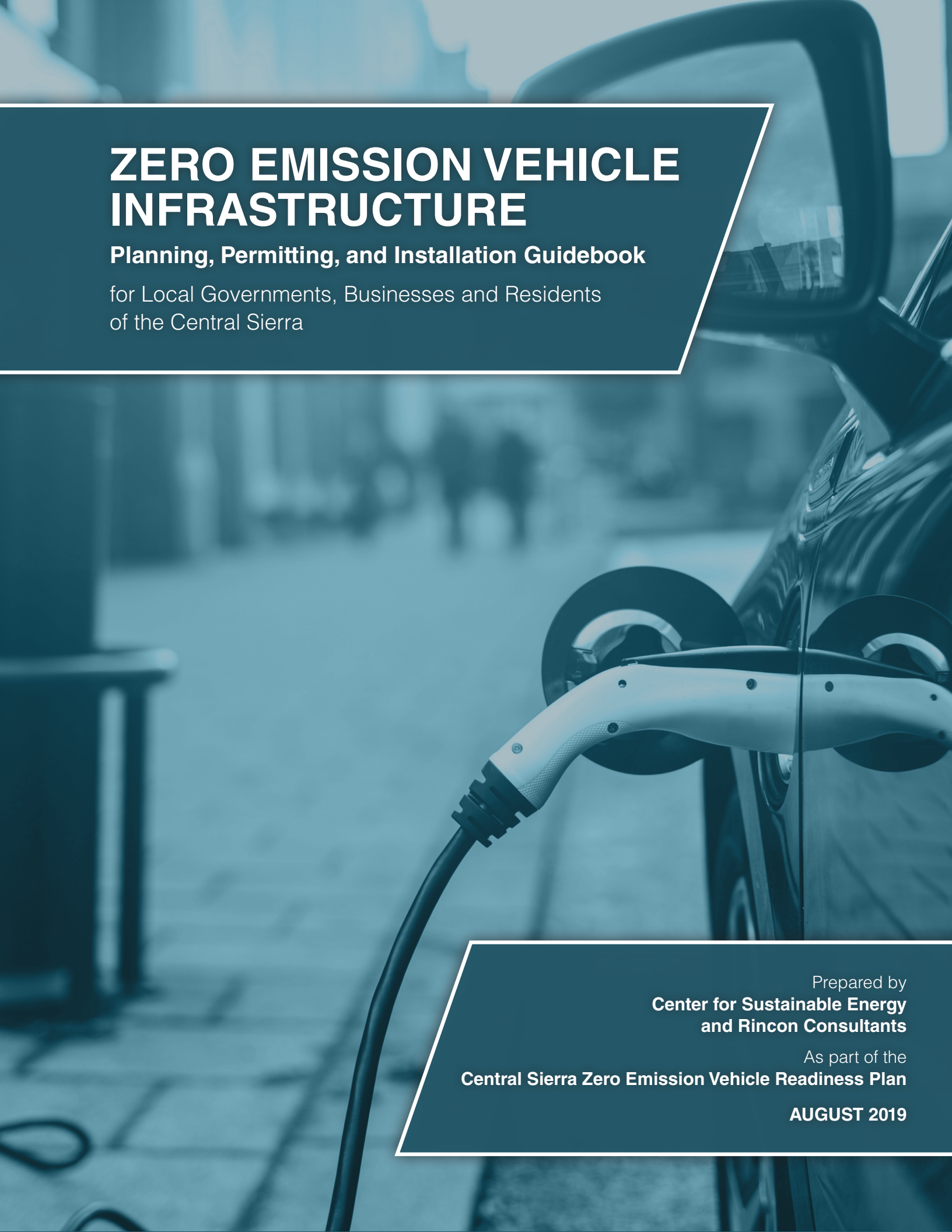

ZERO EMISSION VEHICLE INFRASTRUCTURE

Planning, Permitting, and Installation Guidebook

for Local Governments, Businesses and Residents of the Central Sierra

Prepared by

Center for Sustainable Energy and Rincon Consultants

As part of the

Central Sierra Zero Emission Vehicle Readiness Plan

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Overview

The Central Sierra is known for its iconic recreational destinations, historic character, and wine industry. As an international tourist destination, the region has a unique opportunity to advance the use and adoption of plug-in electric vehicles (PEV). The Central Sierra Zero Emission Vehicle (ZEV) Readiness Plan establishes a process to expand charging infrastructure at key locations throughout Alpine, Amador, Calaveras and Tuolumne counties. By achieving Plan guidelines, the region will help meet state PEV deployment and greenhouse gas emission reduction targets, as well as improve air quality for all inhabitants, employees, and visitors.

By supporting the development of a robust regional PEV charging network, businesses and local governments can help the Central Sierra region become a leading PEV corridor. Making installation and use of charging stations easier will facilitate the growth of PEVs by reducing driver range anxiety, increasing convenience of charging and ownership, and saving money on gasoline. By following the Central Sierra Readiness Plan to advance electric vehicle charging infrastructure, businesses and local governments will help increase usage, comfort levels, and adoption of PEVs for residents, workers, and visitors.

Purpose of this Guide

The *Zero Emission Vehicle Infrastructure Planning, Permitting and Installation Guidebook* offers a reference for PEV equipment installers and a compilation of the typical procedures necessary for siting, design, approval, and installation. It covers pre-planning, construction and operational phase installation considerations and requirements, as well checklists to help guide the planning and installation process. The guidebook provides examples of best practices for site selection and design. Because each jurisdiction and potential charging site has its own constraints, characteristics, and priorities, the suggestions should be tailored to each location. As charging stations are a new decentralized transportation infrastructure, many jurisdictions do not have set or detailed guidelines for installation or long-term maintenance. Instead, jurisdictions in the Central Sierra will lead the way to clear regulatory pathways that facilitate regional infrastructure deployment and electric vehicle (EV) adoption. This action will be critical for the growth of the EV market and the ability to reach state EV adoption goals.

Who Should Use This Guide

The primary audiences for this guide are local government staff, business persons, and private property owners in the Central Sierra region who would benefit from understanding electric vehicle charging station (EVCS) infrastructure and charging basics, planning processes, and regulations involved in installation. This guidebook instructs practitioners at all levels of state and local government who want to encourage EVCS deployment. It will help public and private installers of EVCS, developers, and other private-sector actors understand the constraints and considerations to include when they propose to install EVCS. It will help local planning departments incorporate PEVs into transportation planning priorities. It will also help residents

Variations such as geography, demographics, administrative structures. and existing markets for EVs must be considered for each potential EVCS location.

understand installation processes and policies for personal use, as well as the planning considerations used by external groups for installation in public and commercial locations. Finally, this guide will be informative to policy makers who develop, enact, or enforce strategic plans, regulations, and legislation; industry stakeholders; and private sector interest groups.

Guidebook Structure

This guidebook is organized for simple navigation and use. Sections may be used individually, or the guidebook may be read in its entirety depending on the needs of the jurisdiction. Sections in this book include:

- **The Basics**. Basic information on electric vehicles and vehicle charging
- **Site Design**. An overview of considerations in choosing and designing EV charging sites
- **Regulations**. Suggestions on how to use regulatory tools, such as building codes, parking and zoning requirements, and jurisdictional policies, with guidance on existing regulation that should be followed
- **Permitting**. Permit application procedures and requirements for local governments and applicants
- **Costs and Funding**. Installation costs depending on chosen infrastructure, available funding and financing, ownership structures, and equipment maintenance costs
- **Resources.** Resources for installation, ownership, and regulation of EVCS, and a list of key contacts in the Central Sierra region
- **Appendices.** A list of policies and regulations applicable to federal and local jurisdictions where EVCS may be installed; example permit application and plan review checklists; and example installation checklists applicable to particular charging locations

1 The Basics

Charging Infrastructure

Electric vehicle charging infrastructure is differentiated typically by the amount of power that can be delivered to the vehicle's battery. This determines the time required to charge the vehicle's battery. Each electric vehicle charging station (EVCS) has one or more charge ports or plugs.

EVCS can be installed to serve distinct driving needs and audiences. The four common charging types include:

- **Residential:** At homes and multi-unit dwellings, at Level 1 or Level 2 stations
- **Workplace:** Provided by an employer to employees via on-site charging facilities, normally at Level 1 and Level 2 stations
- **Opportunity:** Non-residential and non-workplace charging, at Level 1, Level 2, and direct current (DC) Fast Charging stations; can include retail locations, shopping centers, gas stations, or other areas where the time a person spends at the locations is similar to the time needed to charge
- **Fleet:** For commercial or government fleets, normally at in a fleet-owned location, at Level 1, Level 2, and DC Fast Charging stations

Acronyms

BEV:	Battery electric vehicle
EVCS:	Electric vehicle charging station
EVSE:	Electric vehicle supply equipment
ICE:	Internal combustion engine
PEV:	Plug-in electric vehicle
PHEV:	Plug-in hybrid electric vehicle
ZEV:	Zero emission vehicle

Level 1

- Standand current
- 8-12 hours to fully charge, although larger batteries could take 1-2 days
- Standard outlets and standard J1772 coupler
- In-vehicle power conversion

Level 2

- Requires installation of charging equipment and may require utility upgrades
- 4-8 hours to fully charge
- Inside or outside locations
- Public use, often requiring payment and providor network interfaces
- In-vehicle power conversion

DC Fast Charge

- Requires installation of charging equipment and may require utility upgrades
- 80% charge in as little as 30 minutes
- Relatively high-cost compared ot Level 2 chargers
- Requires utility upgrades and dedicated circuits
- Electrical conversion occurs in EVCS unit itself

Connectors

Most EVs and EVCS use the Society of Automotive Engineers J1772 connector and receptacle that are standard for level 1 and 2 charging equipment. Nearly all EVs come equipped with a portable level 1 cord that can plug into a typical wall outlet.

DC fast chargers generally have a dual standard with the SAE Combo Charging System (CCS) and CHAdeMO charging plugs. Tesla chargers are the exception to this with a unique charger. However, adapters allow for Tesla vehicle charging using dual standard plugs.

Figure 1. Connector Types
Top: Level 2 (J1772) Connector and Plug; Bottom: DC Fast Charge/Level 2 (J1772) Combined Connector and Plug

The charging station acts as the point of transfer from grid to vehicle. For level 2 and up they contain network communications, utility communications and monitoring, payment interface and, user information opportunities, such as advertising screens.

The battery charge is regulated on the vehicle. The majority of the charging operation occurs in the vehicle's on-board charger, where the conversion from alternating current (AC) to DC takes place at charging levels 1 and 2.

2 Site Design

Site Design Considerations for EVCS Installation

Implementation Considerations

This section describes basic site design concerns and wider implementation considerations, such as the reasons for installing the EVCS, costs, and operational issues relevant to shaping EVCS deployment on a site-by-site basis. The installation contexts described in the following pages of this guide will place design issues in perspective. It is acknowledged that each context shown here would include a wide degree of site-specific variation.

Infrastructure Costs

The capital outlay associated with EVCS includes purchase of the unit and construction costs associated with trenching, structural, utility, or electrical work. Soft costs are incurred during the permitting process, and for maintenance and network servicing of the EVCS.

In some cases, EVCS manufacturers and service providers will supply the EVCS unit for free if they are in position to collect data or fees associated with usage. For this reason, the business models of the EVCS manufacturing groups may have an influence on emerging charging locations based on their ability to collect fees in certain kinds of locations.

Regulations

Ordinances serve planning and permitting purposes at the city or county-wide scales and are another layer of agreement for developers and EVCS hosts. City or county regulations regarding site design, utility needs, environmental review, and other factors will influence if and where a host installs an EVCS. Liability issues associated with hazards and accessibility are another regulatory concern.

Host Agreements

Tenants, such as retail operators, contract with landowners; both of these parties may assume responsibility for EVCS-related costs, but landlords will likely assume liability for the EVCS. Owners, tenants, developers, parking lot operators and EVCS networks may be operators of the EVCS. EVCS ownership and management is discussed further below.

Weather and Climate

Equipment rated for outdoor use must be chosen when installing an EVCS outside or under partially covered areas. Shelters that block wind and precipitation such as snow and rain can increase convenience and comfort for users. Use outlets with weatherproof coverings. Although the EVCS is designed to operate safely in wet areas, users will be more comfortable if it is not located near pooling water or where irrigation systems spray. Install EVCS in well-drained locations to avoid standing water, particularly in areas subject to rising sea levels or prone to salt-water erosion. The National Electrical Code requires that outdoor AC Level 1 charging installations have a ground fault circuit interrupter.

Proximity to a Power Source

By minimizing distance to an electrical panel or transformer, the charging station host may save money by reducing the need for trenching or drilling to add electricity conduits.

Network Connectivity

For drivers passing through a region, charging stations are usually found easily by using a phone application that identifies sites and their details on a map. Apps let users submit updates, reviews and photos about a charger to inform others. However, both identifying an EVCS location and uploading information requires that users have wireless internet connectivity: if visitors don't know about a charging station, they won't be able to use it. Therefore, expanding regional network connectivity can greatly increase use of new EVCS. Because local residents and employees are more aware of area resources, network connectivity is less of a concern for their optimal use of EVCS.

Figure 1. A line of easily visible Level 2 EVCS charging vehicles next to a pedestrian path.

Visibility and Lighting

Charging stations should be located in areas with high visibility, with a lot of foot and vehicle traffic, to make them easy to find and less vulnerable to vandalism. Well-lit areas enhance safety and improve user operation. Lighting should enable users to read signs and instructions and to operate the EVCS easily. Jurisdictions may have their own codes and standards for electric vehicle charging station (EVCS) illumination.

Safety

Several safety measures should be taken when installing and maintaining EVCS. Charging cords should not impede walking paths and should be stored on hooks or brackets. They should be no longer than necessary for the location. Protective barriers should be placed around EVCS, including wheel stops, bollards, curbs, or wall-mounted barriers as appropriate. Lighting and shelter should be provided for the safety, comfort, and convenience of users.

The National Electrical Code requires that cords be no longer than 25 feet unless the charging station is equipped with a retraction or other cord control device. Experienced installers recommend a site design that will require cord distances no more than three to five feet from vehicle to charging stations to minimize tripping hazards.

Ventilation

Ventilation requirements for indoor charging vary depending on equipment. Some older batteries emitted hydrogen gas during charging, though this is no longer a concern with newer PEV batteries. Refer to operating manuals and equipment labels. Section 625.29(D) of the National

Electric Code has requirements for ventilation for single and multiple vehicle stations; Section 625.15(B)&(C) provides ventilation-labeling requirements for EVCS.

Best Practices

Locating and installing the EVCS is part of the site's overall traffic circulation. Consideration must be given to the traffic flow and parking lot design, and EVCS must be located where it can be connected to the power grid. While the placement and type of EVCS will depend highly on the specific circumstances of a site, general best practices can be followed for guidance.

Siting Considerations	Design Consideration
• Economic feasibility • Legal concerns • Operational need • Market demand	• Pedestrian safety • Clear signage • High-profile locations • Solar carports

Commercial Areas

Commercial operator priorities will focus on customer services and branding, and will most often implement Level 2 chargers. Charging may be free to promote the use of EVCS and provide a service to customers, or operators may charge a small fee to offset the cost of electricity and ensure customer turnover.

Multi-Unit Residential Areas

Providing charging in multi-unit residential buildings is more complex than it is in many other situations. Specific challenges with multi-unit residential EVCS include:

- Metering and billing of EVCS usage
- Locating EVCS in places that minimize cost and complications
- Limitations on parking space
- Cost of installation, maintenance, and management
- Land use and zoning regulations

Despite these challenges, the provision of EVCS in multi-family housing is a highly-desired amenity for residents and could improve the desirability and per-unit market value at the complex.

3 Regulations

Role of Development Requirements in Expanding EVCS

To facilitate EV readiness, policies and regulations will need to incentivize or require EVCS infrastructure, eliminate procedural barriers, consider potential financial incentives, or mandate pre-wiring for EVCS installation in new development. EV readiness can be achieved through a number of regulatory tools, including zoning, parking ordinances, building or electrical codes, and streamlined permitting processes.

Regulatory Tools

Zoning	• Establish allowable uses • Incentivize inclusion of EVCS in development • Set standards for EVCS deployment
Parking	• Provide ways to regulate spaces and usage • Encourage EVCS in varying situations • Make opportunities for providing incentives
Codes	• Help make locations EV-ready • Include EVCS guidance as part of code updates • Allow for locally relevant requirements
Permitting	• Ease implementation of EVCS and reduces fees • Allow for locally relevant processes
Partnerships	• Build consensus and sharing knowledge • Develop funding options from agencies and organizations • Accomplish mutual goals and benefits

No one-size-fits-all policy exists to approach increasing EV readiness. Each agency needs to evaluate the objectives behind any potential new policy, code revision, or other change and follow a path that best suits the jurisdiction.

Despite differences across the Central Sierra region, a handful of factors need to be in place to successfully advance policy, legislation, and ordinances relevant to EV infrastructure. EV-ready planning includes creating and implementing solutions to one or more of the following barrier reducing actions:

- Ensure that new construction is EVCS ready
- Clear administrative pathways for residential service upgrades and EVCS retrofit
- Provide safe, consistent, and accessible EVCS installations and implement good site planning and design
- Ensure new construction can support higher electricity demand, with the potential to add future vehicle battery charging capacity and eventually energy storage devices
- Enable dedicated parking spaces for EVs in both public and private realms, with clear protocols for the usage and operation of the spaces and EVCS
- Align EVCS deployment with policy and environmental mandates to achieve emissions reductions, air quality improvements, transportation technology advances, and energy independence

Local governments have an important role to play in the development of public and private PEV charging infrastructure due to their authority over zoning, parking, signage, building codes, and permitting and inspection processes. Local governments can use their authority to regulate and approve new development projects and ensure ample charging opportunities are available. There are many ways to go about this. The most common approach is to require pre-wiring, where builders run electrical conduit that can hold the hardware to power charging equipment to appropriate parking locations. Since no chargers are installed, pre-wiring itself does not create new charging opportunities, but it dramatically reduces the cost of installing chargers in the future. Local governments can require charging equipment to be installed or they can take a softer approach and offer incentives or adopt policies that encourage charger installations.

A number of mechanisms can help local governments require or encourage charging. These mechanisms are discussed in more detail in what follows, along with issues to be considered when determining how best to foster charging opportunities. There is no “right” way to create new charging infrastructure in private developments, but putting protocols in place now sets a precedent that local governments can expand upon as charging demand or development patterns shift.

Building Codes

Building codes set standards for new construction, and they are the most common mechanism through which local governments can require pre-wiring or inclusion of EVCS. The 2016 Green Building Standards Code (CalGreen) effective January 1, 2017 requires all new developments to include pre-wiring for Level 2 (208/240V) charging. Any local government that adopts the state building code by reference will have these pre-wiring requirements in place. Specifically, CalGreen's mandatory requirements specify new single-family homes and townhomes with attached garages must pre-wire locations where vehicles will be parked, and that multi-family developments with 17 or more units must pre-wire at least three percent of total parking spaces. At non-residential developments, pre-wiring is mandated for a portion of total parking spaces, shown in **Table 1**.

Table 1. CalGreen Required EV Pre-Wired Spaces for Non-Residential Developments

Total Number of Parking Spaces	Number of EV Charging Spaces Required
0 – 9	0
10 – 25	1
26 – 50	2
51 – 75	4
76 – 100	5
101 – 150	7
151 – 200	10
201 and over	6% of total

Source: CalGreen, Chapter 5, Section 5.106.5.3

Local governments can take additional action to exceed the CalGreen mandatory requirements by mandating pre-wiring for a greater proportion of spaces or requiring actual EVCS in lieu of pre-wiring. This could be achieved by adopting all or part of the voluntary tier 1 or tier 2 sections of CalGreen through an ordinance amending the local municipal code. The 2019 Green Building Standards Code offers more stringent regulations and becomes effective January 1, 2020.

Parking Requirements and Zoning Development Standards

Local governments specify how much parking should be provided at different locations and/or land uses in their zoning ordinances, development guidelines and standards, or parking codes. These documents can also include charging requirements or incentives. Local governments with minimum parking requirements in place may also wish to consider whether PEV parking should count toward overall parking requirements. This is recommended as it gives developers an incentive to provide PEV parking without increasing the total number of spaces required. Zoning ordinances and development regulations are similar to building codes in that they can be used to specify in detail how much charging or pre-wiring should be provided and where it should be situated. There are two key differences between zoning ordinances and parking codes, however, that allow local governments more flexibility to determine how to best create more charging opportunities:

Zoning ordinances can be used to increase charging opportunities in high priority locations: Whereas building codes usually categorize land uses broadly (e.g., residential and nonresidential), zoning ordinances can be more nuanced, distinguishing between residential districts of different densities, non-residential districts with differing types and mixes of uses, or high-activity areas such as downtowns and transit stations. This means that zoning ordinances create the flexibility to focus new infrastructure in the places where it matters the most: for example, downtown districts and activity centers with high turnover are good candidates for charging opportunities, as are employment centers that need more workplace charging opportunities.

Zoning ordinances offer more flexibility in how to implement new charging infrastructure: A zoning ordinance that requires pre-wiring would have the same effect as the CalGreen update discussed above, but a local government could require actual charger installations at new developments in specific areas through its zoning ordinances or development standards. It could also offer developers incentives such as density bonuses in exchange for increased charging opportunities. For instance, through its planning regulations a jurisdiction could require at least three percent of parking spaces be designated electric vehicle charging stations in parking facilities containing 17 or more spaces that serve multi-unit residential and lodging uses. Such spaces may count toward parking requirements. For all other uses, EV charging stations are eligible for development bonuses.

Policies

Local governments can include goals and policies in general plans, climate action plans, or similar documents that require or encourage electric vehicle charging. These plans are broader and less detailed than building codes and zoning ordinances, so policies calling for increased charging opportunities typically do not contain specific details on where chargers are needed or on how much charging should be provided. Even voluntary or loosely described policies can provide a basis for local governments to negotiate with developers for charger installation during discretionary review. They also set the stage for more detailed implementation through building codes or zoning ordinances.

Charging Station Installation Requirements

The state of California has created requirements for pre-wiring charging spaces in new development and using signs to indicating chargers. **Table 2** summarizes these requirements as they apply to charging spaces in new development and newly constructed charging stations.

Table 2. 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	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.

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.

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 DC Fast Chargers should indicate a time limit, for example up to one hour. Time limits will also require the participation of local authorities or parking managers to enforce the regulations stated on the sign. See ***Enforcement*** under Costs and Ownership for details.

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.

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.

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.

Figure 3. Display screen of a charging station

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 California Vehicle Code requires off-street PEV charging spots to be properly identified. The Manual on Traffic Control Devices (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 consist signage across communities.

ADA Accessibility

Under the California Building Code, a portion of all chargers at multi-family buildings 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.

Figure 4. ADA accessible spaces outside the Adventist Hospital in Sonora. EVCS installation funded by PG&E. Source: Tuolumne County Transportation Commission, 2019.

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 3**. 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.

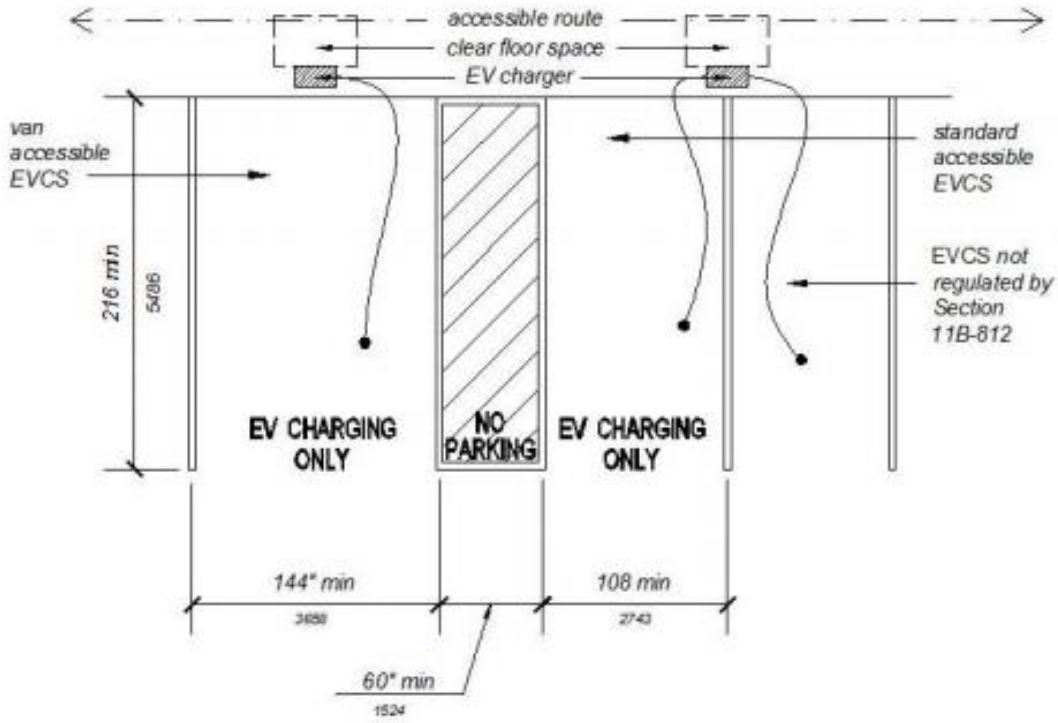


Figure 5. ADA accessible space on left with surface markings following CalGreen Building Code standards. Source: California Building Standards Commission, 2016 California Building Standards Code Section 11B-812.9

Table 3. 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

Environmental Assessments

Many buildings and corridors in the Central Sierra have historical qualities and unique ecological features that need to be considered when siting EVCS. Generally, technical environmental assessments are not necessary for EVCS if they are installed in a developed area as standalone projects or as building additions. If EVCS are to be installed as part of a larger development project or located in a culturally, biologically, or historically unique location, environmental constraints should be considered, and an environmental review may be necessary.

Environmental Constraints

Because the safety, siting and operation of EVCS can be affected by the regional environment, publicly available EVCS will need to consider regional environmental factors for both siting and compliance with state and federal regulations. Several possible constraints are described below. See your county's Central Sierra Regional ZEV Streamlined Permitting Guidebook for a more detailed description of each for county applicability.

Aesthetic impact: EVCS may be located in a historic district, on public land, or in another city zone that has design requirements to preserve the local character and resources. This could affect the EVCS model options or need for coverings, coloration, height or placement restrictions to blend with the historical quality of a building and natural surroundings. Refer to jurisdictional building codes and the CEQA guidelines for local requirements.

Agricultural resources: Protection of agricultural resources in often an important component of County General Plans. To ensure protection of local resources, developers must comply with County and city zoning and land use designations.

Air quality and greenhouse gas emissions: Developers must be in compliance with Air Quality Pollution Control District regulations, but EVCS is likely to improve air quality and reduce greenhouse gas emissions since electricity will offset vehicle fuel and requires a certain percentage sourced from renewable energy (in compliance with the State Renewable Portfolio Standard). Installation is also minimally energy intensive unless as part of a larger development project.

Biological resources: Several rare species and critical habitats exist throughout the Central Sierra region. Developers should consult government agencies such as the U.S. Forest Service, California Department of Fish and Wildlife, U.S. National Park Service, and California Native Plant Society to ensure compliance with species, resource and land use regulations.

Cultural resources: Numerous state historic sites, cultural sites and historic districts exist in the Central Sierra region, reflecting its pioneer and Gold Rush history. Developers must comply with

regulations of state and federal agencies if EVCS is located in their immediate vicinity, and with city zoning standards.

Hazards and hazardous materials: The Central Sierra region has some risk of flooding, particular near water bodies and downward of dams. Many areas have high risk of wildfire; the area is scattered with faults extending throughout the Sierra region and into Nevada; and some counties have a federally designated Superfund site. Installers should be cognizant of risks associated with siting EVCS and consult appropriate federal and state agencies to ensure compliance with regulations.

CEQA Environmental Review

The California Environmental Quality Act (CEQA) requires state and local government agencies to inform decision makers and the public about the potential environmental impacts of proposed projects, and to reduce those environmental impacts to the extent feasible. The CEQA Guidelines do not directly address the installation of EVCS. However, most installations into existing residential or commercial structures can obtain an over-the-counter or ministerial building permit and would not be subject to CEQA review. Examples of ministerial EVCS projects are:

- Installation of a new EVCS in an existing structure such as a single family or multi-family residential garage or commercial/industrial garage or covered parking area.
- Installation of EVCSs in front of existing outdoor parking spaces in a single family residence driveway, multi-family residential parking area, commercial/industrial parking lot, or public building or park outdoor parking area.

EVCSs that are part of a new residential, private, or public development project (i.e. park, sports facility, public works yard, etc.) may require CEQA review. As the CEQA lead agency, County or City staff (depending on the land's incorporation) would determine the level of review necessary based on potential environmental impacts.

If a project is not expected to cause any adverse environmental impacts, a public agency may adopt a brief document known as a Negative Declaration. If a project may cause adverse environmental impacts, the public agency must require a more detailed study called an Environmental Impact Report (EIR). EIRs examine the effects of a proposed project on several environmental and cultural issue areas, including the environmental constraints listed above, and consider alternatives to the proposed project. See your county's Central Sierra Regional ZEV Streamlined Permitting Guidebook for details on current County and City codes related to environmental review.

4 Permitting

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 must 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:

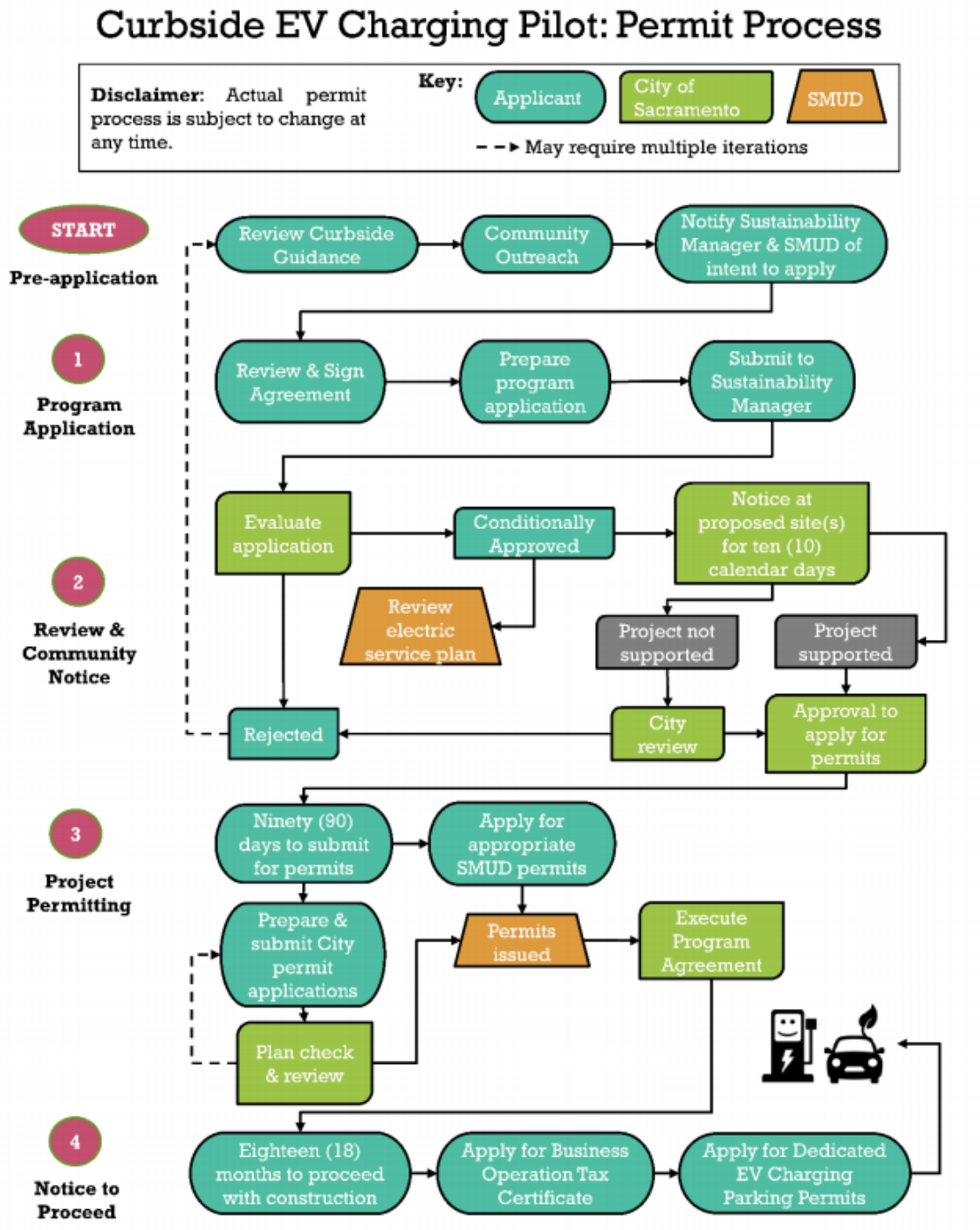
- Prepare combined informational materials providing all guidance on the permitting and inspection processes specific for residential, multi-family dwelling, and non-residential charging equipment installations
- Prepare all guidance, including a permitting and inspection checklist and application materials 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

Utility providers can support permitting and inspections by assigning utility representatives to review and approve PEV charging installation projects, and by working with local government permitting offices to create a notification protocol for new charging equipment.

To provide permitting consistency between jurisdictions in the Central Sierra 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.

Because the permitting process can be complicated and long depending on the nature of the project, each jurisdiction should consider developing a flowchart that outlines the steps in the permitting process to clearly guide the installer through each step. This will prevent confusion and unnecessary delays in permit approval and EVCS installation. While not all projects are as involved, the following provides an example flow-chart from the City of Sacramento.

Sacramento EV Curbside Permit Process



Source: City of Sacramento Curbside EV Charging Program, 2018

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 in **Appendix B**. 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.

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.

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:

- Permit application
- Plan for installation
- Line drawings
- Electrical load calculations
- Permit and inspection fees
- 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. 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

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 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).

Installation Costs

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 4. Approximate Costs for Non-Residential Single-Port EVCS

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*

The values presented in **Table 4** 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 DC Fast Charging 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 4. Wall-mounted (left) and pedestal-mounted (right) EVCS

- **Technological features:** The simplest units 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 EPRI study 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.

5 Costs and Ownership

EVCS Ownership and Management

Ownership

There are three types of EVCS ownership and management. First, it 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. Secondly, it 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. Lastly, 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 6** for further differences among the ownership types.

Table 5. 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 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

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 electric vehicle service providers (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 AC 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 the Tahoe-Truckee region, time limits apply most 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. DC fast charging units 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.

6 Resources

Plug-in Electric Vehicle Handbook for Public Charging Station Hosts, U.S. Department of Energy (DOE). Published in 2012, this handbook covers PEV and charging basics, charging station locations and hosts, ownership and payment models, and installing and maintain charging stations. http://www.afdc.energy.gov/pdfs/51227.pdf

Workplace Charging Challenge Employer Workshop Toolkit, U.S. DOE Clean Cities. The Toolkit provides best practices for planning, organizing, and executing successful and educational workplace charging events. Includes employer workshop and outreach templates, as well as examples of workplace charging events. https://cleancities.energy.gov/technical-assistance/workplace-charging-challenge/

Community Toolkit for Plug-In Electric Vehicle Readiness, The California Plug-In Electric Vehicle Collaborative. This toolkit highlights actions communities can take to get ready for PEVs and offers tangible best practices examples and case studies from communities and stakeholders throughout California and abroad. http://www.pevcollaborative.org/sites/all/themes/pev/files/docs/toolkit_final_website.pdf

Ready, Set, Charge, California! A Guide to EV-Ready Communities, Association of Bay Area Governments. The guidebook provides public agencies throughout California with guidance on how to advance community PEV readiness. This guide provides standardized policies, ordinances and best-practices, providing a consistent framework for deployment of PEVs and charging infrastructure including information on signage, ADA compliance, permitting and other key matters. http://baclimate.org/wp-content/uploads/2015/10/Ready-Set-Charge-California-EV-Communities-Guide.pdf

Siting and Design Guidelines for Electric Vehicle Supply Equipment, U.S. DOE Clean Cities, Transportation and Climate Initiative, and Georgetown Climate Center. These guidelines offer addition design considerations, particularly detailed for location type, such as multi-unit dwellings, commercial lots, or on-street parking, carports, service stations and fleets. https://www.georgetownclimate.org/files/report/EV_Siting_and_Design_Guidelines.pdf

Plugging In: A Stakeholder Investment Guide for Public Electric-Vehicle Charging Infrastructure, Rocky Mountain Institute. This investment guide is designed to inform potential investors about the costs, revenues, and benefits of charging infrastructure. It presents some overarching conclusions while the accompanying model allows investors to examine the likely costs, revenues, and benefits for their specific investment scenario. http://www.10xe.orwww.10xe.org/Content/Files/Plugging%20In%20-%20A%20Stakeholder%20Investment%20Guide.pdf

7 Appendices

Appendix A
Applicable Policies and Regulations

National Park Service Design Standards and Management Policies. While EVCS-specific guidelines do not exist for U.S. National Park Service (NPS) permitting and installation, EVCS must abide by Electrical Engineering and numerous other requirements of its Design Standards and Management Policies. Applicable Management Policies consider lifecycle costs of installation and use, integration with the park environment and sensitivity to the landscape, preservation of cultural values, adaptive use of properties, sustainable design, ADA accessibility, siting, revegetation (as necessary), energy management and conservation, consistence with each park's general management plan and asset management plan, improvement to the visitor experience through ease of use, applicable franchise and commercial use fees, signage design and placement, and equipment maintenance by a third-party. EVCS must follow National Electric Code and National Electric Safety Code standards.

The NPS is working the U.S. Department of Energy's Clean Cities Coalition to increase EVCS at its sites nationwide. Some EVCS are free to use, while a third-party collects a fee at others. The installation process involves site selection review, design review, and permitting, and can take two to six months. Priority locations for EVCS installation are those with fewer EVCS already in the area, more PEV drivers who might utilize the equipment, and most conducive to NPS natural and cultural landscape considerations.

U.S. Bureau of Land Management and Forest Service Regulations, U.S. Code and Code of Federal Regulations. While the U.S. Bureau of Land Management (BLM) and U.S. Forest Service (USFS) do not have EVCS-specific installation guidelines, EVCS must abide by the U.S. Code and Code of Federal Regulations. Few EVCS have been installed on these federal lands; however, partnership with the U.S. Department of Transportation, state and regional visitors bureaus and third-parties may increase their success. The first EVCS installed on USFS land was at Mt. Hood National Forest, in partnership with the U.S. Department of Transportation, the local utility, the Office of the Governor, and a third-party manufacturer.

Zero and Near-Zero Emission Vehicle Plan. The California Air Resources Board's (ARB) Charge Ahead California Initiative was established to help place into service at least 1 million zero- and near-zero emission vehicles in California by January 1, 2023. As part of the Charge Ahead California Initiative, ARB, in partnership with the State Energy Resources Conservation and Development Commission, air districts, and the public, must:

- Develop a plan at least every three years that forecasts the funding needed to support zero- and near-zero emission vehicle adoption based on vehicle market conditions;
- Adopt revisions to the Clean Vehicle Rebate Project requirements to ensure that rebate levels can be phased down based on cumulative sales determined by ARB, eligibility is based on income, and other incentive methods will be considered to increase participation;
- Establish programs that increase disadvantaged, low-income, and moderate-income community and consumer access to electrified transportation, such as loan or loan-loss reserve programs, zero- and near-zero emission car sharing programs, additional incentives for vehicle replacements, and the installation of charging infrastructure in disadvantaged communities; and

- Require agricultural vanpool programs to allocate 25% of funds appropriated by the legislature to service low-income communities.

Plug-in Electric Vehicle (PEV) Parking Space Regulation. An individual may not park a motor vehicle within any on- or off-street parking space specifically designated by a local authority for parking and charging PEVs unless the vehicle is a PEV fueled by electricity. Eligible PEVs must be in the process of charging to park in the space. A person found responsible for a violation is subject to traffic violation penalties.

Volkswagen Group of America's (VW) Zero Emission Vehicle (ZEV) Investment Plan. The California Air Resources Board (CARB) approved the VW California ZEV Investment Plan. As required by the October 2016 2.0-Liter Partial Consent Decree, VW must invest $800 million over ten years to support the increased adoption of ZEV technology in California. VW will submit a series of four 30-month cycle ZEV investment plans to CARB for approval; EPA has approved the Cycle 1 plan, covering Quarter 1, 2017, through Quarter 2, 2019. The Cycle 1 plan includes building a basic charging network, launching a multi-lingual public outreach and education campaign, and beginning ZEV access projects. ZEV infrastructure rollouts will be focused in six metropolitan areas: Fresno, Los Angeles, San Francisco, San Jose, San Diego, and Sacramento. VW has also designated Sacramento as the first "Green City," with the goal of offering residents a better quality of life through enhanced mobility and improved air quality.

Plug-In Electric Vehicle (PEV) Charging Requirements. New PEVs must be equipped with a conductive charger inlet port that meets the specifications contained in Society of Automotive Engineers (SAE) standard J1772. PEVs must be equipped with an on-board charger with a minimum output of 3.3 kilovolt amps. These requirements do not apply to PEVs that are only capable of Level 1 charging, which has a maximum power of 12 amperes (amps), a branch circuit rating of 15 amps, and continuous power of 1.44 kilowatts.

Plug-In Electric Vehicle (PEV) Infrastructure Information Resource. The California Energy Commission, in consultation with the Public Utilities Commission, must develop and maintain a website (located at https://www.driveclean.ca.gov/pev/Related_Sites.php) containing specific links to electrical corporations, local publicly owned electric utilities, and other websites that contain information specific to PEVs, including the following:

- Resources to help consumers determine if their residences will require utility service upgrades to accommodate PEVs;
- Basic charging circuit requirements;
- Utility rate options; and
- Load management techniques.

Electric Vehicle Supply Equipment (EVCS) Policies for Multi-Unit Dwellings. A common interest development, including a community apartment, condominium, and cooperative development, may not prohibit or restrict the installation or use of EVCS in a homeowner's designated parking space. These entities may put reasonable restrictions on EVCS, but the policies may not significantly increase the cost of the EVCS or significantly decrease its efficiency or performance. If installation in the homeowner's designated parking space is not possible, with authorization, the homeowner may add EVCS in a common area for their use. The homeowner must obtain appropriate approvals from the common interest development association and agree in writing to comply with applicable architectural standards, engage a licensed installation contractor, provide a certificate of insurance, and pay for the electricity usage associated with the

EVCS. Any application for approval should be processed by the common interest development association without willful avoidance or delay. The homeowner and each successive homeowner of the parking space equipped with EVCS is responsible for the cost of the installation, maintenance, repair, removal, or replacement of the station, as well as any resulting damage to the EVCS or surrounding area. The homeowner must also maintain a $1 million umbrella liability coverage policy and name the common interest development as an additional insured entity under the policy. If EVCS is installed in a common area for use by all members of the association, the common interest development must develop terms for use of the EVCS.

Electric Vehicle Supply Equipment (EVCS) Policies for Residential and Commercial Renters. The lessor of a dwelling or commercial property must approve written requests from a lessee to install EVCS at a parking space allotted for the lessee on qualified properties. Certain exclusions apply to residential dwellings and commercial properties. All modifications and improvements must comply with federal, state, and local laws and all applicable zoning and land use requirements, covenants, conditions, and restrictions. The lessee of the parking space equipped with EVCS is responsible for the cost of the installation, maintenance, repair, removal, or replacement of the equipment, electricity consumption, as well as any resulting damage to the EVCS or surrounding area. The lessee must also maintain a $1 million umbrella liability coverage policy and name the common interest development as an additional insured entity under the policy.

Zero Emission Vehicle (ZEV) Promotion Plan. Under Governor Edmund G. Brown Jr. Executive Orders B-16-12 and B-48-18, the State is prioritizing the widespread deployment of zero emission vehicles. Specifically, all state agencies must support and facilitate the rapid commercialization of ZEVs in California. In particular, the Air Resources Board, Energy Commission (CEC), Public Utilities Commission, and other relevant state agencies must work with the Plug-in Electric Vehicle Collaborative, the California Fuel Cell Partnership, and the private sector to establish benchmarks to achieve targets for ZEV commercialization and deployment. These targets include:

- By 2020, the state will have established adequate infrastructure to support one million ZEVs;
- By 2025, there will be 1.5 million ZEVs on the road in California and clean, efficient vehicles will displace 1.5 billion gallons of petroleum fuels annually;
- By 2025, there will be 200 hydrogen fueling stations and 250,000 plug-in electric vehicle (PEV) chargers, including 10,000 direct current fast chargers, in California;
- By 2030, there will be 5 million ZEVs on the road in California; and
- By 2050, greenhouse gas emissions from the transportation sector will be 80% less than 1990 levels.

State agencies must also work with their stakeholders to accomplish the following:

- Update the 2016 ZEV Action plan, with a focus on low income and disadvantaged communities;
- Recommend actions to increase the deployment of ZEV infrastructure through the Low Carbon Fuel Standard;
- Support and recommend policies that will facilitate the installation of PEV infrastructure in homes and businesses; and
- Ensure PEV charging and hydrogen fueling are affordable and accessible to all drivers.

The ZEV promotion plan additionally directs the state fleet to increase the number of ZEVs in the fleet through gradual vehicle replacement. By 2020, ZEVs should make up at least 25% of the fleet's light-duty vehicles. Vehicles with special performance requirements necessary for public safety and welfare are exempt from this requirement. For more information about the plan, see CEC's Zero-Emission Vehicles and Infrastructure Update.

Electric Vehicle Supply Equipment (EVCS) Open Access Requirements. EVCS service providers may not charge a subscription fee or require membership for use of their public charging stations. In addition, providers must disclose the actual charges for using public EVCS at the point of sale; allow at least two options for payment; and disclose the EVCS geographic location, schedule of fees, accepted methods of payment, and network roaming charges to the National Renewable Energy Laboratory. Exceptions apply.

The California Air Resources Board may adopt interoperability billing standards for network roaming payment methods for EVCS. Providers would be required to meet these standards within one year of adoption.

Electric Vehicle Supply Equipment (EVCS) Local Permitting Policies. A city or county with a population of less than 200,000 residents was required to adopt an ordinance that creates an expedited, streamlined permitting process for EVCS by September 30, 2017. Each city or county was required to consult with the local fire department or district and the utility director to develop the ordinance, which must include a checklist of all requirements for EVCS to be eligible for expedited review. A complete application that is consistent with the city or county ordinance must be approved, and entities submitting incomplete applications must be notified of the necessary required information to be granted expedited permit issuance.

Appendix B
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.

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)	

☐ **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

☐ ELECTRIC VEHICLE CHARGING STATION INSTALLATION GUIDELINES

☐ COMPLETED ELECTRICAL LOAD CALCULATIONS PER CEC[1] 220

1) Based on the load calculation worksheet, is a new electrical service panel upgrade required[2]? Yes ☐ No ☐

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[1] 2016 California Electrical Code. Article 220 Branch-Circuit, Feeder, and Service Calculations

[2] **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.

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 ☐

COMPLIANCE WITH 2016 California Green Building Standards Code (CALGreen) FOR NEW CONSTRUCTION[3] (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)

[3] 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

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)		

☐ 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.

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

☐ COMPLETED ELECTRICAL LOAD CALCULATIONS PER CEC[4] 220

[4] 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[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 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 ☐

[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.

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

2016 CALGreen Mandatory EVCS Requirements for New Construction[6]

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[7]

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 ☐

[6] 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*
[7] 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.