California Energy Commission
San Joaquin Valley Air Pollution Control District

San Joaquin Valley Plug-In Electric Vehicle Coordinating Council

Date: Monday, June 10, 2013
Time: 1:30 p.m. – 3:30 p.m.
Location: SJVAPCD Fresno Office
1990 E. Gettysburg Ave.
Fresno, CA 93726

Teleconference information: Call-in: 646-364-1285 Access Code: 6619701

Video Teleconferencing at the following locations:

Modesto	Bakersfield
4800 Enterprise Way	34946 Flyover Court
Modesto, CA 95356	Bakersfield, CA 93308

June 10, 2013 Meeting Agenda (+ next to an item indicates an attachment)

1. Welcome and Introductions (Nhia Vu, SJVAPCD)

2. Announcements and Public Comments (All)

+3. Summary of May 2, 2013 Meeting (Tyler Petersen, CCSE)
   A. Workplace Charging

   B. Updating Building Codes for EVSE

4. EVSE 101 (SJVPEVCC members and Tyler Petersen, CCSE)
   - Presentation on EVSE charging protocols, charging networks and available resources
   - SJV PEVCC member feedback and discussion

+5. Regional PEV Readiness Plan Development (SJVPEVCC members and Tyler Petersen, CCSE)
   A. EVSE at Multi Unit Dwellings (MUDs)
      - MUD definition and regional barriers to deployment of EVSE at MUDs
      - SJV PEVCC member feedback and discussion
   B. EVSE Installation & Inspection Guidelines
      - Review installation guidelines from the U.S. Department of Energy PEV Handbook
      - SJV PEVCC member feedback and discussion

6. Barrier topics for July 2013 meeting (SJVPEVCC members and Tyler Petersen, CCSE)
   A. Public agency EVSE installations
   B. Regional planning for public EVSE siting
   C. Plans to attract PEV manufacturing, production, infrastructure and services of PEV development in region

The next SJV PEVCC meeting will need to be scheduled

San Joaquin Valley Plug-in Electric Vehicle Coordinating Council

May 2, 2013 MEETING SUMMARY

ATTENDEES:

Video Teleconference (VTC): Fresno (Central), Modesto (North) and Bakersfield (South)

Central Office Attendees:				
City of Clovis	**City of Clovis**	**City of Visalia**	**Fresno COG**	**Merced County**
Kendall Cook	Andy Haussles	Betsy McGovern-Garcia	Lauren Dawson	Jeff Fugelsang
PG&E	**SJVAPCD**	**SJVAPCD**	**SJVAPCD**	**SJVAPCD**
Bob Riding	Nhia Vu	Colette Kincaid	Juan Cano	Lisa Van de Water

North Office Attendees:	
City of Stockton	**Stanislaus County Association of Governments**
David Stagnaro	Arthur Chen
Stanislaus County Association of Governments	
Mike Costa	

South Office Attendees:
SJV Clean Cities/Kern COG
Linda Urata

Conference Call Attendees:				
CCSE	**CCSE**	**Charge Point**	**Turlock Irrigation District**	**Tulare Irrigation District**
Tyler Petersen	David Almeida	Kumar Gogineni	Chris Polley	Jason Waters

San Joaquin Valley Plug-in Electric Vehicle Coordinating Council

Agenda Notes:

ITEM #1: WELCOME AND INTRODUCTIONS

Nhia Vu, San Joaquin Valley Air Pollution Control District (SJVAPCD), welcomed the group to the fourth San Joaquin Valley Plug-in Electric Vehicle Coordinating Council (SJVPEVCC) meeting. Ms. Vu opened up the meeting for introductions for all attendees on the phone as well as those at the Fresno, Modesto and Bakersfield District offices.

ITEM #2: ANNOUNCEMENTS AND PUBLIC COMMENTS

There were no announcements or public comments.

ITEM# 3: SUMMARY OF APRIL 4, 2013 MEETING

A. Climate Action Plan, Sustainability Action Plan & Adaption Plan follow up

Tyler Petersen, California Center for Sustainable Energy (CCSE), commented that PEV planning best practices and policies are available in the agenda. The best practices include policy examples that promote PEV adoption in local regional climate action plans, sustainability action plans and general plan updates. Mr. Petersen encouraged the PEVCC to use this document if jurisdictions are currently drafting or updating local action or general plan updates.

PEVCC members provided the following comments:

- Bob Ridding, Pacific Gas & Electric (PG&E), commented that the City of Fresno is working on the 2035 General Plan Update which will likely include EVSE-friendly language.
- Dave Stagnaro, City of Modesto, thanked CCSE staff for providing the climate action plan examples for PEVs. Mr. Stagnaro forwarded the PEV-friendly examples to the consultant group drafting Modesto's Climate Action Plan.
- Linda Urata, Kern County COG/SJV Clean Cities, commented that Kern County and five cities within Kern County have begun working on Energy Action Plans, which include language for PEVs. Kern COG is currently working on its Sustainable Communities Plan to include PEV policies.
- Betsy Garcia, City of Visalia, will include language in the city's Climate Action Plan to physically install charging stations. This will include the total number charging stations and the locations, in additional to general PEV-friendly policies. Ms. Garcia will distribute Visalia's CAP when finalized.

B. Lack of Public Knowledge of PEV and EVSE

Mr. Petersen commented that PEVCC feedback and edits have been incorporated into the San Joaquin Valley PEV education and outreach presentation. The updated presentation includes text in the notes section of each slide to assist presenters, and slides on the history and background of the electric vehicle industry. A PowerPoint and PDF copy are available on the *Plug-in & Get Ready* website, www.energycenter.org/pluginready.

PEVCC members provided the following comments:

- David Almeida, CCSE, discussed offering a "train-the-trainer" webinar for PEVCC members on the PEV education and outreach presentation.
- Mr. Stagnaro commented that it would be better to offer a single presentation from a knowledgeable source and then disseminate that through the region. Jeff Fugelsang, County of Merced, supported the idea of an audio presentation.
- Ms. Urata agreed that an audio recording would be most beneficial. Ms. Urata also offered to give the presentation to groups in the southern San Joaquin Valley.
- Mr. Ridding asked if the presentation will be tailored to the San Joaquin Valley region. Mr. Ridding also asked if the SJV PEVCC could coordinate with other regional PEV coordinating councils' outreach efforts.
- Mr. Petersen replied that the presentation is region-specific and will contact other PEVCC's to discuss coordinating outreach efforts.

ITEM #4: COMMERCIAL PERMITTING

Mr. Petersen reviewed the draft document from the California Zero-Emission Vehicle (ZEV) Readiness Guidebook: "Retail and Public Sector Charging" document. This document was created by the Governor's Office of Planning and Research (OPR). Mr. Petersen stated that the group's goal will be to add or modify the recommendations included in the retail and public sector charging document.

PEVCC members provided comments to the following OPR recommendation:

Permitting agencies should create similar or duplicate permitting applications for workplace and retail charging installations.

- Ms. Garcia commented that City of Visalia, to her knowledge, has not developed a permitting process for either workplace or retail EVSE installations. Ms. Garcia will clarify the permitting process with the city's building division, but she suspects that for each EVSE installation, an electrical permit would be needed.
- Mr. Fugelsang commented that permits for either EVSE installation scenario would go through building department with Merced County. Mr. Fugelsang supported having the same permitting application for workplace and retail charging installations.
- Lisa Van de Water, SJVAPCD, stated that modifications may have to be made between the two installations with jurisdictions that have parking lot design standards. She added this would affect permitting procedures for retail EVSE installations, but not necessarily workplace installations. She continued that installed signage may be reviewed for retail installations.
- Ms. Garcia commented that by recommending the jurisdiction create a similar or duplicate application, this gave jurisdictional staff flexibility when creating permitting processes.
- Kumar Gogineni, ChargePoint, recommended that both permitting processes as simple as possible.
- Mr. Fugelsang commented that Merced County's parking guidelines are the same for workplace and retail locations, so a similar application would make sense.
- Ms. Urata commented that a single application would be most useful.
- Kendall Cook, City of Clovis, commented that signage for PEV parking would be considerably different for private workplace locations as opposed to publically-available retail locations.

- Mr. Gogineni commented that cities with online permitting for all EVSE installations are much easier and convenient.
- Mr. Stagnaro asked if the installed EVSE is UL certified and meets current safety and electrical guidelines.
- Mr. Gogineni responded that all the charging stations are generally UL certified.
- Mr. Stagnaro added that the UL certification will clarify concerns for building officials inspecting EVSE installations.

PEVCC members provided comments to the following OPR recommendation:

Local Governments can provide information about payments and financing options for retail charging

- Mr. Gogineni commented information on payments or financing options for retail charging should not be provided by local governments. He added that this is the responsibility of the retailers that provide the charging.
- Andy Haussles, City of Clovis, commented that jurisdictions should not be responsible for providing this information. He added that jurisdictions could provide a website created by a third-party that housed EVSE payment and financing information.

ITEM #5: REGIONAL PEV READINESS PLAN DEVELOPMENT

A. Workplace Charging

Mr. Petersen reviewed the draft document from the California Zero-Emission Vehicle (ZEV) Readiness Guidebook: "Workplace Charging" document.

PEVCC members provided comments to the following OPR recommendations:

Contact pertinent permitting agencies and obtain all pertinent building and use permits. Identify special local fire, construction, environmental, or building requirements. Obtain all applications. Determine additional permitting costs. Determine site plan requirements. Hire the prime contractor and verify contractor subcontractor credentials.

- Mr. Fugelsang commented that workplace charging and commercial EVSE sites that are publically available would fall under the same permitting requirements.
- Mr. Ridding commented that PG&E does not want to slow down the permitting process for commercial or workplace EVSE installations, but would like all customers to be informed of the tariff structure and potential rate impacts for offering EV charging.
- Mr. Haussles stated that more detail needs to be provided for employers. He mentioned examples of accessibility and how to apply for grant funding as needing more detail.
- Jasna Tomic, Calstart, commented that Calstart is leading a working group addressing workplace charging. Ms. Tomic suggested that a detailed workplace charging fact sheet would be more beneficial, but provide citations.
- Ms. Urata commented that local fire and construction codes would be handled by local building departments.

- Mr. Stagnaro commented that most regional jurisdictions have a common set of fire and building codes without much variation. Local amendments or additions to the building codes may exist and should be made available by regional jurisdictions.
- Mr. Fugelsang agreed with Mr. Stagnaro's comment and added that three cities within the Merced County and the County itself, all contract with California Fire, and would share the same fire and building codes.
- Mr. Stagnaro commented that workplaces interested in charging would benefit from a simple application process, which would possibly reduce permit fees.

The group recommends that OPR provide a simple permitting template for workplace charging installations. In turn, adoption of this simple permitting process would reduce review times and streamline the process. Additionally, the group recommends that local jurisdictions waive the permit fees to spur EVSE adoption.

B. Updating Building Codes for EVSE

PEVCC members provided comments to the following OPR recommendations:

Review traffic, pedestrian flow, parking requirements, and applicable ADA compliance issues

- Ms. Garcia commented that smaller installation projects (e.g. one EVSE installation) would not require a plan check review. She added that larger projects, with multiple EVSE installations may trigger a plan check procedure where the traffic, pedestrian flow and parking requirements are reviewed.

Mr. Petersen reviewed the building codes section from the San Joaquin Valley PEV Readiness Assessment (December 2012). CCSE will forward the group comments to Energy Solutions, the contractor working on California Building Code and Title 24 updates for EVSE.

PEVCC members provided comments to the following SJV PEV Readiness Assessments recommendations:

Modify Existing Use/Discretionary Permitting Processes to Include EVSE (near-term)

Adopt/Update Prewiring for EVSE in Residential and Nonresidential New Construction (long-term)

Specific code recommended code language:

> *For NONRESIDENTIAL AND RESIDENTIAL PROJECTS, include a space dedicated in the electrical panel for a circuit for plug-in electric vehicle charging; and a label stating "PEV CAPABLE" shall be posted in a conspicuous place at the service panel or subpanel and next to the raceway termination point. (Language adapted from County of San Diego and CALGreen Voluntary Building Code A4.106.6.1.1)*
>
> *For NONRESIDENTIAL PROJECTS, ensure each parking space required in the table below, provide panel capacity and dedicated conduit for one 208/240 V 40 amp circuit terminating within 5 feet of the midline of each parking space. (Language adapted from CALGreen Voluntary Building Code A5.106.5.3.1)*

For NONRESIDENTIAL PROJECTS, ensure each parking space required in the table below, provide panel capacity and dedicated conduit for one 208/240 V 40 amp circuit terminating within 5 feet of the midline of each parking space.

Table 1:

Total Number of Parking Spaces	***Number of Required PEV Spaces***
1 – 50	**1**
51 – 200	**2**
201 and over	**4**

For RESIDENTIAL PROJECTS (e.g. planned subdivisions), provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), in both single-family and multifamily unit dwellings. The outlet(s) shall be located in the parking area and have a minimum of the following:

- ✓ *Single-Family Dwellings: 1 per unit*
- ✓ *Multifamily Unit Dwellings: 5% of parking capacity*

- Ms. Urata asked if EVSE code language will be required in the CALGreen codes. Ms. Urata also commented that she had no issues with the recommended code language.
- Mr. Haussles, City of Clovis, asked for clarification of the definition of "PEV CAPABLE" where the panel has adequate electrical capacity.
- Mr. Stagnaro commented that for nonresidential projects, the electrical capacity for a 208/240 V 40 amp circuit would require a double pull breaker instead of a single pull breaker.
- Mr. Stagnaro added that for larger nonresidential or commercial projects, only one dedicated EVSE space be sufficient.
- Ms. Garcia agreed with PEV parking space ratio in Table 1, and would not recommend an increase.
- Mr. Stagnaro also agreed with the PEV parking space ratio and cautioned that a higher number or may receive pushback in the region. Ms. Urata also agreed that the ratio were sufficient.
- Mr. Fugelsang commented that to require one EVSE unit in new residential projects would be too aggressive in the region. He added that by the time local residents adopt the technologies, the dedicated outlets may be outdated.
- Mr. Fugelsang commented that 5% of PEV parking capacity in a MUD would be sufficient for developments with shared parking. He added that shared parking (publically available parking) would likely increase EVSE adoption and usage.
- Ms. Garcia asked if information existed on the cost savings for EVSE installation projects with conduit already installed.
- Ms. Urata commented that a 5% PEV parking capacity for MUD sites is not practical. This is due to the issues of EVSE ownership and shared electricity costs.
- Mr. Fugelsang noted that it may be appropriate to have the EVSE units in a common-use space instead of dedicated parking space.
- Lauren Dawson, Fresno Council of Governments, commented that her organization does not take a position on local building codes as land-use issue handled by local jurisdictions.
- Ms. Urata commented that Kern Council of Governments focuses on transportation planning as opposed to land-use planning.

- Mr. Stagnaro recommended that based on the region's expected percentage of PEV ownership in the state by 2025, the group could use the expected population of the San Joaquin Valley region will by 2025 and configure a set ratio for EVSE "pre-wired" units for single-family homes and MUDs to meet PEV demand.
- Ms. Dawson commented that the Fresno COG develops a housing needs assessment in the region. She added that the regional transportation plan for 2040, the modeling accounts for future land-use and transportation planning, fleet assessments and demographic changes.
- Mike Costa, Stanislaus County Association of Governments, commented that his organization has worked with local jurisdictions to utilize their General Plan Update to conduct regional housing assessments.
- Mr. Fugelsang asked for a definition of a MUD. Mr. Fugelsang noted there are no buildings that are three stories or higher in Merced County.
- Mr. Petersen replied he will follow up with a formal MUD definition.
- Mr. Stagnaro encouraged that staff focus on the California Department of Finance statistics for regional housing forecasts.

Challenges to Installing Chargers in Multi-Unit Dwellings

Source: California Center for Sustainable Energy, www.energycenter.org/pluginready

Multi-unit dwelling (MUD) is a generic term for a spectrum of multi-unit residences including but not limited to apartment buildings, attached and detached housing units within a community, high rise buildings, mobile home communities and others. Installing an electric vehicle charging station in a MUD presents a number of barriers.

Barrier	Description
Cost	Installation costs can range anywhere from $2,000 to $10,000. A building that has sufficient panel capacity and an existing conduit running from the panel to the PEV parking space will likely only incur charging station, permit, and electrician installation/assessment costs, resulting in a lower cost installation. On the other hand, a building with limited panel capacity, no conduit, and a parking space located a significant distance from the electrical panel, will likely incur higher installation costs.1
Power Supply	The charging load of PEVs range from 3.3 kW, similar to a large household appliance or Nissan LEAF, up to 6.6 kW, similar to a Ford Focus Electric. Large scale adoption of PEVs will inevitably require increases in transformer capacity. Transformers supplying multifamily buildings typically have 10% to 15% excess capacity, or overhead, which is enough to sustain a few electric vehicles. However, as PEV adoption grows and vehicles are equipped with higher charging loads, these transformers may be insufficient to handle wide scale conversion to electric vehicles.2
Proximity to Metering Equipment	Service panels for MUDs can be located at substantial distances from where the charging station is to be installed.3
High Rise Units	Generally in high rise units, meter rooms are often located on the upper floors of the building and conduit space is limited. Challenges are faced in installing additional conduit and/or encountering physical limitations (e.g., drilling through concrete floors).4
Parking	Parking is not standard across MUD building types. In some MUDs parking is bundled into the rent or sale price of the unit. In other buildings it is unbundled or paid for separately. Unbundled parking spaces can be assigned on a first-come first-serve basis, or they can be unassigned. A charging station tied to a bundled parking space could be added value to a future tenant; however, a charging station on an unbundled or unassigned spot may pose challenges for assigning costs to individual owners. Choice of spaces also must address issues with proximity to metering equipment as addressed above.5
Electricity Rates and Meters for Common Areas	Parking garages/lots are typically on a common meter. This means, electricity provided in parking garages and other common areas is paid by the property manager or homeowner

	association (HOA) and then billed to residents through HOA fees or rent. This creates a challenge in allocating charging costs to individual owners.[6]
Homeowner Associations (HOAs)	HOAs cannot prohibit or restrict the installation of a PEV charging station. Senate Bill 880 codified this and other provisions for charging installations in common areas. However, HOA boards may still resist installations. Lack of information regarding charging station installations remain a significant barrier.

1. Peterson, David. Addressing Challenges to Electric Vehicle Charging in Multifamily Residential Buildings June 2011, UCLA Luskin School of Public Affairs.
2. Ibid.
3. Bianco, James S. Power Share System for Electric Vehicle Service Equipment, 2012.
4. Pointon, Joel, SDG&E. Clean Cities US Department of Energy, Electric Vehicle Spring 2011 Quarterly Discussion webinar presented on March 28, 2011.
5. Peterson, David. 2011.
6. Pointon, Joel. 2011.

Charging and Permitting in Multi-Unit Dwellings

Snapshot: Multi-unit dwellings (MUDs), which include apartment and condominium buildings, make up a significant percentage of the housing stock in many California jurisdictions. As such, they represent a large potential source of PEV adoption in the future since most charging occurs at home. Identifying clusters of MUDs and understanding their proportion of the land use mix within a local jurisdiction will help planners target PEV readiness priorities to this housing type.

Background: Many multi-unit EVSE installations are straightforward and very similar to commercial installations. However, some are complicated by physical space or electric distribution limitations, or by ownership and management issues. The physical challenges faced by MUD residents, owners and management groups include:

- **Limited parking**: In most multi-family complexes, especially older ones, parking spaces are at a premium and there may not be room to install charging stations.
- **Long distance between utility meters, parking spaces and unit electrical panels**: A new 208/240V PEV charging circuit requires connection between the charger location and the tenant's or building owner's electrical panel. In MUDs, the electrical panel may be in the residential unit and located hundreds or even thousands of feet from the parking area.
- **Inability to take advantage of off-peak charging rates**: A new meter and utility service may be required to take advantage of off-peak PEV charging rates. Since most multi-family units have meters that are clustered together in a central location, there may not be space to add another meter.
- **Limited electrical capacity**: Older buildings typically have limited electrical capacity. AC Level 2 chargers typically require a minimum of a 40 amp circuit. Some may work on a 20 amp circuit. Individual units in older apartments or condominium may have only a 60 amp service or less. Upgrading electrical capacity may be very costly and may also trigger requirements to bring the property up to today's building codes.
- **Variable costs associated with installation**: Costs for MUD installations are largely determined by existing electrical capacity and distance from the electrical panel to the parking space. Cost mitigation strategies can include placement of charging equipment in guest parking spaces or other common areas. While these high costs can be significantly reduced if EVSE capacity is included in the construction phase, other approaches must be considered for existing buildings.

The National Electrical Code requires electrical capacity for charging equipment to reflect the full load charging capability of the equipment, plus an additional 25% capacity buffer, in order to prevent circuit overload. If multiple charging stations are installed, planners and utilities have historically had to assume that all might be in use simultaneously when determining electrical needs. However, the need to upgrade electrical panels in existing buildings may be reduced by the use of energy management software, which can monitor and regulate the additional load

brought by PEV charging. A tentative interim amendment to the National Electrical Code has been issued, allows the maximum electric vehicle supply equipment load on a service panel or feeder to reflect the maximum load permitted by an automatic load management system. To view this amendment, please visit the NFPA website.

Other difficult issues surrounding installing EVSE in multi-unit dwellings relate to the governance structure of these properties. Rental units are controlled by property managers or property owners. Condominiums and townhomes often have Homeowners' Associations (HOAs) with elected Boards of Directors and contracts that govern the use of both private and common area space. Installing charging units at the deeded or assigned parking spaces may be physically impossible or impractical, requiring alternative options such as use of visitor parking, common space or other options. Any of these options will require approval by property managers and homeowners' associations.

The rights and responsibilities of HOAs and PEV owners for charging in common-interest developments (condominiums, co-ops and other ownership MUDs) are outlined under California law by Senate Bill 880, which was signed February 29, 2012. The law provides a basic framework for resolving challenges to PEV charging posed by HOAs. Note that Senate Bill 880 does not apply to apartment buildings.

The basic purpose of this law is to ensure that PEV drivers are not unreasonably prohibited from installing a charging station, either in their deeded or designated parking spaces or in common areas. HOAs must allow charging in common areas only if installation in the PEV owner's deeded or designated space is impossible or unreasonably expensive. If a driver has exclusive use of a charging station in a common area, HOAs must then enter a license agreement with the PEV driver, who must meet the following conditions:

- The charging station meets all applicable health and safety standards as well as all other applicable zoning, land use or other ordinances, or land use permits
- The charging station meets all applicable measurement standards pursuant to the Business and Professions Code, Division 5.
- The charging station complies with the association's architectural standards for the installation of the charging station
- A licensed contractor is engaged to install the charging station.
- Within 14 days of approval, provide a certificate of insurance that names the association as an additional insured party under the owner's homeowner liability coverage policy in the amount of $1,000,000 (except when existing wall outlets are used).
- Pays for the electricity usage associated with the charging station.

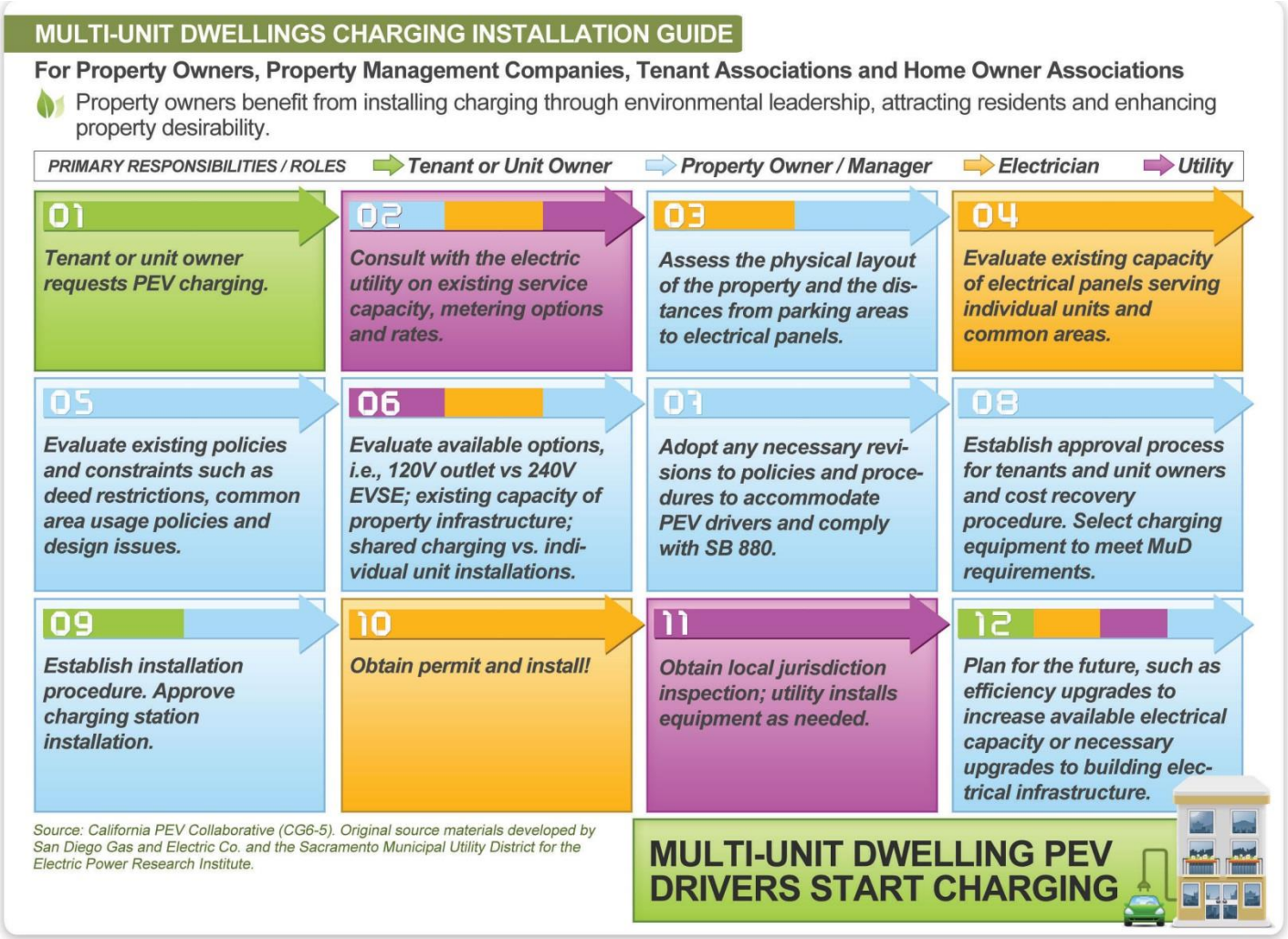
The HOA can also compel current and future owners of the charging station to pay for maintenance, repair or removal of the charging station and for any resulting damage to the station, common area, or exclusive use common area. Importantly, the law allows, without a full HOA member vote, a portion of the common area to be used for utility lines or meters to

support charging in a deeded or designated parking space. The provisions of this bill can be found in sections 1353.9 and 1363.07 of the Civil Code.

While many challenges exist to installing MUD charging, it is clear is that local governments can play a key role in solving these challenges. In some cases, the solutions may involve adjusting local regulations such as new construction codes to require pre-wiring of EVSE. However, in many situations, the most effective role of local government may be outreach to residents and property managers alike, about MUD permitting challenges and solutions. For an overview of how the MUD permitting process may look, please refer to the diagram below.

Recommended Actions:

- **For MUD Landlords or Owners:**
    - Poll residents to find out their current and future interest in PEVs. A survey is provided on the PEV Resource Center.
    - **Determine Parking Configuration for PEVs in MUD on case-by-case basis.** Multi-unit Dwellings come in a variety of configurations. Parking arrangements for these residential buildings are equally diverse, ranging from deeded to assigned parking to no parking at all. If AC Level 2 charging at a tenant's assigned parking space is not feasible, other possible PEV charging options include:
        - Equipment
            - Set up AC Level 1 charging (120 volt).
            - Install charging equipment that can serve more than one PEV.
            - Use charging stations with advanced technology to address issues such as electricity metering, billing and payment for electricity, and access by multiple users.
            - If electrical capacity is an issue, consider using an energy management system to control or limit simultaneous charging.
        - Location
            - Consider reassigning parking places so PEV drivers can park where it's cheapest to install charging.
            - Install EVSE in guest parking spaces.
            - Examine nearby municipal lots, business buildings or shopping malls for available overnight charging, and consider partnerships or agreements.
            - Suggest parking at on-street charging locations close by.
            - Provide or refer to alternative charging options such as workplace, public charging, DC fast charging or car sharing services.
        - Cost
            - Bundle the cost of electricity with the cost of parking.
            - Adopt energy efficiency measures to free up electrical capacity in the building.



- **For Local Governments:**
  - **Develop and deploy an EVSE permit checklist:** Develop and utilize an EVSE Permit Checklist that references all required elements for approval of a permit. This allows a permitting agency to determine if certain criteria are being met, such as proof of electrical capacity. It also highlights that MUD charging installation will vary depending on the specific case. For your assistance, a checklist template has been provided in the Template Section of the Guidebook.
  - **Fast-track approval of MUD EVSE projects:** As you may recall from the explanation of the "charging pyramid," home charging is essential for PEV Readiness. As such, local authorities may give priority to MUD permit

Case Study: San Diego Gas and Electric created an easy-to-understand guidance document for members in their community titled "Prepping for Plug-In Electric Vehicles at Condos, Townhomes, and Apartments. Learn more.

Note: Please email Ben.Rubin@opr.ca.gov about viewing the document in alternative formats

applications since these EVSE installations are necessary for home charging. In addition, MUD inspection approvals may be fast-tracked.

- **Develop written procedures to ensure early contacts with local utilities for MUDs**. Working cooperatively, local agencies and utilities are encouraged to develop procedures acceptable design and metering options.
- **Publish submittal and plan check requirements for EVSE projects**: Local agencies are encouraged to make informational materials available (for over-the-counter and online distribution) containing the requirements for EVSE permitting and installation.

Featured Resource: The California Plug-In Electric Vehicle Collaborative is currently working on a Multi-Unit Dwelling Guidelines publication, expected to be available for use in summer 2013. The Guidelines will also include information about MUD permitting and case studies. Once completed, this resource will be posted to the PEV Resource Center.

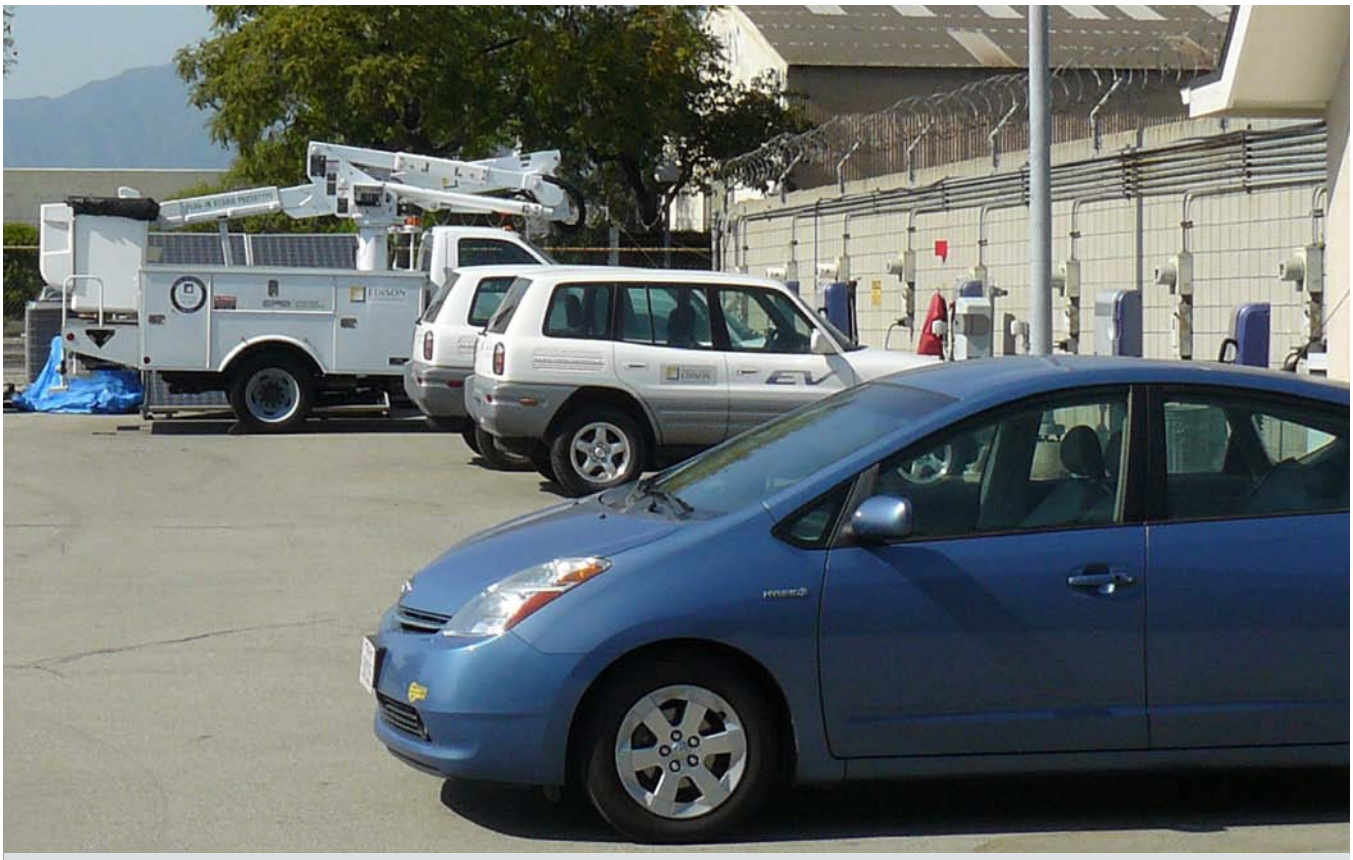
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Plug-In Electric Vehicle Handbook

for Electrical Contractors

Clean Cities

U.S. Department of Energy



Many fleets with PEVs will need electrical contractors to help install and maintain EVSE at fleet facilities. *Photo from Southern California Edison, NREL/PIX 19664*

Installing and Maintaining EVSE

EVSE installations range from simple to complex. This section provides a brief overview of the issues you will need to consider when installing EVSE, but it is not intended to be a comprehensive instructional guide. Before becoming involved with EVSE installations, you should receive training from a reliable organization (see *EVSE Training for Electrical Contractors* on page 18).

Complying with Regulations

EVSE installations must comply with local, state, and national codes and regulations. Appropriate permits may be required from the local building, fire, environmental, and electrical inspecting and permitting authorities.

You can learn about codes and standards typically used for U.S. PEV and infrastructure projects on the AFDC's Codes and Standards Resources page (*www.afdc.energy.gov/afdc/codes_standards.html*) and from EVSE training (see *EVSE Training for Electrical Contractors*). EVSE is considered a continuous load by the National Electrical Code (NEC). Knowledge and application of the current NEC is required for a safe and code-compliant installation. NEC Article 625 contains most of the information applicable to EVSE.

If possible, consult PEV manufacturer guidance for information about the required EVSE and learn the specifications before the customer purchases equipment and electric services.

In many areas, a site installation plan must be submitted to the permitting authority for approval before EVSE installation can proceed. A plan may require the proposed use and locations of elements, such as electrical system components, hazardous materials, EVSE, lighting, vehicle and pedestrian traffic flow, ventilation, signage and striping, safety and accessibility measures, and landscaping. Your customer may ask you to develop this plan.

Site Assessment and Planning

Thorough site assessment and planning by the electrical contractor and customer is essential to a successful EVSE installation. Following is a brief summary of the guidelines provided in Advanced Energy's *Charging Station Installation Handbook for Electrical Contractors and Inspectors*.

As the contractor, you should first assess the site characteristics and customer's charging needs. You can then assist the customer by making suggestions that will facilitate the installation process and by helping implement the suggestions. This includes contacting the utility, determining the current electrical service and upgrade requirements, and identifying all local regulations that apply to the installation (e.g., the permitting process and load calculation requirements). After helping with selection of appropriate EVSE and design of the charging site, you can prepare for installation via the following steps:

- ☐ Submit price quote for all work to customer and obtain customer approval
- ☐ Order necessary equipment (EVSE, wiring, breakers, panels, etc.)
- ☐ If necessary, have engineering calculations performed and stamped
- ☐ Complete site modification plan as necessary
- ☐ Apply and obtain approval for permit
- ☐ Complete service upgrade and/or new service assessment as necessary
- ☐ Coordinate work by all parties involved, including construction contractors and utility personnel
- ☐ Have utility infrastructure marked before installation begins (use "call before you dig" services)

General Installation and Inspection Process

Although installations will vary widely based on the type of site and user and the number and type of EVSE units, much of the installation and inspection process will be similar for all installations. These common steps, from Advanced Energy's *Charging Station Installation Handbook for Electrical Contractors and Inspectors*, are summarized below. See that document for additional details, requirements, and lessons learned.

- ☐ Post permit in visible location at site
- ☐ Excavate material to allow installation of wiring, conduit, and EVSE (remove drywall, insulation, pavers, concrete, etc., and perform hand digging, trenching, drilling, etc.)
- ☐ Run conduit from power source to station location (residential garages may not require conduit)
- ☐ Obtain rough inspection and correct deficiencies as needed
- ☐ Pull wires, including a neutral and a ground
- ☐ Prepare mounting surface per EVSE manufacturer instructions
- ☐ Mount EVSE
- ☐ Install impact-protection devices (e.g., bollards and/or wheel stops) as necessary
- ☐ Install electrical panels and sub-panels as necessary
- ☐ Have utility work performed as necessary, including new or upgraded service and/or meter
- ☐ Make electrical connection
- ☐ Obtain final inspection
- ☐ Verify EVSE performance
- ☐ Perform finish work

Residential Installations

Many PEV drivers will charge their vehicles overnight at home using Level 1 or Level 2 EVSE. Home-based EVSE frequently will be installed in garages, but outdoor installation and use are also safe, even if the PEV is being charged outdoors in the rain. Note that you can install indoor-rated EVSE in a garage, but outdoor installations require outdoor-rated EVSE. Charging at a multi-family residential complex requires additional considerations and may be more similar to public charging than to charging at a single-family home.

The NEC requires that all EVSE protect against shock, therefore Level 1 charging requires no special equipment installation if using a listed Level 1 charging cord and a properly installed 120-V outlet. This should be confirmed by a site assessment.

Level 2 charging requires the purchase and installation of Level 2 EVSE. It is best to install the Level 2 EVSE recommended by the manufacturer of the PEV that will use it.

Typically, home installation is relatively simple for homes that already have electrical service that can accommodate Level 2 EVSE. However, if an electrical service upgrade is required, the installation can be more complex. A site assessment and load calculation are required to make a proper and safe determination. This is important because many homes have 100-A service, and Level 2 EVSE can draw 30 to 80 A as a continuous load. Even a home with 200-A service may not have adequate power if the home has many other loads. An open slot in an electrical panel is not indicative of adequate service.

You and the customer should check with the electrical utility before installing EVSE or modifying the electrical system. Figure 6 summarizes the process for installing EVSE in a residential garage or carport. Also see page 12 for a home EVSE installation example in Raleigh, North Carolina.

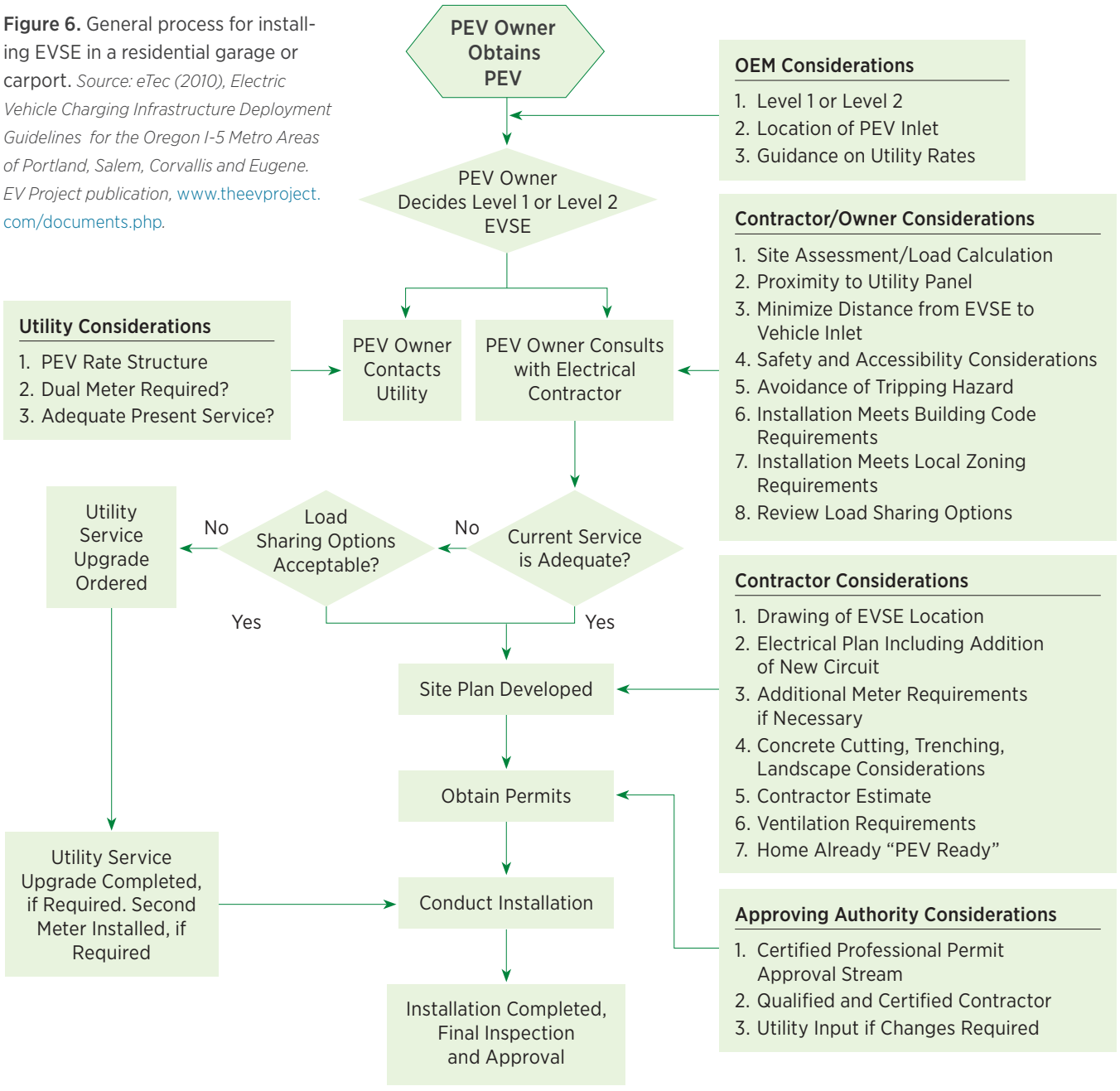


Figure 6. General process for installing EVSE in a residential garage or carport. *Source: eTec (2010), Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene. EV Project publication,* www.theevproject.com/documents.php.

Example Home EVSE Permitting and Installation Process: Raleigh, North Carolina

EVSE permitting and installation processes vary across states and municipalities. However, the key steps are similar in most areas that have planned for PEV introduction. Raleigh, North Carolina, is one of the nation's leaders in PEV deployment. Its entire assessment, permitting, installation, and inspection process for a simple home-based EVSE project can be completed in as few as two days (this time requirement varies substantially in other areas). The following is a brief description of the process. For additional examples, see the AFDC's Plug-In Hybrid and All-Electric Vehicle Deployment Case Studies (*www.afdc.energy.gov/plugin_case_studies*).

Step 1: Connecting Customers with EVSE Providers

PEV customers contact automakers, dealers, or their utility, which can provide a list of licensed electrical contractors to help with EVSE installation. For example, all Nissan Leaf purchases are facilitated through the Nissan Leaf website. The site sends information about Raleigh's Leaf customers to Nissan's EVSE provider, AeroVironment, and AeroVironment contacts the customers about EVSE options. As more vehicle choices enter the Raleigh market, the manufacturers of those vehicles likely will partner with EVSE providers to serve their customers.

Step 2: Assessing a Customer's Site

PEV customers can obtain a home assessment from an electrical contractor in an EVSE provider's preferred-contractor network (such as AeroVironment's network for Nissan Leaf customers) or any other licensed electrical contractor to determine whether the capacity of their electrical panel is adequate for installation of EVSE. Results of a survey by Raleigh's utility, Progress Energy, indicate that Level 2 EVSE could be installed in the majority of homes without upgrades to the homes' utility service. However, informing the local electric utility about EVSE installation is still essential.

Step 3: Getting a Permit

The licensed electrical contractor or EVSE customer/homeowner visits one of two City of Raleigh inspection centers to obtain a permit. The process to apply for and receive a permit takes approximately one hour and costs $74.

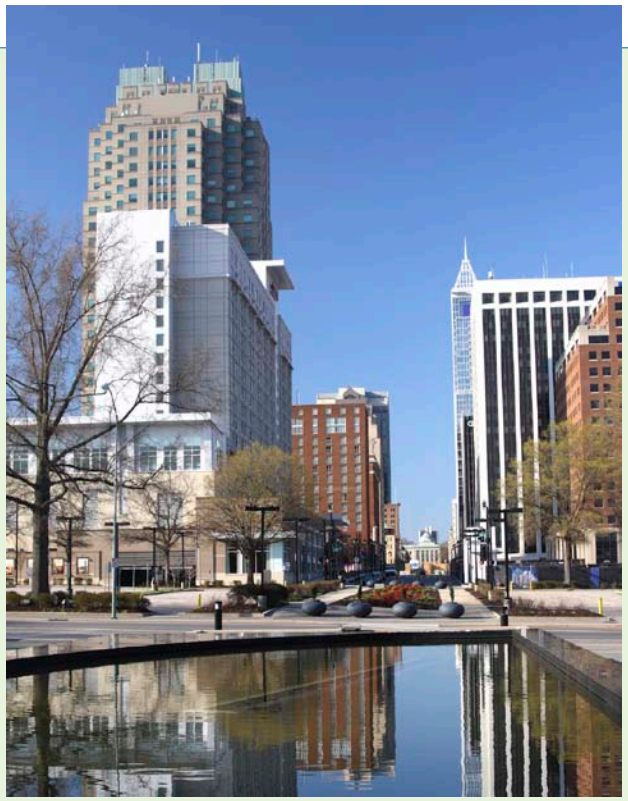


Photo from iStock/9350517

Step 4: Installing EVSE

The licensed electrical contractor installs the EVSE. In the cases in which a utility service upgrade is required, the electrical contractor or customer contacts Progress Energy to coordinate the upgrade. The customer can give authority to Progress Energy to work directly with the electrical contractor, which can expedite the process.

Step 5: Inspecting the Installation

The licensed electrical contractor or customer/homeowner calls the City of Raleigh to schedule an inspection. If the call is received by 4 p.m., the inspection is performed the next day. The EVSE is approved for use as soon as it passes the inspection.

Step 6: Connecting with the Grid

Progress Energy has been an active participant in Raleigh's PEV efforts. Through modeling and planning, it is confident that Raleigh's current grid can manage near-term EVSE-related demand. Residential electrical equipment, such as EVSE, is not metered separately, so energy used to charge a PEV is simply added to a customer's electricity bill. However, customers can opt into time-of-use electric rates on a whole-house basis, which could promote off-peak PEV charging.

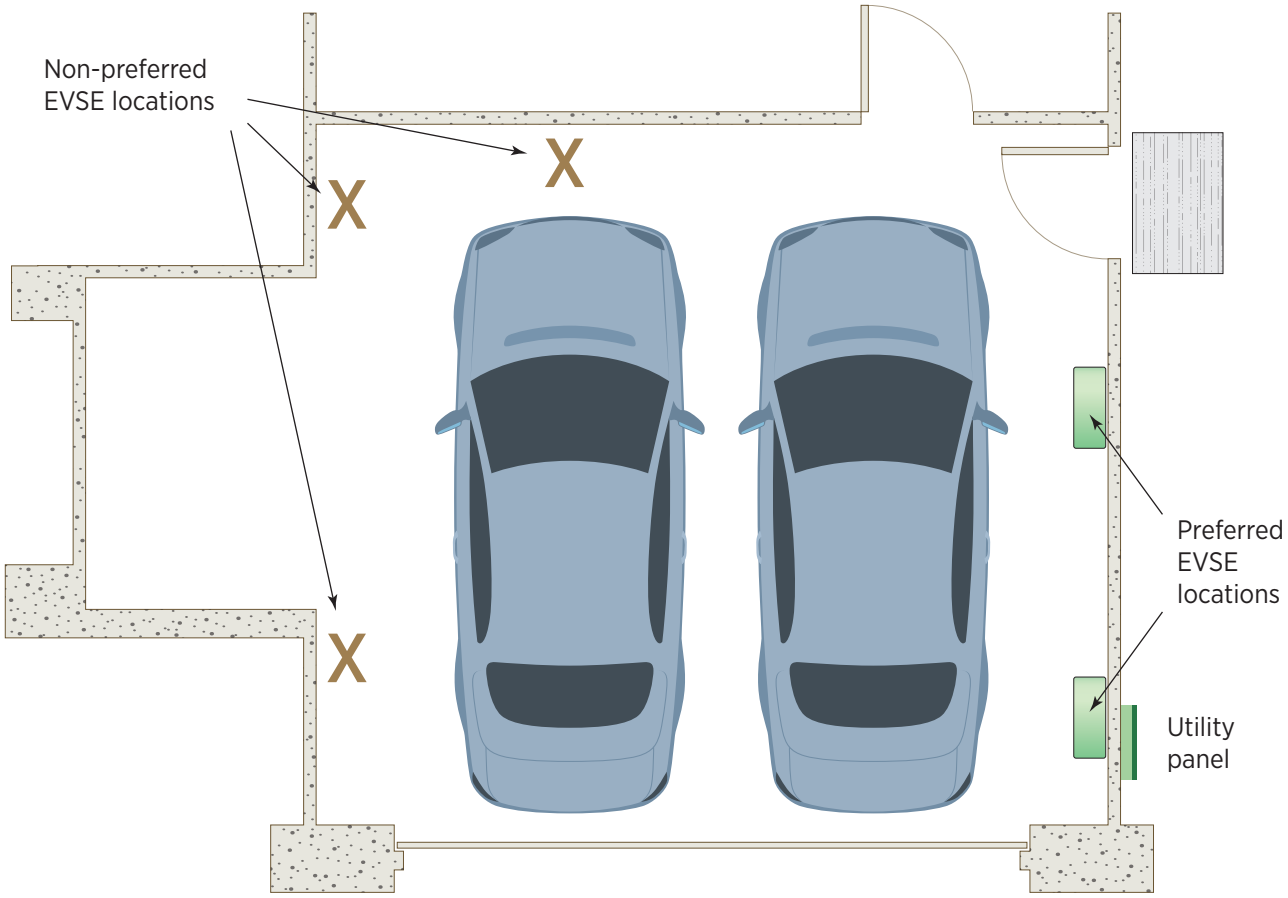


Figure 7. EVSE installation points to avoid tripping over the cord. *Source: eTec (2010), Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene. EV Project publication, www.theevproject.com/documents.php. Illustration by Dean Armstrong, NREL*

The safety risks of installing and using home EVSE are low but somewhat different than those associated with other large appliances like clothes dryers, because charging a PEV is a continuous load. The EVSE wall unit should be protected from contact with the vehicle—a wheel-stop can be useful for this purpose. The EVSE wall unit also should be positioned to minimize the hazard of tripping over the power cord. In general, this means keeping the cord out of walking areas (Figure 7) and positioning the wall unit as closely as possible to the vehicle's electrical inlet. Another option is to install a listed and labeled overhead support that keeps the cord off the floor. EVSE cords are built to withstand some abuse—even being run over by a car—and the power flow through the cord is cut off when the vehicle is not charging.

Non-residential Installations

A variety of non-residential locations can accommodate EVSE, including vehicle fleet facilities, businesses that offer charging to their employees, commercial parking lots and garages, retail stores, pay-for-use charging stations, and government-sponsored free charging stations. Figures 8 and 9 summarize the processes for installing fleet and public EVSE, and the following sections address some of the considerations related to installing and operating EVSE at non-residential facilities.[2]

2. These recommendations are primarily summarized from Pacific Gas and Electric's Electric Vehicle Supply Equipment Installation Manual (http://evtransportal.org/evmanual.pdf) and eTec's Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene (www.theevproject.com/documents.php). See those documents for additional details.

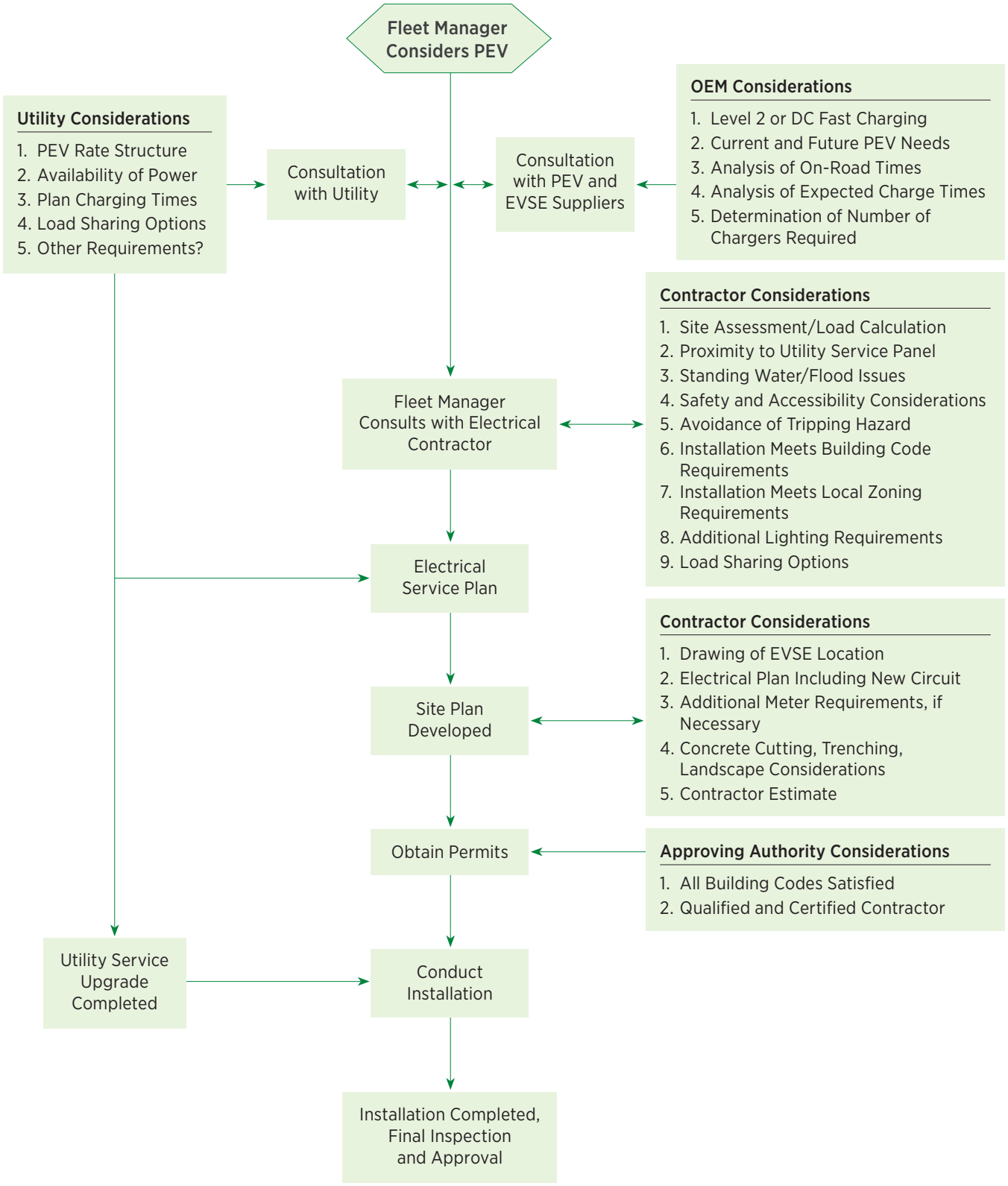


Figure 8. General process for installing EVSE at a fleet facility. *Source: eTec (2010), Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene. EV Project publication (www.theevproject.com/documents.php).*

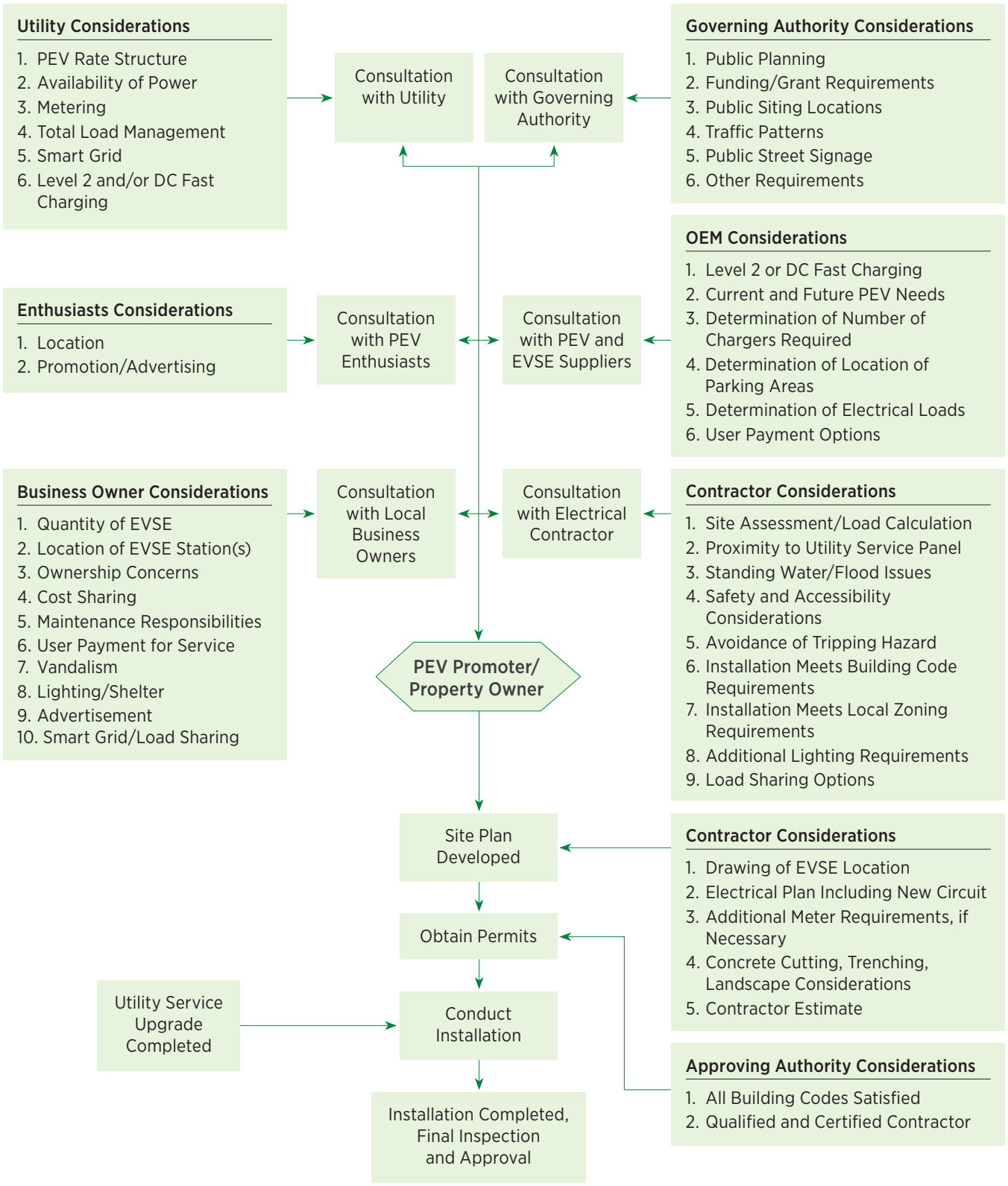


Figure 9. General process for installing EVSE at a public facility. *Source: eTec (2010), Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene. EV Project publication (www.theevproject.com/documents.php).*

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) INSPECTION CHECKLIST

Key Concerns for Electric Vehicle Supply Equipment Inspections
1. Is the appropriate permit secured and is there a plan and calculation as required by the AHJ?
2. What type of electric vehicle supply equipment (EVSE) is being installed (i.e. Level 1, Level 2, other)?
3. Where is the EVSE located in relation to the charging location and the service or supply source?
4. Is the EVSE listed by an NRTL and are the installation instructions available for reference?
5. Is the EVSE going to be cord-and-plug connected (and so listed) or direct wired to an individual branch circuit?
6. What amount of voltage and current is required for the type of EVSE (nameplate information)?
7. Is the EVSE securely mounted to the structure and individual branch circuit wiring installed per NEC?
8. Is the properly sized equipment grounding conductor connected and proper overcurrent protection provided?
9. Does the service or source have adequate capacity for the load served?
10. Are separate utility meter(s) and/or service disconnecting means installed for special utility rates?

INSPECTION CHECKLIST (non-inclusive)

EVSE Inspection Activity Details				
	Item	Inspection Activity	Code Reference	Comments
	1.	Verify permit is posted and all plans, calculations and installation instructions are available as required. May require use of examples in NEC Chapter 9. A calculation may be required to determine adequate capacity.	Local Regulations and NEC 90.8, 220.12, 220.14, 220.16, 220.82	
	2.	Verify that the EVSE is listed by an NRTL and installation instructions are provided.	NEC 90.7, 625.5, 110.3(B)	
	3.	Verify the EVSE location and that it is securely fastened to the structure and guarded from physical damage as required.	NEC 110.13, 110.27(B), 625.29, 625.30	
	4.	Determine if EVSE is directly wired to the branch circuit or is cord-and-plug connected. Must be listed for cord-and-plug connection. Individual receptacle reqd.	NEC 110.3(B), 625.13, 625.18, 625.19, 625.29	
	5.	Verify an individual branch circuit is installed for the EVSE. Applies to Level 1, Level, 2, and fast chargers. Branch circuit and feeders (if applicable) must be sized 125% of nameplate current.	NEC Article 100 continuous load, 210.19(A)(1), 215.2(A), 625.21	
	6.	Verify installed branch circuit wiring method is listed and securely fastened to the structure. Listed wiring and fittings must be installed. Check fished and surface wiring.	NEC 300.11 and the applicable .30 section of article	
	7.	Verify the size of the branch circuit overcurrent protection is per nameplate and protects the conductors.	NEC 110.3(B), 240.4	
	8.	Verify circuit conductors are sized not less than 125% of EVSE nameplate current. Be sure that the conductor ampacity complies with the rating of the overcurrent protection.	NEC 210.19(A)(1), 215.2(A), 110.3(B), Table310.15(B)(16), 310.15(B).	
	9.	Verify properly sized equipment grounding conductor is installed with the branch circuit and connected at the EVSE and to panelboard or service. Verify the equipment grounding conductor is identified.	NEC 250.110, 250.112, 250.114, 250.120, 300.3(B), 250.119, 250.122.	

	10.	Check the electrical connections of the circuit conductors and equipment grounding conductor connections.	NEC 110.14, 250.148(A) Annex I	
	11.	Verify disconnecting means is provided and properly located for EVSE rated greater than 60 amperes and 150 volts.	NEC 625.23	
	12.	Verify installation of EVSE is in a neat and workmanlike manner.	NEC 110.12, NECA 1, NECA 413	
	13.	Verify existing service conductors are of adequate size. For Level 2 EVSE installations, identify any existing service conductor sizes that might have been installed using NEC 310.15(B)(7) and Table 310.15(B)(7)	NEC 230.31, 230.42, 310.15(B)(7) and Table 310.15(B)(7)	
	14.	Verify circuit breaker compatibility with existing panelboard or service equipment. Must be manufactured by the panelboard or service equipment manufacturer.	NEC 110.3(B), Article 240 Part VII, Article 408 part I	
	15.	Branch circuit device and any disconnects must be identified as to the use.	NEC 408.4(A), 110.22(A)	
	16.	Where separate utility metering and enclosures are installed, verify NEC compliance for service equipment and conformance to applicable utility regulations.	Utility company regulations and NEC Article 230	
	17.	Verify equipment is suitable for connection to the line side of the service disconnecting means.	NEC 230.82	
	18.	Verify sufficient working space is provided at EVSE, Panelboards, service equipment, and disconnects.	NEC 110.26	
	19.	Verify additional service disconnects (if installed) are grouped.	NEC 230.72	
	20.	Verify the maximum number of service disconnects has not been exceeded	NEC 230.71	
	21.	Verify that any additional service disconnect is properly rated.	NEC 230.79	
	22.	Verify the wiring method used for the additional service conductors installed.	NEC 230.43	
	23.	Verify that additional service disconnects are properly identified.	NEC 230.70(B)	
	24.	Verify service disconnect is listed as suitable for use as service equipment.	NEC 230.70(C)	
	25.	Verify the overcurrent protection for any newly installed service equipment and conductors.	NEC 230.90, 230.91	
	26.	Verify grounded conductor (neutral) is brought to the service disconnect and bonded to the enclosure.	NEC 250.24(C)	
	27.	Verify metal service equipment enclosures and raceways are bonded together effectively.	NEC 250.92, 250.92(B)	
	28.	Supply-side bonding jumpers are sized properly	NEC 250.102(C), 250.66	
	29.	Verify existing service grounding and bonding.	NEC 250.50, 250.104(A) and (B)	
	30.	Verify EVSE that is intended to be used as interactive systems, bi-directional, or optional standby systems be listed for that purpose.	NECA Articles 702 and 705	

** Note: These items included in the checklist are non-inclusive and are to serve as a guide or basis for inspection. They do not include any local Code requirements or regulations.*



THE ELECTRICIAN'S GUIDE:

Installing Electric Vehicle Charging Stations at Single-Family Homes

Preparing a home for electric vehicle charging requires the collaboration of several parties to help our mutual customers make the right decisions for their personal situations. Southern California Edison (SCE), electricians*, customers and cities each play important roles in this process.

This guide provides useful information on the process for preparing single-family residences for safe and reliable electric vehicle (EV) charging.

The process *may* include installing a dedicated circuit for EV charging, installing an EV charging station, upgrading an existing electrical panel, or adding a second electrical panel, meter socket box and/or two-meter socket panel to accommodate separate EV metering. Installing this equipment is ***optional*** and depends on the ***SCE rate plan*** the customer enrolls in and the level at which the customer ***chooses to charge the vehicle*** (120 volts or 240 volts). Each customer should select his/her rate plan and charging level before the electrician begins any electrical work on the house. Otherwise, customers and electricians alike run the risk of costly delays.

Before you assess your customers' home panel and wiring needs, please ensure that customers who live in SCE's service territory contact us to learn about their rate plan options and how each rate plan may affect their home panel, wiring and electric vehicle charging options.

Please ask your customer to call an **SCE Home Fuel Advisor℠**:
1-800-4EV-INFO
(1-800-438-4636)

Customers can also visit:
sce.com/ElectricVehicle

For step-by-step training modules, customer handouts and more, visit:
sce.com/EVInstall

*The term "electrician," as used throughout this guide, includes entities such as independent electricians, electrical contractors and third parties offering end-to-end EV services.

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Installation Process

The flowchart below illustrates the basic processes used by SCE to prepare single-family residences for electric vehicle charging. Also shown are the points at which electricians play an especially important role in moving the installation process forward.

Automaker/Dealer…

- Explains charging options to customer
- Advises customer to call SCE to learn about rate plan options

SCE…

- Provides customer with an **EV Power Plan**[SM] including an analysis of customer's past energy usage and estimated costs on EV rate plans

Electrician…

- Confirms customer has contacted SCE and spoken with an **SCE Home Fuel Advisor**[SM] about rate plan options
- Assesses customer's home wiring and panel needs, with customer's rate plan preference in mind
- Provides price quote to complete work for both single and dual meter options

Customer…

- Considers rate plan and charging options
- Selects rate plan and panel configuration
- Contacts SCE and electrician to provide rate selection and panel configuration decision*

SCE…

- Dispatches Service Planner to verify adequacy of SCE infrastructure and evaluate customer's electrical plan, as needed

Electrician…

- Obtains city permit(s)
- Completes installation of necessary home wiring, upgraded or new panel / meter socket box, dedicated circuit, and/or electric vehicle charging equipment, as needed
- Arranges for city inspection

SCE…

- Receives city inspection approval
- Completes meter work (as needed)
- Updates customer billing rate plan (as needed)

All systems "go" for electric vehicle charging!

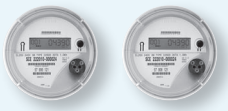
* By reminding your customer to call both you **and** SCE after deciding on the electrical work, SCE can send a Service Planner to the customer's home so you can finish your work as quickly as possible. Knowing a customer's rate plan selection, electrical vehicle charging level, and planned panel configuration will allow SCE's Service Planner to properly inspect the local transformer and service drops and evaluate the customer's electrical plan.

Important Steps for Electricians

1. Confirm customer has contacted SCE about rate plan options and implications ***before*** you conduct a home assessment of electrical panel and wiring needs. If not, direct your customer to call 1-800-4EV-INFO (1-800-438-4636) M-F, 8:00 am - 5:00 pm.
2. Evaluate residential electrical panel and wiring for ***capacity*** to charge the electric vehicle at the desired charging level.
3. Provide a price quote to complete electrical work for ***all*** applicable rate/panel options.
4. Once SCE has approved the proposed electrical plan, upgrade the existing panel or add a second panel or meter socket box, as necessary, in accordance with customer's selected rate plan.
5. If customer selects the Electric Vehicle Plan (two meters): Install the appropriate panel option and remember that this power is for **EV charging only.** *Note: SCE will install the second meter after the panel is installed and the city approves the installation.*
6. Refer to **SCE's Electric Service Requirements (ESR)** for complete panel configuration details (*sce.com/EVInstall*).

Rate/Panel Options

The combination of SCE electric vehicle rate plans and panel configurations yields 6 rate/panel options:

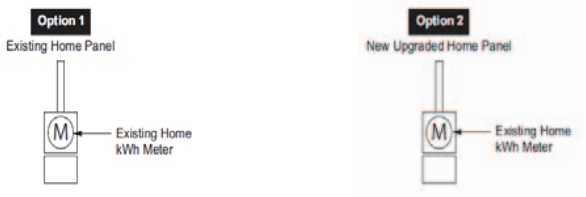
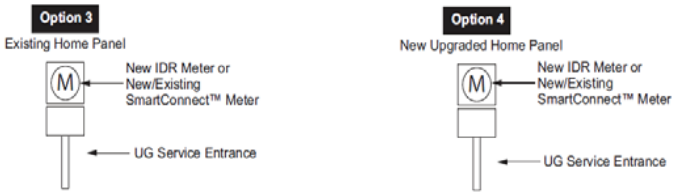
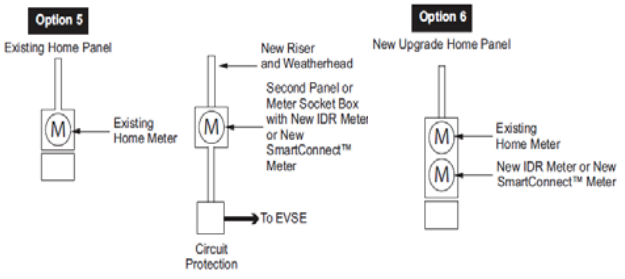
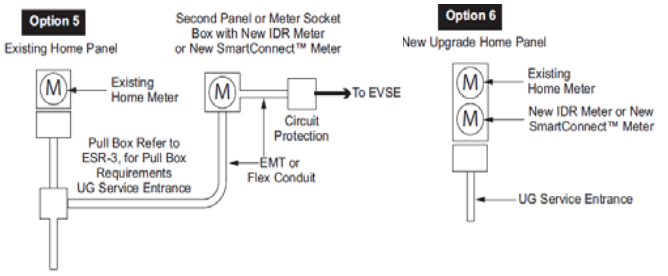
Rate Plans	Rate Description	Panel Choices		
		Use Existing Panel	Add 2nd Panel or Meter Socket Box	Upgrade Existing Panel
Residential Plan (Your Current Rate) *Single Meter*	**Your Current Rate** Home and electric vehicle loads measured together	 **Option #1** (no meter change)	N/A	 **Option #2** (meter may need to be replaced)
Home & Electric Vehicle Plan (TOU-D-TEV) *Single Meter*	**Time-of-Use Tiered Rate*** Home and electric vehicle loads measured together; rates higher during the day and lower at night	 **Option #3** (meter may need to be replaced)	N/A	 **Option #4** (meter may need to be replaced)
Electric Vehicle Plan (TOU-EV-1) *Two Meters*	**Time-of-Use Rate** Electric vehicle load metered separately from home load; home remains on current rate and meter; electric vehicle rate is higher during the day and lower at night	N/A	 **Option #5** (panel upgrade or addition must take place before second meter is installed) See page 4 for detailed panel configurations.	 **Option #6**

*With tiered rates, cost per kWh increases with the amount of electricity used.

Panel Configurations

SCE publishes and maintains an Electrical Service Requirements (ESR) document* describing SCE rules pertaining to electrical service connections and customer installations of service wiring and equipment. Creating an acceptable work plan for electric vehicle charging, by adhering to ESR requirements, will help you and your customers save time and money by avoiding the planning (or beginning) of work that otherwise may not be approved by SCE and/or your local building inspector.

The following abbreviated information can be found in its complete form in Chapter ESR-1, Section 5. The figures below show both overhead (left side) and underground (right side) connection diagrams for the six most common rate/panel options:

Overhead Service	Underground Service
Residential Plan (D) – Single Meter 	**Residential Plan (D) – Single Meter** 
Home & Electric Vehicle Plan (TOU-D-TEV) – Single Meter 	**Home & Electric Vehicle Plan (TOU-D-TEV) –Single Meter** 
Electric Vehicle Plan (TOU-EV-1) –Two Meters 	**Electric Vehicle Plan (TOU-EV-1) – Two Meters** 

Note 1: SCE provides *only a single service line* for all panel configurations, regardless of whether one or two panels are installed.

Note 2: Where at all possible, the second panel or meter socket box shall be at the same location and directly adjacent to the existing metering.

Key

UG:	Underground
OH:	Overhead
IDR:	Interval Data Recorder
EMT:	Electrical Metallic Tubing
EVSE:	Electric Vehicle Service Equipment

* SCE's Electrical Service Requirements are available on the web at **sce.com/EVInstall**.

Panel Configurations

The following abbreviated information can be found in its complete form in Chapter ESR-5, Section 9. The figures below describe required clearances when electrical panels are either upgraded or added to a residence:

Figure 5–4: Separation of Meter Assemblies for Electric and Gas Services

1. Maintain a 3-foot clear, level, and unobstructed workspace in front of electric service equipment.
2. Plumbing fixtures extending more than 6 inches out from wall surface must be located 18 inches minimum from the outside edge of the meter panel.
3. This drawing pertains to both overhead and underground electric service applications.
4. Size and dimensions of panels will vary. Drawings are not to scale.

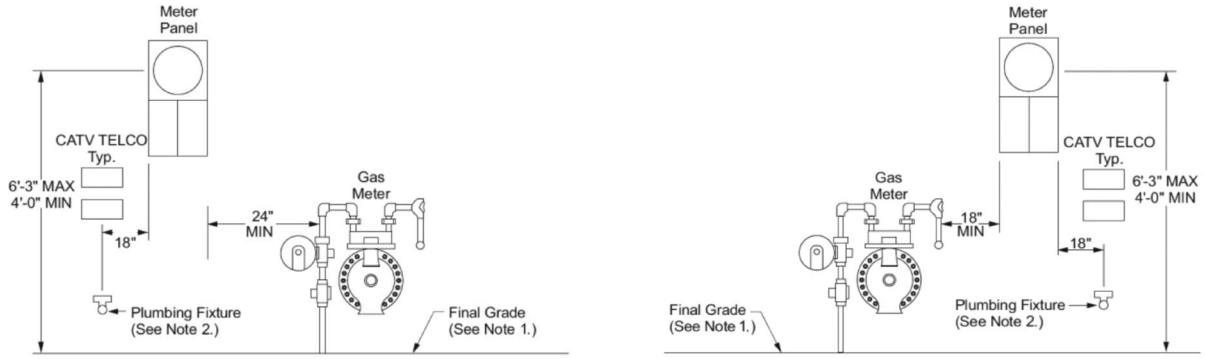
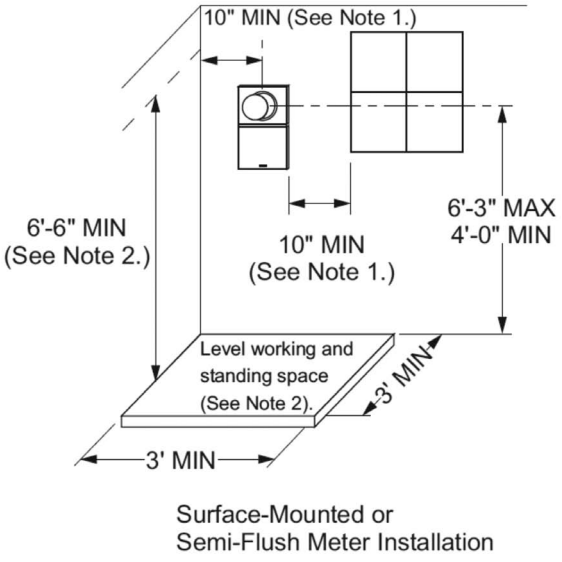


Figure 5–5: Surface-Mounted or Semi-Flush Meter Installation

1. The horizontal clearance from the centerline of the meter to the nearest side wall or other obstruction shall be 10 inches minimum. A horizontal clearance from the edge of the meter panel to the edge of a window or doorway (including sliding glass doors) shall be 10 inches minimum. A gas meter or plumbing fixture that does not protrude more than 6 inches out from the wall, or extend less than 18 inches horizontally from the outside edge of the meter panel, shall not be considered an obstruction. See Figure 5–4 (Page 5–24).

2. A level working and standing surface, clear and unobstructed, entirely on the property of the customer, shall be provided. The minimum width of the workspace shall be 36 inches overall, but need not be centered beneath the meter. The minimum depth of the workspace shall be 36 inches. Where meters are enclosed in a closet or recessed in an enclosure, the depth of the workspace is measured from the outer face of the closet or recess. The minimum height of the workspace shall be 78 inches.



Surface-Mounted or Semi-Flush Meter Installation

Additional sections of SCE's Electrical Service Requirements may be applicable depending on customer infrastructure. Please review the ESR in full to ensure comprehensive compliance with these requirements.

* SCE's Electrical Service Requirements are available on the web at **sce.com/EVInstall**.

Best Practices for Electricians to Help Customers Get Ready for EV Charging

- ✓ Anticipate playing a coordinating role among the customer, SCE, local authority having jurisdiction and possibly the property owner or homeowner's association.
- ✓ Encourage your customer to contact SCE and speak with an **SCE Home Fuel Advisor** at **1-800-4EV-INFO** (1-800-438-4636), M-F, 8:00 am - 5:00 pm, before conducting your initial home assessment to ensure the customer understands SCE's EV rate plans and installation implications.
- ✓ Be familiar with SCE's EV rate plans and installation implications to help guide the customer through the process.
- ✓ Be familiar with SCE's ESR to ensure your plans and work are ESR-compliant.
- ✓ Visit **sce.com/EVInstall** and review the ESR on a quarterly basis for possible EV updates.
- ✓ Provide customer with estimates for one and two-meter options to prevent delays and added costs if customer changes rate plan choice.
- ✓ Participate in the SCE Service Planner's visit to the customer site in person or by phone to discuss the electrical plan, as necessary.
- ✓ Confirm the customer's plan is approved by an SCE Service Planner, as necessary, before initiating the work.

SOUTHERN CALIFORNIA EDISON®
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Getting Started Guide

Plug-In Electric Vehicles

Gear up for a greener driving alternative

Pacific Gas and Electric Company (PG&E) is committed to helping California customers take advantage of the latest innovative technologies in energy efficiency. By driving a Plug-in Electric Vehicle (PEV), you can save money while protecting the environment.

PG&E can assist you in making a smooth transition to driving a vehicle with cleaner fuel economy. You may need to upgrade your home's wiring or the electrical panel you will use to charge the car. It may also be necessary for us to make some upgrades to the infrastructure that delivers electricity to your property.

Following these steps will prepare your home for charging your new vehicle:

1 You apply for service

Contact PG&E at **1-877-743-7782**. You will need charging load information provided by your auto manufacturer. Your service agreement will be based on charging options and a rate plan customized for PEV customers.

PEV charging options	
Level 1	120-volts (8 to 14 hours)
Level 2	208-240 volts (4 to 6 hours)

PEV customers pay according to the E9 rate options, which offers lower prices if you plan to charge your vehicle during the off-peak time period when the demand for electricity is lower.

E-9 rate options	
E-9A	Provides a single PEV rate for your residence and PEV loads through a single meter.
E-9B	Provides two separate rate options for your residence and PEV through two meters.

2 An electrical contractor assesses your home

Consult an electrical contractor about the charging capacity of the electrical panel in your residence. But first, check with your automobile dealer as the home assessment may be included in the PEV purchase price. Your contractor can help you determine if upgrades are needed, what permits may be required to complete the work, and how much the project will cost.

3 PG&E identifies service upgrade requirements and costs

Within two days of receiving your application, a PG&E representative will contact you to get detailed information about your existing service. If necessary, we will schedule a field inspection. This allows us to determine if your current electric service is sufficient for charging your PEV or if any service upgrades are needed. PG&E will give you a written estimate of charges you will incur for this work.

4 Any necessary upgrade projects are completed

If necessary, PG&E will make the adjustments to our distribution equipment, such as replacing wires and transformers, to allow you to charge your vehicle. Until the upgrades are complete, you may be asked to charge your vehicle only during non-peak times, 12 a.m. - 7 a.m.

5 After final inspections, service is connected

If construction must be done on your property, you may be required to have the property inspected by city or county authorities. Once you have cleared those inspections, contact PG&E to coordinate your service connections.

Visit **www.pge.com/newconstruction** or call PG&E today at **1-877-743-7782** to learn more about PEVs and how to get started.

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