit – Multi-Unit Dwellings

Why Install Electric Vehicle Charging?

Providing electric vehicle (EV) charging can be an excellent differentiator to attract and retain multi-unit dwelling (MUD) residents with a desirable amenity and increase the value of your property. EV charging stations (EVCS) also contribute to sustainability goals and count toward Leadership in Energy and Environmental Design (LEED) certification.

Installing EV charging at multi-unit dwellings (MUDs) has numerous benefits. While public and workplace charging play a significant role, most EV owners will want an option for charging their vehicles at home. In addition to growing resident demand, recent policy and code developments encourage increased installation of EV charging at MUDs. Current state law prevents MUD property owners from unreasonably restricting tenants from installing EV charging at their dedicated parking spaces. California Green Building Code (CALGreen) (Title 24, Part 11) is changing to require additional EVCS readiness in new construction. Future-proofing your property by installing EV charging ensures you will be able to compete with newer properties and accommodate accelerating EV ownership rates.

Benefits of EV Charging

Attract New Tenants

Enhance Property Value

Improve Environmental Image

Site Owner EV Charging Checklist

While each installation is unique, many properties have similar questions and challenges when planning EVCS. This document summarizes common steps to help you consider options and understand how and when to engage the experts – your local utility, licensed contractors and EVCS vendors. The toolkit provides general information and helpful resources to guide you through each step of the checklist provided below.

While this checklist is presented in a linear format, the process of installing EVCS will be dynamic, with various interrelated considerations. Steps 1-4 will be preliminary explorations of issues that can be revisited with expert help once you've decided to move forward and contacted your utility and/or EVCS vendors. Actions listed are from the perspective of the project lead for your site. Your utility, vendors, and contractors will guide you through actual installation steps and more detailed considerations.

STEP 1: Estimate Demand

- ☐ **1.** Survey Residents to determine who owns an EV, who plans to purchase an EV, typical daily driving distance, workplace charging availability, and similar data to inform decision-making.
- ☐ **2.** Find a MUD with similar parking spaces and tenants that have already installed EVI for comparison and reference for investment.
- ☐ **3.** Estimate volume of EVs visiting MUD (non-residents) to determine if charging in needed in common spaces or visitor parking areas.

STEP 2: Consider EVCS Options

- ☐ **4.** Consider appropriate charging equipment types based on estimated demand. Explore Level 1 solutions for tenants that do not have long daily travel needs and will charge overnight. Explore Level 2 solutions for tenants with long daily commutes. Direct Current Fast Charging (DCFC) is not recommended for most MUDs.
- ☐ **5.** Examine physical siting constraints (e.g., access to electrical infrastructure, Americans with Disability Act (ADA), visibility etc.).
- ☐ **6.** Weigh EVCS ownership models - tenant, property owner, or third-party vendor?
- ☐ **7.** Determine if you want to measure EVCS use and charge users (networked vs. non-networked…paid vs. free models).
- ☐ **8.** Consider increasing installation size to account for growing demand, reducing future capital costs.
- ☐ **9.** Decide if electricity will be supplied from residents' individual meters or from a common load meter. If common load, determine how users will be billed.
- ☐ **10.** Determine ownership (e.g., residents, property owner, or Home Owners Associations (HOA)).

STEP 3: Estimate Capital Costs

- ☐ **11.** Determine the number and type of EVCS you want to install onsite.
- ☐ **12.** Measure distance to EVCS location from power point of connection to estimate Make-Ready costs (e.g., trenching and conduit installation).

☐ **13.** Determine if your electrical service/panel requires an upgrade (engage utility or technology provider).

☐ **14.** Have technology provider estimate operations & maintenance costs (e.g., electricity use, demand charges, networking fees).

STEP 4: Evaluate Cost Recovery Options

☐ **15.** Research available incentive and funding programs (e.g. Southern California Edison (SCE) Charge Ready Program, California Electric Vehicle Infrastructure Program (CALeVIP), etc.).

☐ **16.** Consider contracting with EVCS network provider to recover ongoing charging costs.

☐ **17.** Look into vendors offering free charging for advertising space.

STEP 5: Contact Utility to Conduct Site Evaluation

STEP 6: Contract with Vendors - Choose from offered equipment and service contracts

STEP 7: Hire Installers - Work with utility, vendors to plan, permit, and install EV charging

STEP 8: Implement Management Policies

☐ **18.** Ensure compliance with ADA regulations, consider general parking and traffic flow issues

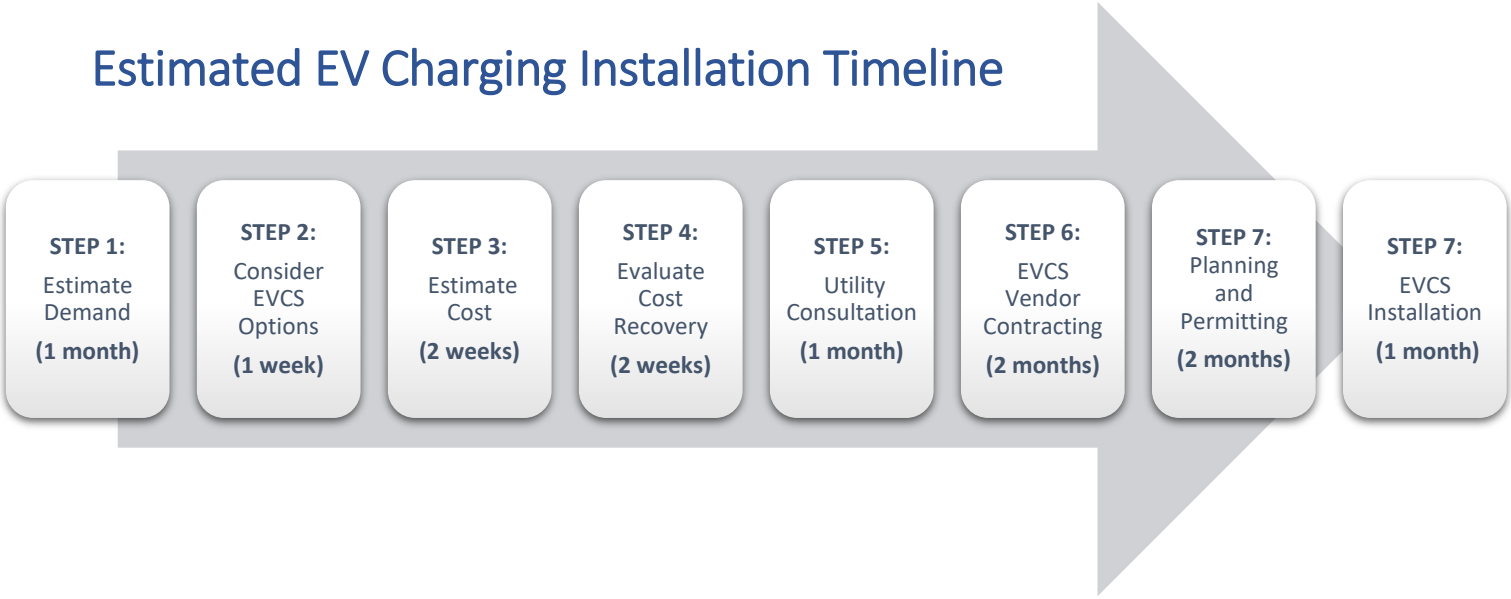
☐ **19.** Contact insurer regarding potential liability issues

☐ **20.** Consider installing signage guiding visitors to EV charging

☐ **21.** Communicate with site tenants/stakeholders regarding installation and use of EVCS

☐ **22.** Set schedule to review EVCS usage and contracts with third parties to consider adjustments

Estimated EV Charging Installation Timeline



EV Charging Resources

STEP 1. Estimate Demand

What is your current EV charging need, and how will it grow into the future? Weighing the need for EVCS at your commercial destination will require reaching out to stakeholders at your site and researching existing EV charging locations nearby. A simple first step is to contact each tenant or property stakeholder at the site to inquire about EV charging interest or their employees or visitors. A key question will be evaluating the typical vehicle dwell times at your site to consider the appropriate charging speed.

Tool 1: Resident Sample Survey

The California Plug-In Electric Vehicle Collaborative and Veloz prepared a sample survey for residential buildings to gather information about potential demand. It gives a good idea of what types of questions to consider: https://www.veloz.org/resource/empower-resident-survey/

Tool 2: EV Charging Location Maps

Use these maps to see where nearby chargers are located, how many chargers are available, and their rates and access rules. Keep in mind that demand will continue to grow. PlugShare: https://www.plugshare.com/.

U.S. Department of Energy (U.S. DOE): https://afdc.energy.gov/stations/#/find/nearest.

STEP 2. Consider EVCS Options

What charging speeds, controls and billing capabilities do you require? You will want to consider the demand and dwell times of visitors to your location to select appropriate charging equipment. The table below provides a summary of EVCS types. Levels 1-3 offer increasing charging speed but with added cost and complexity.

Tool 3: EV Charging Information

The U.S. DOE maintains a clearinghouse of information and resources for alternative fuels, including EV charging: https://afdc.energy.gov/fuels/electricity.html

	Level 1	Level 2	Level 3 (DCFC)
Charging Speed	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
Typical Locations	Single-family homes Townhomes Multi-family dwellings Office buildings	One and two-family homes Townhomes Multi-family dwellings Office buildings	Public access Retail shops Highway corridors Hospitality & recreation facilities
Equipment Description	Standard 120 Volt Alternating Current (VAC) outlet and cord set charger that typically comes with EV Metering and billing not available	240 VAC outlet and wall-mounted or bollard style charging port Networked units available, allowing for advanced controls, billing options	Commercial-grade 208, 440 or 480 VAC converted into direct current (DC) through large standing unit Often requires upgrades to a site's electrical service Not all EVs can utilize

An important consideration is the number of EVCS that you will install at your location. California green building codes for new construction currently require that 6% of parking spaces be EV-ready, meaning with electrical capacity and raceway to support future charging. Charging stations placed in 3-6% of spaces is appropriate for an initial installation,

with future expansion based on demand. When trenching to install conduit for chargers, it is cost-effective to install additional conduit to support future charging.

The most common MUD charging scenario is where electricity is supplied to EVCS from a common load electrical panel or subpanel, located near the parking area. The property manager or HOA will have electrical conduit installed from the panel either to a point near the parking area or to each individual parking space. Residents that wish to install an EV charger will then pay for any additional electrical conduit run to their parking space, purchase the EV charger unit, and pay for installation costs.

Another option for MUD EV charging from a common load meter is to install chargers next to common or visitor parking spaces. EV drivers can park in common spaces to charge, and then move their vehicle to their assigned parking space once their charging session has finished.

Tenants that rent are less likely to purchase an EV charger or pay for the installation of electrical conduit to their parking space. In this case, the property manager may elect to absorb the entire cost of installation and amortize it in the form of higher rent.

STEP 3: Estimate Cost

The cost of installing EV charging varies considerably based on specific site requirements. Aside from the actual cost of the EV charging equipment, often referred to as electric vehicle supply equipment (EVSE), typical installation costs include trenching for electrical conduit and upgrades to the site's electrical service.

Tool 4: EV Charging Cost Report

The U.S. DOE has prepared a report on average equipment and installation costs for non-residential EV charging projects: https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

The table below provides a simplified estimation tool based primarily on costs provided in the DOE report. It includes average potential costs that may or may not apply to every project. Early consultations with your utility and EVCS providers will help refine these estimates.

EVCS Installation Cost Estimator

Cost Driver	Average Costs	Example
Installation Costs		**2x Dual Port (4 Ports)**
Equipment – Level 2 (Non- Networked)	$500 - $2,000 x Ports	=
Equipment – Level 2 (Networked)	$1,500-$6,000 x Ports	= *$3,000 x 4 Ports*
Equipment – DC Fast Charging Equipment	10,000-$40,000 x Units	=
Installation – Level 2 Equipment	$3,000 - $6,000 x Ports	= *$3,800 x 4 Ports*
Installation – DC Fast Charging Equipment	$8,500 - $51,000 x Units	=
Trenching for Electrical Conduit	$100 x Feet	= *$100 x 45 feet*
Transformer Upgrade	$10,000-$25,000	=
	Total Estimated Cost:	= *$31,700*

Additionally, site hosts must consider the ongoing costs of EV charging. The primary ongoing cost for EV charging stations is the cost of electricity used to charge EVs, and demand charges. In the case of MUD charging, the property manager will typically select a networked charging solution by which electricity usage is tracked and EV owners pay for

the cost of electricity associated with their individual charging. In this case, the property manager may need to cover ongoing network operation and data fees.

STEP 4. Evaluate Cost Recovery

Installing EV charging will often require a considerable up-front capital expenditure. A MUD site owner/operator may recover cost through increased rent and lower tenant turnover, or by billing residents directly; this section describes additional ways to either decrease or recover the up-front investment.

Site hosts may wish to recover the costs of installation and ongoing use from tenants and visitors based on individual usage, incorporate these costs into rent or lease terms, or elect to absorb the cost themselves and provide EV charging as a free amenity. No matter what cost recovery strategy you choose, there are additional resources that can provide funding for eligible EV charging installation projects, as listed below.

Tool 5: CALeVIP Incentive

The California Electric Vehicle Infrastructure Project (CALeVIP) is a California Energy Commission-funded project that provides incentives for Level 2 and DC fast charging in select locations throughout the state: https://calevip.org/

Tool 6: DriveClean Incentive Search Tool

The California Air Resources Board's DriveClean.ca.gov website provides a search tool to help you find incentives for EVs and charging infrastructure: https://www.driveclean.ca.gov/Calculate_Savings/Incentives.php

Tool 7: Add Solar photovoltaics to EV infrastructure

The National Renewable Energy Laboratory created a summary of considerations for adding distributed solar PV with EV charging: https://www.nrel.gov/docs/fy14osti/62366.pdf. Solar Sage provides an easy online calculator for estimating solar panel costs based on electricity demand.

STEP 5. Contact Utility

Once you taken time to consider the items listed in Steps 1-4 of the checklist, you'll be well prepared to begin speaking with your utility, EV service providers and electrical contractors who will be able to recommend solutions suited to the needs and constraints of your location. These experts can also help refine cost estimates and potential recovery strategies. The utility specifically can help walk you through any necessary electrical service upgrades, potential electricity bill impacts, and other technical aspects of the project.

Tool 8: Southern California Edison EVCS Resources

Explore SCE's EVCS-related programs and resources, such as the Charge Ready program. Contact your account representative for additional support. https://www.sce.com/business/electric-cars

STEPS 6 & 7: Contract with Vendors & Hire Installers

EVCS equipment and network providers offer a variety of products, services, and unit ownership arrangements. Speaking with several vendors and reviewing case studies and past projects is an important step before finalizing a contract with your chosen provider.

Tool 9: CALeVIP Connects

CALeVIP Connects is provided as part of the CALeVIP incentive program. It is a free online directory that allows you to connect directly with EV service providers and request information for potential EV charging projects. https://calevip.org/find-an-evsp

STEP 8: Implement Management Policies

Once your EVCS is operational, you will want to take steps to ensure it is well utilized and enhances your site. Communication with property stakeholders, staff and visitors will be key to success. Distributing a written use and management policy to tenants and installing signage to direct potential users to charging units are two important steps. You may also want to set a schedule to review utilization and ongoing costs to decide whether your current EVCS and services are still serving your needs.

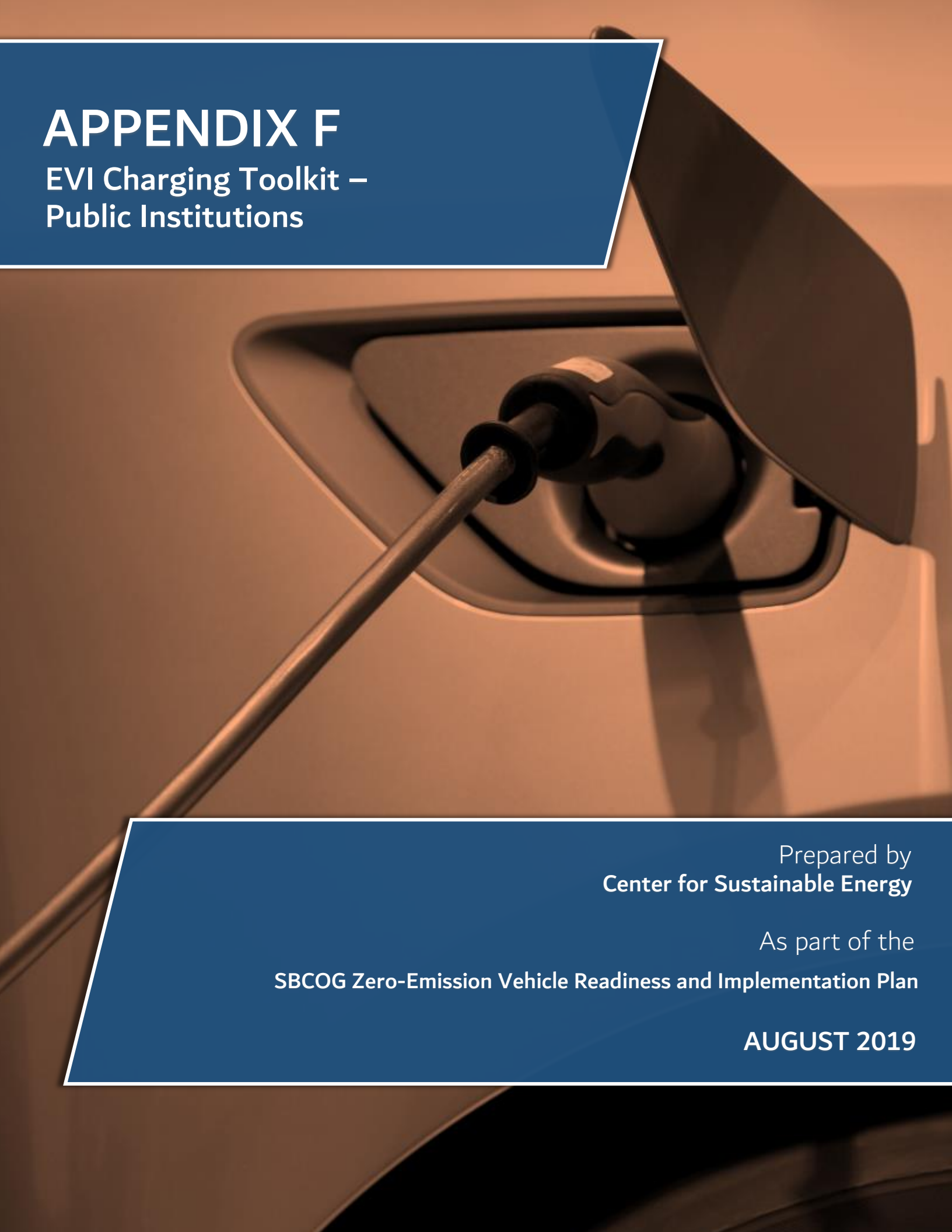
Tool 10: Veloz Accessibility and Signage Guide

Veloz provides a number of EVCS-related resources on its website, including a report with recommendations on parking management, accessibility and signage.
https://www.veloz.org/resource/accessibility-signage-for-pev-charging-infrastructure/

Additional Resources

Alternative Fuels Data Center (AFDC) – The U.S. DOE's AFDC is an information clearinghouse with useful resources like case studies, an EV charging locator and a list of relevant laws and incentives. https://afdc.energy.gov/fuels/electricity.html

Veloz/PEV Collaborative – Veloz provides many useful resources including case studies, templates and fact sheets on their website. https://www.veloz.org/veloz-resources/



APPENDIX F

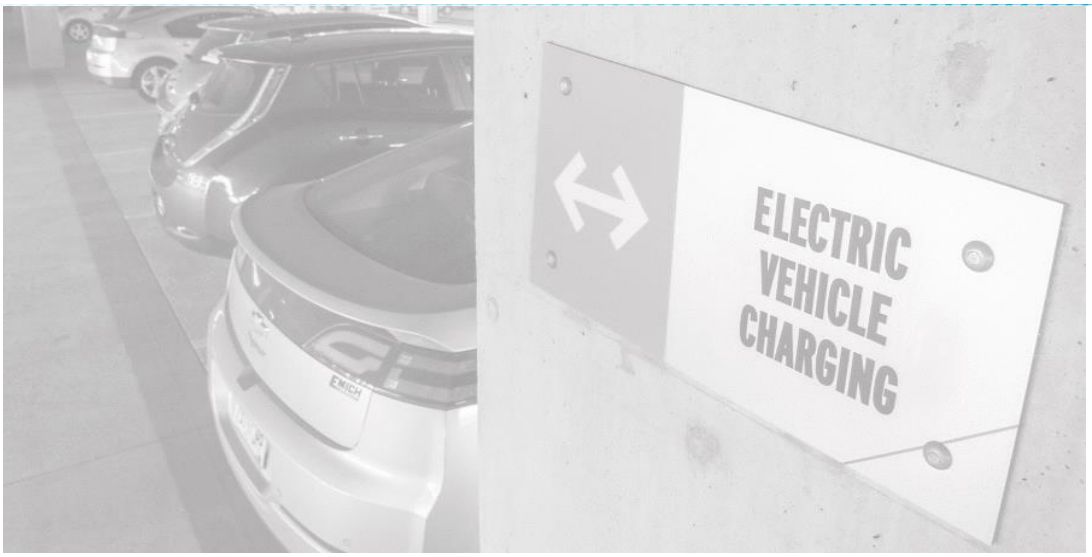
EVI Charging Toolkit – Public Institutions

Prepared by
Center for Sustainable Energy

As part of the
SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

EVI Charging Toolkit – Public Institutions



Why Install Electric Vehicle Charging?

Electric vehicle (EV) adoption is experiencing rapid growth. In 2018, nearly 8% of new car sales in California were EVs. The number of Plug-In Electric Vehicles (PEV) in San Bernardino County is projected to reach roughly 45,000 vehicles by 2025. California policy, such as Governor Brown's 2018 Executive Order (EO) B-48-18, set ambitious targets for EV adoption and supportive infrastructure. Local governments play a crucial part of transforming California's transportation sector to zero emission vehicles.

Hydrogen fuel infrastructure is not currently planned to be widely deployed in the San Bernardino County Region. Hydrogen fuel cell vehicles may be a suitable solution for a very limited number of public agencies, but the high cost and limited infrastructure likely is not realistic in the near-term; as a result, this toolkit will focus on EV infrastructure.

Installing EV charging at public institutions is a visible display of commitment to local clean air and sustainability efforts and providing services to the community. Whether located at a public location like a park or library or at an administrative center, EV charging stations (charging stations) provide many benefits to the public and to local governments. EV charging is an increasingly valuable service for visitors as well as employees. Adding EVs to your fleet can significantly lower operating costs through reduced fuel and maintenance needs. Charging station installations can be paired with other sustainability upgrades, such as solar arrays, to offset the increased electricity use.

In short, charging stations are a good fit for many types of public institutions. While different use cases will involve diverse considerations, many resources and case studies are available.

Potential Locations for EV Charging

Fleet Yards	Administrative Centers	Public Parks	Public Libraries	Agency Offices	Community Centers

Public Site EV Charging Checklist

While each installation is unique, many locations have similar questions and challenges when planning for charging stations. This document summarizes common steps to help you consider options and understand how and when to engage the experts – your local utility, licensed contractors and charging stations vendors. This toolkit provides general information and resources for each step of the following checklist.

This checklist is presented in a linear format, but the process of installing charging stations will be dynamic, with various interrelated considerations. Steps 1-4 will be preliminary explorations of issues that can be revisited with expert help once you've decided to move forward and contacted your utility and/or charging stations vendors. Actions listed are from the perspective of the project lead for your site. Your utility, vendors, and contractors will guide you through actual installation steps and more detailed considerations.

STEP 1: Estimate Demand

- ☐ **1.** Check availability of existing charging stations nearby using PlugShare or other maps.
- ☐ **2.** Contact site employees/visitors to gauge interest; survey to quantify charging needs.
- ☐ **3.** Estimate average employee/visitor dwell time – what speed of EV charging is appropriate?

STEP 2: Consider Charging Station Options

- ☐ **4.** Consider appropriate charging equipment types based on estimated demand, visitor dwell time (Level 1 typically suit low mileage & long dwell, Level 2 mid/long mileage & mid/long dwell, and Direct Current Fast Charging (DCFC) for short dwell).
- ☐ **5.** Examine physical siting constraints (e.g., access to electrical infrastructure, Americans with Disabilities Act (ADA), visibility etc.).
- ☐ **6.** Weigh charging stations ownership models – public agency or third-party vendor.
- ☐ **7.** Determine if you want to measure charging station use and require payment from users. This will lead to other considerations (e.g., software reqs., networked vs. non-networked capability, in-house vs. third-party payment options, and using pricing to drive parking space turnover).
- ☐ **8.** Consider increasing the installation of make-ready spaces to account for growing demand, reducing future capital costs related to site development (e.g. trenching, wiring).

STEP 3: Estimate Capital Costs

- ☐ **9.** Determine the number and type of charging stations you want to install onsite.
- ☐ **10.** Measure distance to charging stations location from power point of connection to estimate make-ready costs, which cover laying the infrastructure needed for the immediate installation of a

charging station in the future (e.g., trenching and conduit installation).

- ☐ **11.** Determine if your electrical service/panel requires an upgrade (engage utility or technology provider).
- ☐ **12.** Have technology provider estimate operations & maintenance costs (e.g., electricity use, demand charges, networking fees).

STEP 4: Evaluate Cost Recovery Options

- ☐ **13.** Research available incentive and funding programs. Examples include the Carl Moyer Memorial Air Quality Standards Attainment Program, as well as State Programs such as Alternative and Renewable Fuels and Vehicle Technology Program (ARFVTP) and Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP). Some programs (e.g. HVIP) require approval prior to equipment purchase to guarantee coverage.
- ☐ **14.** Consider contracting with charging stations network provider to recover ongoing charging costs.

STEP 5: Contact Utility to Conduct Site Evaluation

STEP 6: Contract with Vendors - Choose from offered equipment and service contracts

STEP 7: Hire Installers - Work with utility, vendors to plan, permit, and install EV charging

STEP 8: Implement Management Policies

- ☐ **15.** Ensure compliance with ADA regulations, consider general parking and traffic flow issues.
- ☐ **16.** Contact insurer regarding potential liability issues.
- ☐ **17.** Consider installing signage guiding visitors to EV charging.
- ☐ **18.** Communicate with site staff/stakeholders regarding installation and use of charging stations.
- ☐ **19.** Set schedule to review charging stations usage and contracts with third parties to consider adjustments.

Estimated EV Charging Installation Timeline

EV Charging Resources

STEP 1. Estimate Demand

What is your current EV charging need, and how will it grow into the future? Weighing the need for charging stations at your public location will require reaching out to stakeholders at your site and researching existing EV charging locations nearby. A simple first step is to contact each stakeholder at the site to inquire about EV charging interest for their staff and visitors. A key question will be evaluating the typical vehicle dwell times at your site to consider the appropriate charging speed.

Tool 1: EV Charging Demand Sample Survey

The U.S. Department of Energy (U.S. DOE) has prepared a sample survey for workplaces to gather information on employee charging stations demand. This may not be appropriate for evaluating public demand but will give a good idea what types of questions to consider: https://afdc.energy.gov/files/u/publication/WPCC_sample_employee_survey_0816.pdf

Tool 2: EV Charging Location Maps

Use these maps to see where nearby chargers are located, how many chargers are available, and their rates and access rules. Keep in mind that demand will continue to grow. PlugShare: https://www.plugshare.com/. U.S. DOE: https://afdc.energy.gov/stations/#/find/nearest.

Considerations for Charging Fleet Vehicles

For public agencies operating a vehicle fleet, part of estimating demand will involve deciding whether to acquire EVs as fleet vehicles. Determining what type and model of EV may be appropriate for your needs can be a daunting process, but many resources are available to help. Many public agencies find the sustainability benefits and reduced fuel and maintenance costs are worth the higher purchase price of EVs, especially factoring in the available incentives and rebates. When thinking about setting up charging stations for fleet purposes, you'll want to evaluate battery-electric vehicles (operate on electricity only) versus plug-in hybrid vehicles (gasoline and electricity), based on driving radius and charging needs. Fleet vehicles may not need to have usage tracked and can stay parked overnight; non-networked Level 2 or even simple Level 1 solutions can be an appropriate, low-cost strategy. You'll need to decide if your site layout and operational needs call for separate fleet-only charging stations or whether they can share use with the public or employee vehicles. Consider upsizing your installation to prepare for future EV purchases. As prices and technology continue to improve, more fleet applications will be appropriate for EVs.

Tool 3: Ready Set Charge Fleets Report

The Bay Area Climate Collaborative has prepared a detailed guide for implementing EVs as fleet vehicles, including charging stations considerations. http://baclimate.org/wp-content/uploads/2015/10/Ready-Set-Charge-Fleets-EV-Fleet-Guide.pdf

Tool 4: Vehicle Incentive Projects

California's Clean Vehicle Rebate Project provides funding for eligible EV purchases, including rebates up to $7,000 for public agencies in designated areas: https://cleanvehiclerebate.org/eng/fleet. Additionally, the Carl Moyer Memorial Air Quality Standards Attainment Program offers incentives for several vehicle

categories and is open to public agencies https://www.arb.ca.gov/msprog/moyer/moyer.htm.

STEP 2. Consider Charging Station Options

What charging speeds, controls and billing capabilities do you require? You will want to consider the demand and dwell times of visitors to your location to select appropriate charging equipment. The table below provides a summary of charging stations types. Levels 1-3 offer increasing charging speed but with added cost and complexity. Level 1 may be adequate to serve employee vehicles parked for many hours at a time, while Level 2 and Level 3 (DCFC) are typically appropriate for visitors at public locations or daily high-mileage fleet vehicles.

Tool 5: EV Charging Information

The U.S. DOE maintains a clearinghouse of information and resources for alternative fuels, including EV charging: https://afdc.energy.gov/fuels/electricity.html

Charging Station Types Summary

	Level 1	Level 2	Level 3 (DCFC)
Charging Speed	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
Typical Locations	Single-family homes Townhomes Multi-family dwellings Office buildings	One and two-family homes Townhomes Multi-family dwellings Office buildings	Public access Retail shops Highway corridors Hospitality & recreation facilities
Equipment Description	Standard 120 Volt Alternating Current (VAC) outlet and cord set charger that typically comes with EV Metering and billing not available	240 VAC outlet and wall-mounted or bollard style charging port Networked units available, allowing for advanced controls, billing options	Commercial-grade 208, 440 or 480 VAC converted into direct current (DC) through large standing unit Often requires upgrades to a site's electrical service Not all EVs can utilize

An important consideration is the number of charging stations that you will install at your location. If providing EV drivers will want reliable access to a charger for at least a portion of their workday. Charging stations intended to serve fleet vehicles may need to be separated from public access unless they only need an occasional charge. If visitors only occasionally utilize charging stations, 1-3 public access charging ports may be enough, but the number will also depend on the level of equipment selected. Faster charging speeds means more vehicles can be served by the same charging stations, and strategically locating units between parking spaces can help facilitate switching cords between vehicles. In general, you want to provide enough charging stations that users are frequently able to charge, but not so many that the charging stations are underutilized. Due to the rapid adoption of EVs, and the fact that charging stations have an expected useful life of at least 10 years, you may want to consider increasing the size of your planned installation to meet future demand. One way to go about this is to install more in-ground infrastructure (often called stub-ups) than chargers. Another strategy is to install a mix of DCFC and Level 2 or Level 1 charging, depending on fleet needs and available funds.

Ownership Models

Public Agency/Property Manager owns equipment

Benefits	Considerations
• Host dictates whether charging is free or fee-based	• Host must buy equipment

• Host determines the fee for charging (if applicable) • Host keeps all revenue, perhaps recovering cost of electricity (if charging for a fee) • Host can determine station users	• Host must pay construction costs • Host must manage payments • Host must properly maintain equipment

Electric Vehicle Service Provider (EVSP) owns equipment

Benefits	Considerations
• No or limited equipment or installation cost to host • EVSP manages and maintains the station • EVSP shares revenue from the station with host	• Host usually remains customer of record on utility bill and must pay electricity costs upfront before EVSP pays host back • PEV drivers need to have membership fees to use stations

STEP 3: Estimate Cost

The cost of installing EV charging varies considerably based on specific site requirements. Aside from the actual cost of the EV charging equipment, often referred to as electric vehicle supply equipment (EVSE), typical installation costs include trenching for electrical conduit and upgrades to the site's electrical service.

Tool 6: EV Charging Cost Report

The U.S. DOE has prepared a report on average equipment and installation costs for non-residential EV charging projects: https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

The table below provides a simplified estimation tool based primarily on costs provided in the DOE report. It includes average potential costs that may or may not apply to every project. Early consultations with your utility and charging stations providers will help refine these estimates.

Charging Station Installation Cost Estimator

Cost Driver	Average Costs	Example
Installation Costs		**2x Dual Port (4 Ports)**
Equipment – Level 2 (Non- Networked)	$500 - $2,000 x Ports	=
Equipment – Level 2 (Networked)	$1,500-$6,000 x Ports	= *$3,000 x 4 Ports*
Equipment – DC Fast Charging Equipment	10,000-$40,000 x Units	=
Installation – Level 2 Equipment	$3,000 - $6,000 x Ports	= *$3,800 x 4 Ports*
Installation – DC Fast Charging Equipment	$8,500 - $51,000 x Units	=
Trenching for Electrical Conduit	$100 x Feet	= *$100 x 45 feet*
Transformer Upgrade	$10,000-$25,000	=
	Total Estimated Cost:	= *$31,700*

Additionally, site hosts must consider the ongoing costs of EV charging. These consist primarily of the cost of electricity and any other impacts to utility bills, such as increased service or demand charges, but may also include monthly or annual payments to network service providers.

STEP 4. Evaluate Cost Recovery

Installing EV charging will often require a considerable up-front capital expenditure. Site hosts may wish to recover the costs of installation and ongoing use from employees and visitors based on individual usage or elect to absorb the cost

themselves and provide EV charging as a free amenity. California law (AB 2414) specifies that providing free EV charging is not a gift of public funds. No matter what cost recovery strategy you choose, there are additional resources that can provide funding for eligible EV charging installation projects, as listed below.

Tool 7: AFDC Incentive Listing Tool

The U.S. Department of Energy's Alternative Fuel Data Center (AFDC) hosts a comprehensive listing of currently available EV incentives within the state of California. Please note that certain programs (ex. California Electric Vehicle Infrastructure Project (CALeVIP)) are time-limited: https://afdc.energy.gov/fuels/laws/ELEC?state=ca

Tool 8: Add Solar photovoltaics to EV infrastructure

The National Renewable Energy Laboratory created a summary of considerations for adding distributed solar PV with EV charging: https://www.nrel.gov/docs/fy14osti/62366.pdf. Solar Sage provides an easy online calculator for estimating solar panel costs based on electricity demand.

STEP 5. Contact Utility

Once you taken time to consider the items listed in Steps 1-4 of the checklist, you'll be well prepared to begin speaking with your utility, EV service providers and electrical contractors who will be able to recommend solutions suited to the needs and constraints of your location. These experts can also help refine cost estimates and potential recovery strategies. The utility specifically can help walk you through any necessary electrical service upgrades, potential electricity bill impacts, and other technical aspects of the project.

STEPS 6 & 7: Contract with Vendors & Hire Installers

Charging stations equipment and network providers offer a variety of products, services, and unit ownership arrangements. Speaking with several vendors and reviewing case studies is important before finalizing a contract.

Tool 9: CALeVIP Connects

CALeVIP Connects is provided as part of the CALeVIP incentive program. It is a free online directory that allows you to connect directly with EV service providers and request information for potential EV charging projects. https://calevip.org/find-an-evsp

STEP 8: Implement Management Policies

Once your charging stations is operational, you will want to take steps to ensure it is well utilized and enhances your site. Communication with site stakeholders, staff and visitors will be key to success. Distributing a written use and management policy and installing signage to direct potential users to charging units are two important steps. You may also want to set a schedule to review utilization and ongoing costs to decide whether your current charging stations and services are still serving your needs.

Tool 10: Veloz Accessibility and Signage Guide

Veloz provides several charging stations-related resources on its website, including a report with recommendations on parking management, accessibility and signage. https://www.veloz.org/resource/accessibility-signage-for-pev-charging-infrastructure/

Case Studies

City of Sacramento

https://www.cityofsacramento.org/Public-Works/Electric-Vehicle-Initiatives

Sacramento currently has nearly 500 public and workplace charging stations. The seventy-eight public chargers at City-owned parking facilities are free apart from one DCFC. Fees at private chargers are determined by the operator or

host. The City also has an interactive charging map mobile application. In 2018, the City began implementing a curbside charging trial program downtown for on-street and public right-of way charging.

Fresno County Solar Charging

http://www.envisionsolar.com/fresno-county-unveils-countywide-solar-powered-ev-charging-program-using-envision-solars-ev-arc/

Fresno County has installed 13 solar powered EV charging stations in rural unincorporated communities, 12 of which are disadvantaged. All stations are free to charge. These stations also have energy storage to provide emergency power during a grid failure and have rotating solar arrays to maximize daily electricity generation.

Colorado Mountain Travel Corridor

http://cleanairfleets.org/programs/charge-ahead-colorado

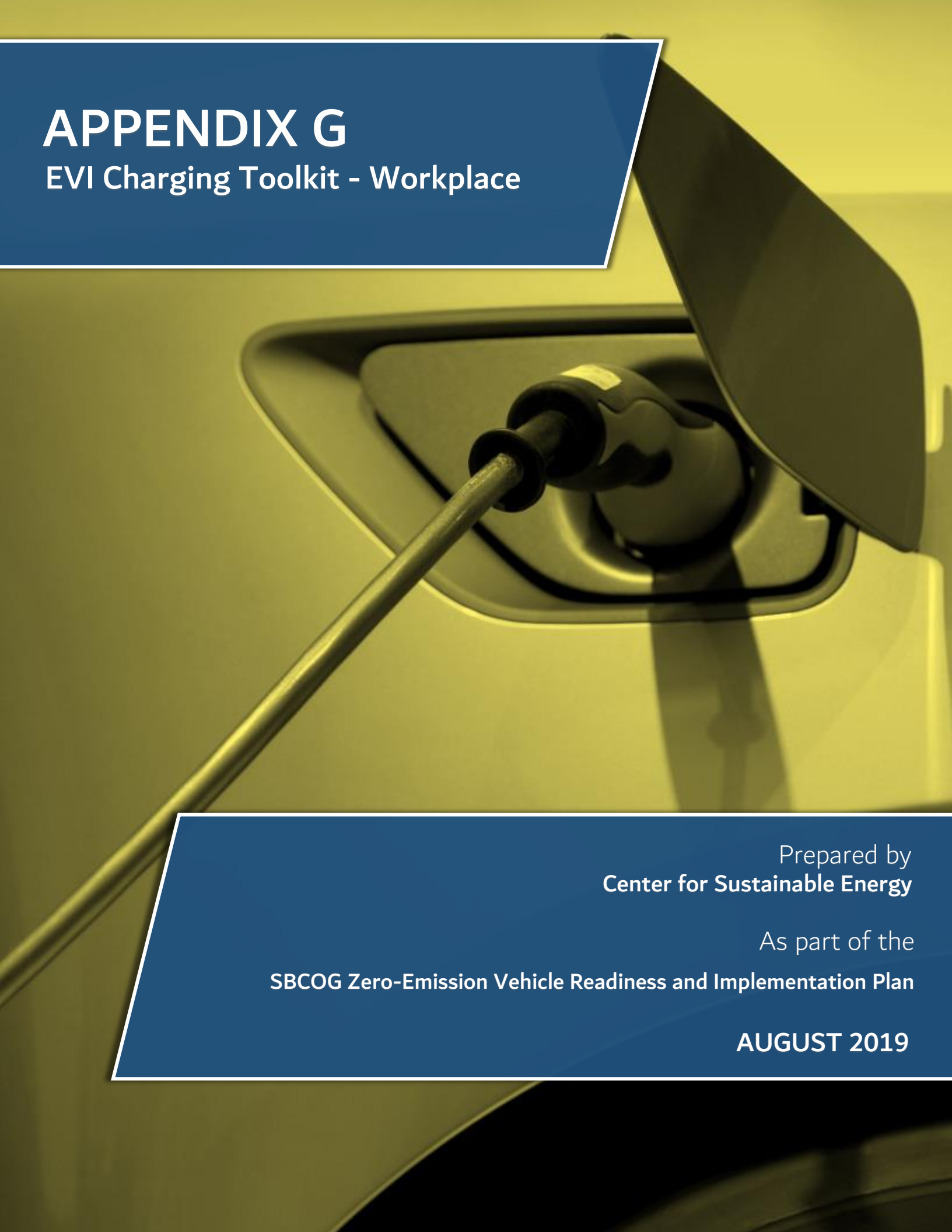
With grant funding from the Colorado Energy Office's Charge Ahead program, towns in Colorado's mountain region have installed public charging stations and created an electric vehicle travel corridor. Participating towns include Montrose, Durango, Ouray and Mountain Village. Mountain Village has a free-to-park and free-to-charge Level 2 station for recreational visitors installed near a ski gondola connecting to Telluride. Ninety-three additional public stations should be funded by Charge Ahead Colorado beyond the 145 already completed.

Additional Resources

Alternative Fuels Data Center (AFDC) – The U.S. Department of Energy's AFDC is an information clearinghouse with useful resources like case studies, an EV charging locator and a list of relevant laws and incentives. https://afdc.energy.gov/fuels/electricity.html

Veloz/PEV Collaborative – Veloz provides many useful resources including case studies, templates and fact sheets on their website. https://www.veloz.org/veloz-resources/

California GoBiz – The Governor's Office of Business provides several EV-related resources, including an extensive Community Readiness Guidebook to help local governments facilitate charging stations installation with templates, tools and resources. http://businessportal.ca.gov/zero-emission-vehicle-program/zev-resources/



APPENDIX G

EVI Charging Toolkit - Workplace

Prepared by

Center for Sustainable Energy

As part of the

SBCOG Zero-Emission Vehicle Readiness and Implementation Plan

AUGUST 2019

EVI Charging Toolkit – Workplaces

Why Install Electric Vehicle Charging?

Electric vehicle (EV) adoption is experiencing rapid growth. In 2018, nearly 8% of new car sales in California were EVs. The number of Plug-In Electric Vehicles (PEV) in San Bernardino County is projected to reach roughly 45,000 vehicles by 2025. California policy, such as Governor Brown's 2018 Executive Order (EO) B-48-18, set ambitious targets for EV adoption and supportive infrastructure. Regional employers play a crucial part of transforming California's transportation sector to zero emission vehicles. Hydrogen fuel cell vehicles are typically not an option for workplace due to limited infrastructure and high cost of investment. As a result, they are not discussed herein.

Installing EV charging stations (EVCS) at your business or workplace has numerous benefits. Providing EV charging demonstrates your business's commitment to reducing the environmental impact of its operations. Showing that value and reducing commuting costs for your employees can help attract and retain high-value employees. EV Charging at the workplace is highly prized by EV drivers – it allows them to get to work and back and attend offsite meetings with confidence. For drivers without reliable access to charging at home, it can be a must-have. In addition, EVCS can contribute to corporate sustainability goals and count toward Leadership in Energy and Environmental Design (LEED) certification[1].

Benefits of EV Charging

- **Attract Top Employees**
- **Stregthen Brand & Environmental Image**
- **Reduce Operational Impacts**
- **Enhance Employee Programs**
- **Enhance Property Value**

[1] USGBC Leadership in Energy and Environmental Design. https://www.usgbc.org/credits/schools-new-construction/v4-draft/ltc8

Workplace EV Charging Checklist

While each installation is unique, many properties have similar questions and challenges when planning for EVCS. This document summarizes common steps to help you consider options and understand how and when to engage the experts – your local utility, licensed contractors and EVCS vendors. The toolkit provides general information and helpful resources to guide you through each step of the checklist provided below.

While this checklist is presented in a linear format, the process of installing EVCS will be dynamic, with various interrelated considerations. Steps 1-4 will be preliminary explorations of issues that can be revisited with expert help once you've decided to move forward and contacted your utility and/or EVCS vendors. Actions listed are from the perspective of the project lead for your site. Your utility, vendors, and contractors will guide you through actual installation steps and more detailed considerations.

STEP 1: Estimate Demand

- ☐ **1.** Survey employees to determine who currently owns an EV, who plans to purchase an EV, typical daily driving distance, and similar data to inform decision-making.
- ☐ **2.** Look at similar sized workplaces with charging to evaluate demand/EVCS needs.
- ☐ **3.** Estimate volume of customer/visitor drivers with EVs to evaluate if public charging is warranted.

STEP 2: Consider EVCS Options

- ☐ **4.** Consider appropriate charging equipment types based on estimated demand. Explore Level 1 solutions for employees that do not have long daily travel needs and will charge overnight. Explore Level 2I solutions for employees with long daily commutes. Direct Current Fast Chargers (DCFCs) are not typically recommended for workplaces.
- ☐ **5.** Examine physical siting constraints (e.g., access to electrical infrastructure, accessibility, etc.).
- ☐ **6.** Weigh EVCS ownership models - tenant, property owner, or third-party vendor.
- ☐ **7.** Determine if you want to measure EVCS use and require payment from users. This will lead to other considerations such as EVCS software, networked vs. non-networked EVCS, in-house or third-party payment companies, using pricing to drive parking space turnover, etc.
- ☐ **8.** Consider increasing the installation of EV-ready/ready-make spaces to account for growing demand, reducing future capital costs related to site development (e.g. trenching, wiring).
- ☐ **9.** Decide if electricity will be supplied from individual meters or from a common load meter. If common load, determine how users will be billed.
- ☐ **10.** Determine ownership (e.g., workplace, property owner, or property manager).

STEP 3: Estimate Capital Costs

- ☐ **11.** Determine the number and type of EVCS you want to install on-site.
- ☐ **12.** Measure distance to EVCS location from power point of connection to estimate make-ready costs, which cover laying the infrastructure needed for the immediate installation of a charging station in the future (e.g., trenching and conduit installation).

☐ **13.** Determine if your electrical panel requires an upgrade to handle increases in load, or to separately meter EVCS from other electrical demand (engage utility or technology provider).

☐ **14.** Have the EVCS technology provider(s) estimate operations and maintenance costs (e.g., electricity use, demand charges, networking fees).

STEP 4: Evaluate Cost Recovery Options

☐ **15.** Research available incentive and funding programs (e.g., Southern California Edison (SCE) Charge Ready program, etc.) Note that some programs (e.g., California Electric Vehicle Infrastructure Program CALeVIP) require approval prior to equipment purchase to guarantee coverage.

☐ **16.** Consider contracting with an EVCS network provider to recover ongoing charging costs.

☐ **17.** Look into vendors offering free charging for advertising space.

STEP 5: Contact Utility to Conduct Site Evaluation

STEP 6: Contract with Vendors - Choose from offered equipment and service contracts

STEP 7: Hire Installers - Work with utility & vendors to plan, permit, and install charging

STEP 8: Implement Management Policies

☐ **18.** Ensure compliance with American Disabilities Act (ADA) regulations, consider general parking and traffic flow issues.

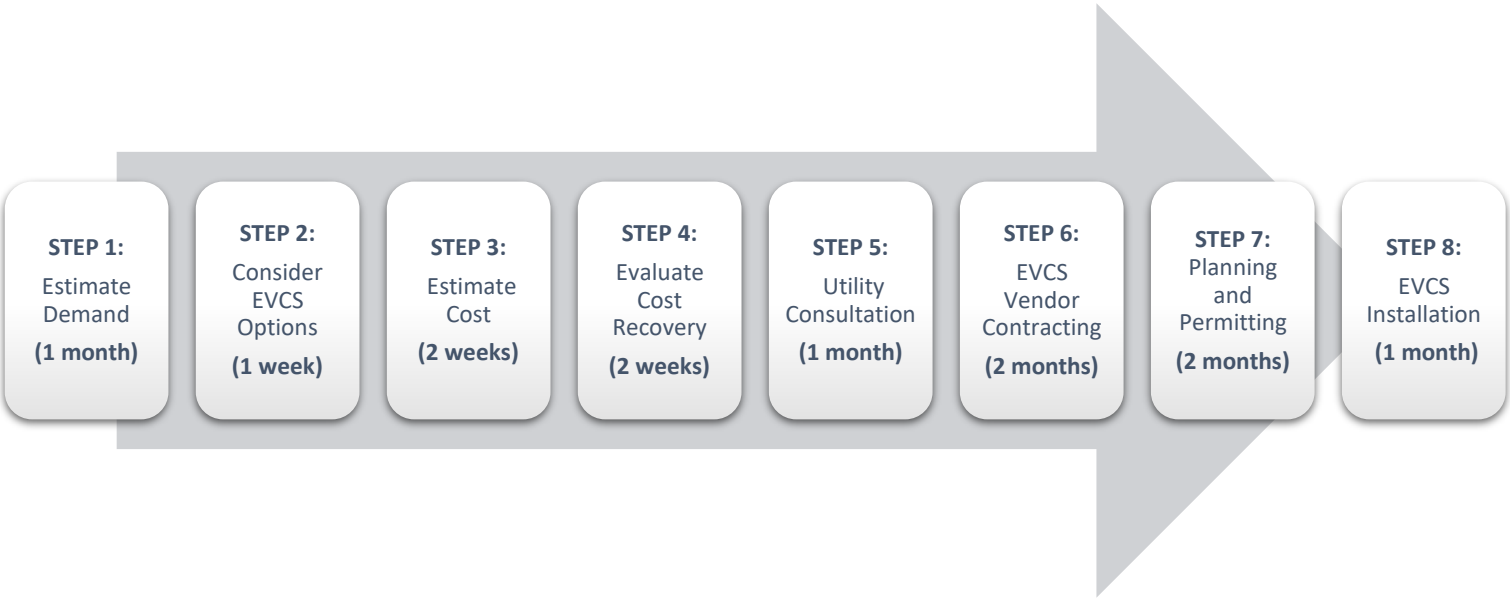
☐ **19.** Contact insurer regarding potential liability issues.

☐ **20.** Consider installing signage guiding visitors to EV charging.

☐ **21.** Communicate with site tenants and other stakeholders regarding installation and use of EVCS.

☐ **22.** Set schedule to review EVCS usage and contracts with third parties to consider adjustments.

Estimated EV Charging Installation Timeline



EV Charging Resources

STEP 1. Estimate Demand

What is your current EV charging need, and how will it grow into the future? Weighing the need for EVCS at your workplace will require reaching out to stakeholders at your site and researching existing EV charging locations nearby. A simple first step is to contact each tenant or property stakeholder at the site to inquire about EV charging interest or their employees or visitors. A key question will be evaluating the typical vehicle dwell times at your site to consider the appropriate charging speed.

Tool 1: EV Charging Demand Sample Survey

The U.S. Department of Energy (U.S. DOE) has prepared a sample survey for workplaces to gather information on employee EVCS demand. This may not be appropriate for tenants at your site unless they have many employees, but it gives a good idea of what types of questions to consider: https://afdc.energy.gov/files/u/publication/WPCC_sample_employee_survey_0816.pdf

Tool 2: EV Charging Location Maps

Use these maps to see where nearby chargers are located, how many chargers are available, and their rates and access rules. Keep in mind that demand will continue to grow. PlugShare: https://www.plugshare.com/. U.S. DOE: https://afdc.energy.gov/stations/#/find/nearest.

STEP 2. Consider EVCS Options

What charging speeds, controls and billing capabilities do you require? You will want to consider the demand and dwell times of visitors to your location to select appropriate charging equipment. The table below provides a summary of EVCS types. Levels 1-3 offer increasing charging speed but with added cost and complexity.

Tool 3: EV Charging Information

The U.S. Department of Energy maintains a clearinghouse of information and resources for alternative fuels, including EV charging: https://afdc.energy.gov/fuels/electricity.html

An important consideration is the number of EVCS that you will install at your location. California green building codes for new construction currently require that 6% of parking spaces be EV-ready, meaning with electrical capacity and raceway to support future charging. Charging stations placed in 3-6% of spaces is appropriate for an initial installation, with future expansion based on demand. When trenching to install conduit for chargers, it is cost-effective to install additional conduit to support future charging.

	Level 1	Level 2	Level 3 (DCFC)
Charging Speed	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
Typical Locations	Single-family homes Townhomes Multi-family dwellings Office buildings	One and two-family homes Townhomes Multi-family dwellings Office buildings	Public access Retail shops Highway corridors Hospitality & recreation facilities
Equipment Description	Standard 120 Volt Alternating Current (VAC) outlet and cord set charger that typically comes with EV Metering and billing not	240 VAC outlet and wall-mounted or bollard style charging port Networked units available, allowing for advanced controls, billing options	Commercial-grade 208, 440 or 480 VAC converted into direct current (DC) through large standing unit Often requires upgrades to a site's electrical service Not all EVs can utilize

available

STEP 3: Estimate Cost

The cost of installing EV charging varies considerably based on specific site requirements. Aside from the actual cost of the EV charging equipment, often referred to as electric vehicle supply equipment (EVSE), typical installation costs include trenching for electrical conduit and upgrades to the site's electrical service.

Tool 4: EV Charging Cost Report

The U.S. DOE has prepared a report on average equipment and installation costs for non-residential EV charging projects: https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

The table below provides a simplified estimation tool based primarily on costs provided in the DOE report. It includes average potential costs that may or may not apply to every project. Early consultations with your utility and EVCS providers will help refine these estimates.

EVCS Installation Cost Estimator

Cost Driver	Average Costs	Example
Installation Costs		**2x Dual Port (4 Ports)**
Equipment – Level 2 (Non- Networked)	$500 - $2,000 x Ports	=
Equipment – Level 2 (Networked)	$1,500-$6,000 x Ports	= *$3,000 x 4 Ports*
Equipment – DCFC Equipment	10,000-$40,000 x Units	=
Installation – Level 2 Equipment	$3,000 - $6,000 x Ports	= *$3,800 x 4 Ports*
Installation – DCFC Equipment	$8,500 - $51,000 x Units	=
Trenching for Electrical Conduit	$100 x Feet	= *$100 x 45 feet*
Transformer Upgrade	$10,000-$25,000	=
	Total Estimated Cost:	= *$31,700*

Additionally, site hosts must consider the ongoing costs of EV charging. The primary ongoing cost for EV charging stations is the cost of electricity used to charge EVs, and demand charges. You can choose to provide charging as a free amenity or select a networked charging solution by which electricity usage is tracked and EV owners pay for the cost of electricity associated with their individual charging. In this case, you may need to cover ongoing network operation and data fees.

STEP 4. Evaluate Cost Recovery

Installing EV charging will often require a considerable up-front capital expenditure. Appropriate cost recovery strategies will depend on the ownership situation of your business site and who will be covering the costs of installation. A site owner has different options than a business leasing space. In an office park environment with multiple businesses, property owners may find it most efficient to provide EV charging for multiple businesses in an open-access area.

Site hosts may wish to recover the costs of installation and ongoing use from tenants and visitors based on individual usage, incorporate these costs into rent or lease terms, or elect to absorb the cost themselves and provide EV charging as a free amenity. No matter what cost recovery strategy you choose, there are additional resources that can provide funding for eligible EV charging installation projects, as listed below.

Tool 5: AFDC Incentive Listing Tool

The U.S. DOE's Alternative Fuel Data Center (AFDC) hosts a comprehensive listing of currently available EV incentives within the state of California. Please note that certain programs (e.g. California Electric Vehicle Infrastructure Project (CALeVIP)) are time-limited:
https://afdc.energy.gov/fuels/laws/ELEC?state=ca

Tool 6: Add Solar photovoltaics to EV infrastructure

The National Renewable Energy Laboratory created a summary of considerations for adding distributed solar photovoltaic (PV) with EV charging: https://www.nrel.gov/docs/fy14osti/62366.pdf. Solar Sage provides an easy online calculator for estimating solar panel costs based on electricity demand.

STEP 5. Contact Utility

Once you taken time to consider the items listed in Steps 1-4 of the checklist, you'll be well prepared to begin speaking with your utility, EV service providers and electrical contractors who will be able to recommend solutions suited to the needs and constraints of your location. These experts can also help refine cost estimates and potential recovery strategies. The utility specifically can help walk you through any necessary electrical service upgrades, potential electricity bill impacts, and other technical aspects of the project.

Tool 7: Southern California Edison (SCE) EVCS Resources

Explore SCE's EVCS-related programs and resources, such as the Charge Ready program. Contact your account representative for additional support. https://www.sce.com/business/electric-cars

STEPS 6 & 7: Contract with Vendors & Hire Installers

EVCS equipment and network providers offer a variety of products, services, and unit ownership arrangements. Speaking with several vendors and reviewing case studies and past projects is an important step before finalizing a contract with your chosen provider.

Tool 8: CALeVIP Connects

CALeVIP Connects is provided as part of the CALeVIP incentive program. It is a free online directory that allows you to connect directly with EV service providers and request information for potential EV charging projects. https://calevip.org/find-an-evsp

STEP 8: Implement Management Policies

Once your EVCS is operational, you will want to take steps to ensure it is well utilized and enhances your site. Communication with property stakeholders, staff and visitors will be key to success. Distributing a written use and management policy to staff and property stakeholders and installing signage to direct potential users to charging units are two important steps. You may also want to set a schedule to review utilization and ongoing costs to decide whether your current EVCS and services are still serving your needs.

Tool 9: Veloz Accessibility and Signage Guide

Veloz provides several EVCS-related resources on its website, including a report with recommendations on parking management, accessibility and signage.
https://www.veloz.org/resource/accessibility-signage-for-pev-charging-infrastructure/

Additional Resources

Alternative Fuels Data Center (AFDC) – The U.S. Department of Energy's AFDC is an information clearinghouse with useful resources like case studies, an EV charging locator and a list of relevant laws and incentives. https://afdc.energy.gov/fuels/electricity.html

Veloz/PEV Collaborative – Veloz provides many useful resources including case studies, templates and fact sheets on their website. https://www.veloz.org/veloz-resources/