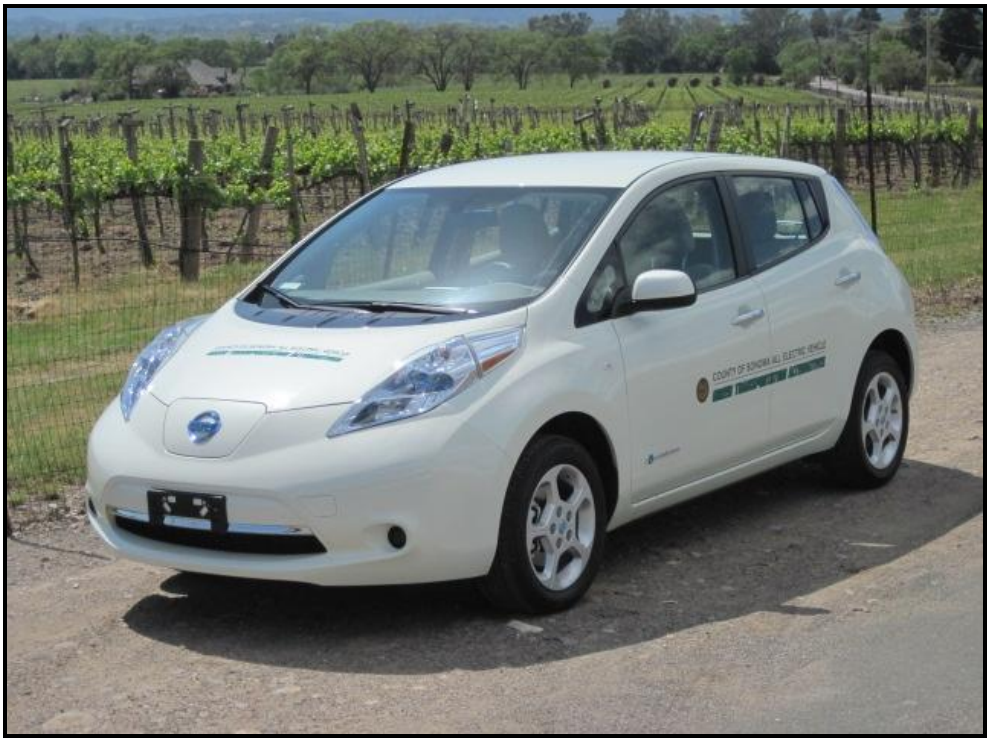
County of Sonoma



Electric Vehicle Charging Station Program and Installation Guidelines

July 2011

County of Sonoma, General Services Department

County of Sonoma

www.co.sonoma.ca.us www.sonoma-county.org

DISCLAIMER

The County of Sonoma Department of General Services, with the assistance of a consultant and an advisory committee, has prepared these guidelines to provide a consistent framework for the installation of electric vehicle infrastructure on public and private parking facilities in Sonoma County. These guidelines establish the initial effort for the consistent and effective deployment of electric vehicle charging stations and infrastructure in Sonoma County.

These guidelines have been prepared at a time when federal and California laws and regulations, as well as accepted practices involving electric vehicles and how to plan for, install, identify, provide access to, regulate and enforce public electric vehicle charging infrastructure, are continuing to develop and undergo change. As a result of such uncertainty, California local governments are working to understand industry, property owner, consumer, and utility company expectations. These guidelines are to serve as a resource only and to assist the County of Sonoma to make the best decisions to achieve goals and targets contained in the Climate Protection Action Plan for Sonoma County, June 2006, as well as local planning and action plans, and should not be interpreted to dictate the manner in which the County of Sonoma or any local government agency chooses to administer the installation of public and private charging infrastructure.

These guidelines were prepared as an account of work sponsored by the General Services Department of the County of Sonoma. Neither the County of Sonoma nor any of its employees makes any warranty, expressed or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed within this document. Local agencies may or may not adopt similar methods of electric vehicle infrastructure installation and operations. The views and opinions of authors expressed herein do not necessarily state or reflect those of the County of Sonoma.

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The following is a list of people, agencies and businesses that participated or showed interest in this project. An asterisk (*) has been placed by the names of people that attended meeting(s), gave verbal or written input, or in some way provided feedback that is incorporated into the final document. The list below is a good example of the level of interest in this effort. All of the participants took this on as an extra duty. They came to meetings in which detailed information was being discussed and listened intently to learn new terms and definitions for a new industry. They gave feedback and helped the leadership group make decisions on approach and direction of this project.

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TABLE OF CONTENTS

Executive Summary.....1
Electric Vehicle Charging Station Program—In Brief.....1
Electric Vehicle Charging Station Program—Background and & Current Status 2
Definitions 3
Battery Charging and Supply Equipment 3
Vehicles 6
Other 9
Electric Vehicle Charging Station Program..... 10
Electric Vehicle Charging Station Siting Plan—Initial Phase 11
Siting Plan Expansion—Guiding Principles 14
Data Collection 16
Signage 17
General Service Signs 18
Regulatory Signs 19
Installation Guidelines—General.....22
Existing Parking Facilities 22
New Buildings, Site Construction or Redevelopment 22
Electric Vehicle Charging Station Installations—Restricted..... 23
Public and Private Fleets 23
Designated Employees 28
Residential—Single Family 29
Residential Charger Installation 30
Residential—Multi-Unit Dwelling 32
Electric Vehicle Charging Station Installations—Public 33
Off-Street Electric Vehicle Charging Stations 34
On-Street Electric Vehicle Charging Stations 39
Permitting Process 42
Residential Installations—Single-Family 42
Commercial & Multi-Family Installations 43
Public Outreach 44
Commercial EVCS Installation Guide 46
Branding Sonoma County's EV Tourism 47
Presentation Material 48
Appendices 49
Appendix A: Glossary of Terms and Acronyms 49
Appendix B: Resource Documents.....51
Appendix C: National Electric Code (Article 625 (Partial).....52
Appendix D: Commercial EVCS Installation Guide.....54
Appendix E: The Sonoma County "Electric Trail" Map.....56

Appendix F: Presentation Material……..…..57, 58

List of Figures and Tables

Figure 1. Sonoma County Electric Vehicle Charging Station Siting Plan—Initial Phase 14
Figure 2. California MUTCD Approved General Service Signs 18
Figure 3. D9-11b (Alternate) Sign 19
Figure 4. Advance Directional Arrows..... 19
Figure 5. Sample Regulatory Signs (Guidance) 20
Figure 6. Public Charger in Downtown Santa Rosa..... 20
Figure 7. EV Charging Station..... 21
Figure 8. Regulatory Dual-Use Sign..... 21
Figure 9. Van Accessible ADA Parking Space with EV Charger 21
Figure 10. Level 1 Charger with non-standard sign 21
Figure 11. Series of Level 1 Chargers (by reservation only)..... 21
Figure 12. Restricted Electric Vehicle Charging Station..... 24
Figure 13. Single Charger (perpendicular) 26
Figure 14. Dual-Port Charger (angle) 27
Figure 15. Multi-Port Charger (opposite parking bays) 28
Figure 16. Examples of Designated Employee Parking Spaces..... 22
Figure 17. Garage Charger (wall mount) 31
Figure 18. Car Port Charger (wall mount)..... 31
Figure 19. Single-Car Garage and Electric Vehicle Supply Equipment (typical)..... 32
Figure 20. Installation of Accessible EVCS (near sidewalk)..... 37
Figure 21. Installation of Accessible EVCS (near accessible parking) 38
Figure 22. Installation of Two Accessible EVCS (angle parking, near path of travel) 39
Figure 23. On-Street EVCS (parallel space, end of block) 41
Figure 24. On-Street EVCS (angle space, charger left of center) 41
Figure 25. On-Street EVCS (parallel space, beginning of block, charger on streetlight pole) .. 42
Figure 26. PG&E Getting Started Guide—Plug-in Electric Vehicles..... .44
Figure 27. Achieving the Vision with Public-Private Partnerships (PPPs)..... 46

Table 1. Summary of Initial Phase of EVSE Programs 13
Table 2. Fleet EVCS Installation Considerations 25
Table 3. Electric Vehicle Battery Capacity Comparisons 29
Table 4. Residential Charger Installation Considerations..... 31
Table 5. Multi-Unit Dwelling Residential Charger Installation Considerations..... 32
Table 6. Comparison of Accessible EVCS with EVCS..... 35
Table 7. Public EVCS Installation Considerations 36
Table 8. On-Street EVCS Installation Considerations 40

EXECUTIVE SUMMARY

Electric Vehicle Charging Station Program—In Brief

The **vision** of the County of Sonoma's Electric Vehicle Charging Station (EVCS) Program is **to provide a comprehensive network of distributed chargers throughout the County which services both public agencies and the private sector and inspires other communities to initiate their own EVCS programs**. The County's mission in this effort is to install EVCS in locations that facilitate the delivery of efficient and effective services by County personnel in a manner that aligns to the goals of its *Climate Protection Action Plan-2006*, and in doing so serves as a resource to other agencies and the general public to expand their electric vehicle driving range for utility or recreational trips.

An overarching goal of these guidelines is to assist Sonoma County to reduce greenhouse gas emissions resulting from County operations, but also to create the genesis for a comprehensive system of safe, reliable and convenient public charging stations throughout the County. By taking this leadership role in developing and implementing this Electric Vehicle Charging Station (EVCS) Program, the County of Sonoma strives to lead the nation by example and become a model community in transitioning to widespread EV use in fleets and by the general public. This planned distributive system of chargers on County-owned or leased properties will be referred to as the County of Sonoma EVCS Program, and the limits of the County will define the comprehensive EVCS Program Area. Combining the public portion of the County of Sonoma's EVCS Program with public installations of other local agencies and property owners forms the evolving Sonoma County EVCS Siting Plan. It is the Siting Plan that will form the primary outreach tool that the general public will rely on for charger type and location, fee structure, and availability information.

An important objective of the County of Sonoma EVCS Program and Installation Guidelines is to ensure program accessibility. These guidelines take into consideration the installation challenges of pre-existing conditions such as uneven topography, location of power supply or space limitations. They also recognize that accessibility requirements and accommodations with new construction or redevelopment will be more easily met than in existing conditions. In all cases, careful planning and consultation with the County Building Official is highly recommended.

Electric Vehicle Charging Station Program—Background & Current Status

Sonoma County, spans over 1500 square miles and is the largest of the San Francisco Bay Area's nine counties. Located just over forty miles north of the Golden Gate Bridge, Sonoma County is bordered by the Pacific Ocean coastline on the west, Marin County to the south, Solano, Napa and Lake Counties to the east, and Mendocino County to the north. Sonoma County leaders are committed to transform its energy infrastructure from fossil fuels to renewables and to reduce harmful greenhouse gas (GHG) emissions from surface transportation.

In 2002, the County resolved to be part of Cities for Climate Protection and by doing so established a greenhouse gas emission reduction target for its internal operations of 20% below

2000 levels by the year 2010. Following in 2006, the County Board of Supervisors adopted the *Climate Protection Action Plan for Sonoma County* which established an action plan consisting of objectives and prioritized steps for achieving reduced emissions. Then in 2008, the *Community Climate Action Plan* (CCAP) was developed for Sonoma County by the Climate Protection Campaign. The CCAP identified transportation as the county's leading and fastest growing source of GHG emissions estimated at 59% of total emissions in 2007. The CCAP contains a countywide target to reduce annual GHG emissions from transportation to 1.755 million tons by 2015, which is 25% below the 1990 level of 2.34 million tons. One of the strategies identified in the CCAP is to create fleets of plug-in hybrid electric vehicles (PHEV) and electric vehicles (EV), and to power them to the highest extent possible with renewable sources of electric energy.

The electrification of the County's light equipment fleet has been a long-standing goal, and currently nearly 30% (243) of that portion of the fleet consists of hybrids, PHEVs and BEVs. In addition, the County has four medium-duty hybrid work trucks in operation and one more scheduled for delivery by the end of 2011. To help plan and coordinate the conversion of other local government fleets to electric vehicles, Sonoma County formed the Sonoma County Local Government Electric Vehicle Partnership in 2008. With the County's General Services Department and the Sonoma County Water Agency as co-leads, in 2010 the partnership identified the need for an Electric Vehicle Charging Station Program and Installation Guidelines.

In December 2010, the County's Fleet Operations Division initiated the development of these guidelines and hired a consultant to assist in the development of a consistent infrastructure installation framework, a siting plan and the creation of outreach materials to facilitate the use of electric vehicles as a viable transportation option across Sonoma County.

As of July 2011, the EVCS Siting Plan consisted of 19 restricted-use chargers for County vehicles at various County offices, 13 public and restricted chargers in the City of Santa Rosa and 9 public and restricted chargers at the Sonoma County Water Agency (SCWA) offices on Aviation Blvd. The County also has 6 more chargers ready for installation by the end of 2011, mostly reserved for fleet use. The County, the City of Santa Rosa, and the SCWA have plans to install an additional 31 chargers (mostly for fleet use), and to receive 31 plug-in electric fleet vehicles through an MTC grant by the end of 2011. A second grant from MTC is estimated to provide an additional 25 public chargers on County-owned properties in the southern part of the County by the end of 2012. In addition, it is anticipated that 12-20 public chargers will be installed in highway corridors on public and private properties funded by the Northern Sonoma County Air Pollution Control District, and 12-20 more public chargers in southern cities funded by the federal Charge Point America Program. In summary, approximately 130 chargers could be in place for fleet and public use throughout the County by the end of 2012.

The County of Sonoma's effort to develop the EVCS Program and Installation Guidelines comes at a time when no other County in the State of California has attempted such a comprehensive effort, including code-ready definitions, substantive installation guidance materials, an initial county-wide siting plan, and public outreach. In fact, there is limited law and regulations, as

well as accepted practice regarding how to install, identify, regulate, provide accessibility for, and enforce electric vehicle charging in California. The information in these guidelines is provided as a resource to the County of Sonoma, and local public agencies to assist in making the best decisions possible during this time of limited codes and standards. As the County and local cities eventually adopt ordinances, codes, private & public development standards and regulations, every effort should be made to update these guidelines to reflect current laws and regulations.

DEFINITIONS

The County of Sonoma is establishing an Electric Vehicle Charging Station Program and Installation Guidelines for its use, as well as for cities and other public agencies that may choose to utilize them in both public and private applications. In addition, the County is developing charging station permitting processes, installation checklists, informational material and an initial county-wide Electric Vehicle Charging Station Siting Plan.

As checklists, siting plans and other documents are developed by other agencies and private property owners in Sonoma County, each should use the definitions and terminology below for consistency purposes among agencies. The definitions are written with the intent that they be included in future local government codes and ordinances. For instance, to standardize public signage and enforcement regulations, the definition of a qualifying electric vehicle contains different types of vehicles that are not purely powered by electricity, but do contain a charging inlet and can receive electrical energy from an off-board source.

Where definitions already exist and are being applied here, the source documents are referenced. In some cases definitions were created as a result of researching and merging definitions from two or more sources. To make the guidelines more user friendly, *comments* are provided after several of the definitions to assist the reader in better understanding the application of the term, and its interrelationship with other terms.

As the County of Sonoma and local cities eventually adopt ordinances, codes, development standards and regulations, every effort should be made to use consistent definitions. As the electric vehicle industry matures and more electric vehicles appear on public roadways and are charged in public and private parking facilities, jurisdictions should update the definitions as necessary or mandated. The definitions are listed in alphabetical order in three categories*; Battery Charging and Supply Equipment, Vehicles, and Other.*

Battery Charging and Supply Equipment

"Accessible Card-Reading Device" is a charger that meets the accessibility requirements of Chapter 11C of the California Building Code and the Americans with Disabilities Act.

> *Comment: The card-reading controls on a charger that contains charging supply equipment to charge two or more vehicles simultaneously, and meets the accessibility requirements of Chapter 11C of the California*

Building Code and the Americans with Disability Act for each vehicle will qualify as an accessible card-reading device for each vehicle.

"Accessible Electric Vehicle Charging Station" is an electric vehicle charging station where the charger and vehicle inlet are approachable and usable by persons with disabilities in compliance with the California Building Code (Title 24) and the Americans with Disabilities Act.

Comment: This definition applies to Public Buildings, Public Accommodations, Commercial Buildings and Publicly Funded Housing.

"Battery Exchange Station" is a fully automated facility that will enable an electric vehicle with a swappable battery pack to enter a drive lane and exchange the depleted battery with a fully charged battery through an automated process.

Comment: Other terms used are battery switch stations, batter swap stations.

"Charger" is an electrical component assembly or cluster of component assemblies designed specifically to charge batteries or other energy storage devices within electric vehicles.

Comment: Chargers include standardized indicators of electrical force, or voltage referred to as Level 1, Level 2, Level 3, and fast charging. (see Charging levels).

"Charging" means that the connector from the charger is inserted into the electric vehicle inlet and electrical power is being transferred for the purpose of recharging the batteries on board the electric vehicle.

Comment: Electricity may or may not be transferred at all times during the act of charging and as vehicle to grid (V2G) advancements occur electricity may flow from the vehicle batteries back to the grid or facility. Another type of charging is through inductive means, where charging uses the electromagnetic field and there is no physical connection between the charging device and the battery. For the purposes of these guidelines, a direct connection (conductive charging) between the charger and the electric vehicle inlet will be used.

"Charging Levels" are the standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged.

AC Level 1	120V AC single phase current (12 amp[1]); power 1.44kw current (16 amp[1]); power 1.92kw	DC Level 1	200-450V DC rated current ≤ 80 amp rated power ≤ 36 kw
AC Level 2	240V AC single phase rated current ≤ 80 amp[1] rated power ≤ 19.2 kw	DC Level 2	200-450V DC rated current ≤ 200 amp rated power ≤ 90kw
AC Level 3	To be determined AC single phase or three phase?	DC Level 3	To be determined 200-600V DC rated current ≤ 400 amp? rated power ≤ 240 kw?

[1] rated current is 80% of circuit breaker size

Comment: The charging configurations and ratings terminology in the table above are from SAE. It is important to note that only the terms "Level 1" and "Level 2" are consistently used between industry and consumers. The use of "Level 3" is not consistently used at this time, and is often referred to as "fast charging". Once Level 3 terms are defined, local governments should adopt amendments to adopted definitions.

"Connector" is a device that, by insertion into an electric vehicle inlet establishes an electrical connection to the electric vehicle for the purpose of charging and information exchange. This device is part of the electric vehicle coupler. *(Electric Vehicle Connector, California Electric Code, Article 625)*

"Coupler" is a mating electric vehicle inlet and electric vehicle connector set. *(Electric Vehicle Coupler, California Electric Code, Article 625)*

"Electric Vehicle Charging Station" is the public or restricted space serviced by a charger including all signs, information, pavement surfaces, surface markings and protective equipment, and where the transfer of electric energy occurs by conductive or inductive means between the charger and the battery or other energy storage device in a stationary electric vehicle.

Comment: This definition combines the battery charging characteristics, traffic control devices, safety equipment and information into one definition as these features are functionally related.

"Electric Vehicle Charging Station — Public" is an electric vehicle charging station that is publicly owned and publicly available (e.g., Park & Ride parking, public library parking lot, on-street parking) or privately owned and publicly available (e.g., a shopping center parking lot).

"Electric Vehicle Charging Station — Restricted" is an electric vehicle charging station that is publicly owned and has restricted access (e.g., fleet parking for designated vehicles) or privately owned and has restricted access (e.g., single-family home, designated employee or valet parking).

Comment: This definition is provided to clarify that not all "public" design criteria will apply to "restricted" Electric Vehicle Charging Stations.

"Electric Vehicle Charging Station Location" is an electric vehicle charging station(s) located within a parking lot, fuel dispensing facility, public garage, or private property.

"Electric Vehicle Charging Station Program" is the distributed network of public and restricted electric vehicle charging stations on County of Sonoma properties.

Comment: It is the intent of the County of Sonoma to combine its EVCS Program with other public agencies and the private sector to create the Sonoma County EVCS Siting Plan.

"Electric Vehicle Charging Station Program Area" is the total area served by the program.

Comment: *The intent of the County of Sonoma program is to serve the unincorporated areas of Sonoma County.*

"Electric Vehicle Infrastructure (EVI)" includes structures, machinery, and equipment necessary and integral to support an electric vehicle, including, but not limited to electric vehicle charging stations, chargers, and battery exchange stations.

Comment: Per this definition, this term is broader than Electric Vehicle Supply Equipment (EVSE) which refers to the charging equipment, cord and connector on the premises

"Electric Vehicle Supply Equipment (EVSE)" are the conductors, including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle. *(California Electric Code, Article 625)*

"Inlet" is the device on the electric vehicle into which the electric vehicle connector is inserted for charging and information exchange. This device is part of the electric vehicle coupler. For the purposes of this code, the electric vehicle inlet is considered to be part of the electric vehicle and not part of the electric vehicle supply equipment (EVSE). *(Electric Vehicle Inlet, California Electric Code, Article 625)*

Vehicles

"Battery Electric Vehicle (BEV)" is any vehicle that operates exclusively on electrical energy from an off-board source that is stored in the vehicle's batteries, and produces zero tailpipe emissions or pollution when stationary or operating.

Comment: Definition is a subcategory of electric vehicles (see "Electric Vehicle).

"Clean Air Vehicle Sticker" California law allows use of High Occupancy Vehicle (HOV) lanes with only one occupant when the vehicle displays Clean Air Vehicle Stickers.

Comment: Evidence of Automatic Vehicle Identification System (FasTrak) must be submitted with HOV sticker application in order to obtain stickers for Clean Vehicles registered in Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano or Sonoma counties. More information on the Bay Area's FasTrak Program and California's ARB Clean Vehicle Program can be found at: http://www.bayareafastrak.org/ and http://driveclean.ca.gov/, respectively.

"Clean Vehicle" refers to any clean fuel vehicle identified by the State of California as qualifying for the California Clean Vehicle Incentives program. As of January 2011, two types of vehicles qualify: Zero Emission Vehicles (ZEV) and Plug-in Hybrid Electric Vehicles (PHEV) that qualify as Enhanced Advanced Technology, Partial Zero Emission Vehicles (AT PZEV).

Comment: California law allows single-occupant use of High Occupancy Vehicle (HOVs) lanes by qualifying clean, alternative fuel vehicles. A list of qualifying vehicles is provided on the California EPA's Air Resources Board website http://www.arb.ca.gov/msprog/carpool/carpool.htm#vehicles. Use of these lanes with only one occupant requires a Clean Air Vehicle Sticker issued by the California Department of Motor Vehicles (DMV).

"Electric Motorcycle" is a battery electric vehicle having a seat or saddle for the use of the rider, designed to travel on not more than three wheels in contact with the ground, and is powered by an electric motor and produces zero emissions or pollution when stationary or operating.

Comment: In California, 3-wheel zero emission vehicles are classified as "motorcycles".

"Electric Vehicle (EV)" is any motor vehicle registered to operate on California public roadways and operates, either partially or exclusively, on electrical energy from the grid, or an off-board source, that is stored on-board for motive purpose. "Electric vehicle" includes but is not limited to: a battery electric vehicle, a plug-in hybrid electric vehicle, a neighborhood electric vehicle and an electric motorcycle.

Comment: This definition provides for inclusion of a variety of plug-in electric vehicles (often referred to as PEVs), and is designed for regulatory purposes, so that factors such as signage are not required to call out detailed differences among BEVs, ZEVs, PHEVs, NEVs and others. Note that extended range electric vehicles (EREV) are not separately defined but are included in the definitional components for PHEV (i.e., runs on electricity from its battery, and then it runs on electricity it creates from an on-board internal combustion engine).

"Extended Range Electric Vehicle (EREV)" see definition of Plug-in Hybrid Electric Vehicle (PHEV)

"Fuel Cell Vehicle" is a vehicle that uses electricity produced by an on-board fuel cell to power motors located near the vehicle's wheels. The fuel cell is powered by filling the fuel tank with hydrogen.

Comment: Since a fuel cell vehicle does not receive its electricity by being connected to a "charger", but through filling an on-board tank with hydrogen, it would not qualify to occupy an "Electric Vehicle Charging Station, but would qualify to park in a "Clean Air Vehicle Parking Space" or an "Electric Vehicle Parking Space". More information on fuel cell vehicles is available at http://www.afdc.energy.gov/afdc/ .

"Hybrid Electric Vehicle (HEV)" is a type of hybrid vehicle which combines a conventional internal combustion (ICE) propulsion system with an electric propulsion system. The presence of the electric drive motor is intended to achieve better fuel economy than a conventional ICE.

Comment: A Hybrid Electric Vehicle does not plug into an off-board electrical source.

"Internal Combustion Engine Vehicle" is a vehicle with an engine that burns fuel within itself as a means of developing power.

Comment: Although the term internal combustion engine (often abbreviated ICE) covers all types of reciprocating and rotary engines, it is typically used with reference to two stroke or four-stroke gasoline and diesel engines, and is the source of power for conventional vehicles.

"Motorized Bicycle" is a device that has fully operative pedals for propulsion by human power and has an electric motor that has a power output of not more than 1,000 watts and is

incapable of propelling the device at a speed of more than 20 miles per hour on ground level. (California Vehicle Code Section 406)

Comment: A "moped" is a form of motorized bicycle and is capable of propelling the device at a maximum speed of not more than 30 miles per hour on level ground. For the purposes of these guidelines all motorized bicycles will be distinct from "electric vehicle" to enable local governments, by ordinance, to treat parking, operation and charging locations for them separately.

"Motorized Electric Scooter" is any two-wheeled device that has handlebars, has a floorboard that is designed to be stood upon when riding, and is powered by an electric motor and produces zero emissions or pollution when stationary or operating. (CVC section 407.5 Motorized Scooters)

Comment: These vehicles are defined as being distinct from "electric vehicle" to enable local governments by ordinance, to treat parking, operation and charging locations for them separately, if that regulation is not in conflict with CVC section 21225.

"Motorized Quadricycle and Motorized Tricycle" a "motorized quadricycle" is a four-wheeled device, and a "motorized tricycle" is a three-wheeled device, designed to carry not more than two persons, including the driver, and having either an electric motor or a motor with an automatic transmission developing less than two gross brake horsepower and capable of propelling the device at a maximum speed of not more than 30 miles per hour on level ground. The device shall be utilized only by a person who by reason of physical disability is otherwise unable to move about as a pedestrian or by a senior citizen as defined in Section 13000. (California Vehicle Code Section 407)

Comment: For the purposes of these guidelines, motorized quadricycles and motorized tricycles will be distinct from "electric vehicle" to enable local governments, by ordinance, to treat parking, operation and charging locations for them separately.

"Neighborhood Electric Vehicle (NEV)" is an electrically powered, four-wheeled self-propelled low-speed vehicle whose speed attainable in one mile is more than 20 miles per hour and not more than 25 miles on a paved level surface and has a gross vehicle weight of less than 3,000 pounds. (California Vehicle Code Section 385.5)

Comment: Definition of a subcategory of electric vehicles (see "Electric Vehicle").

"Non-Electric Vehicle" is any motor vehicle that does not meet the definition of "electric vehicle."

"Plug-In Hybrid Electric Vehicle (PHEV)" is an electric vehicle that (1) contains an internal combustion engine and also allows power to be delivered to drive wheels by an electric motor; (2) charges its battery primarily by connecting to the grid or other off-board electrical source; (3) may additionally be able to sustain battery charge using an on-board internal-combustion-driven generator; and (4) has the ability to travel powered by electricity.

Comment: Definition of a subcategory of electric vehicles (see "Electric Vehicle"). Note that extended range electric vehicles (EREV) are not separately defined but are included in the definitional components for PHEV (i.e., runs on electricity from its battery, and then it runs on electricity it creates from gas).

"Zero Emission Vehicle (ZEV)" is any vehicle driven only by an electric motor that is powered by advanced technology batteries (BEV) or a hydrogen fuel cell, and produces zero tailpipe emissions or pollution when stationary or operating.

Other

"Access Aisle" is an accessible pedestrian space adjacent to or between parking spaces that provides clearances in conformance with Chapters 11A and 11B of the California Building Code Title 24, Part 2 and the Americans with Disabilities Act.

Comment: The surface slopes of accessible parking spaces and access aisles shall be the minimum possible and shall not exceed one unit vertical in 50 units horizontal (2-percent slope) in any direction.

"Accessible Parking Required" means that each lot or parking structure where parking is provided for the public as clients, guests or employees, shall provide accessible parking as required by the California Building Code Title 24. Part 2 and the Americans with Disabilities Act.

Comment: For the purposes of these guidelines an "accessible electric vehicle charging station is distinct from an "accessible parking space".

"Accessible Parking Space" is a parking space where accessible parking is designated for vehicles displaying a Disabled Person (DP) placard or DP license plates. California Building Code (Title 24) and the Americans with Disabilities Act.

"Clean Air Vehicle Parking Space" is any posted and/or marked parking space that identifies the use to be exclusively for the parking of a clean fuel vehicle as defined by the California Air Resources Board.

Comment: This term provides for a space(s) to be designated as a "Clean Air Vehicle" space for qualifying fuel-efficient vehicles and carpool/ van pool vehicles consistent with the California Green Building Standards (CALGreen) Code; or perhaps as an incentive by a public agency or private company for qualifying clean fuel vehicles as defined by the California Air Resources Board or local ordinance.

"Electric Vehicle Parking Space" is any posted parking space that identifies the use to be exclusively for the parking of an electric vehicle.

Comment: This term provides the potential for a space to be designated, perhaps as an incentive by a public agency or private company for parking of electric vehicles and fuel cell vehicles when charging equipment is not provided.

"Level Accessible Area" is an area which is minimally 30 inches by 48 inches level and clear. This area shall be provided within 10 inches in plan-view of the face of the accessible card-reading controls and shall be unobstructed by any features, except the user controlled electrical

cable and connector, with the long side of this space parallel to and centered (plus or minus 9 inches) with the face of the card-reading controls.

> *Comment: The slope of the level accessible area shall not be more than 2-percent in front of the battery charging station. Chapter 11C in the California Building Code allows the slope to extend to 5-percent when the 2% is not obtainable due to unusual site conditions. The maximum slope in any direction in the ADA is 2%. This definition is consistent with liquid fuel dispensing facilities where the pump nozzle and hose may overlap the level accessible area. It is recommended that the ADA slope requirement be used since it is the more restrictive requirement.*

"Path of Travel" is a continuous, unobstructed way of pedestrian passage by means of which the level accessible area is connected to the inlet on the vehicle. It shall include the clearance requirements stated in CBC, Chapter 11B and the ADA for wheelchair passage widths, and relationships of maneuvering clearances to wheelchair spaces.

> *Comment: The minimum clear width or single wheelchair passage shall be 32 inches at a point and 36 inches continuously. CBC Chapter 11B, Section 1118B.1.*

"Point of Service" is the charger, from which the charging service is provided.

"Van Accessible Parking Space" is an accessible parking space sized for a van

Comment: One in every six accessible parking spaces, but not less than one, shall be served by a loading and unloading access aisle 96 inches (2438 mm) wide minimum placed on the side opposite the driver's side when the vehicle is going forward into the parking space and shall be designated van accessible as required by Section 1129B.4 of the California Building Code and Americans with Disabilities Act.

Electric Vehicle Charging Station (EVCS) Program

These guidelines are intended to aid the County of Sonoma in reducing greenhouse gas emissions in County operations, by strategically planning how, when and where to incorporate electric vehicle supply equipment at County-owned or leased facilities. A direct benefit of installing EVCS for fleet use is to seek out those county-wide locations where chargers may also be used by the general public when not in use by County vehicles. Each EVCS installed by the County whether for restricted or public use will become part of the County of Sonoma EVCS Program (see definitions). The **vision** of the County's EVCS Program is **to provide a comprehensive network of distributed chargers throughout the County which services both public agencies and the private sector and inspires other communities to initiate their own EVCS programs**. To assist in achieving this vision, Sonoma County has initiated the development of a county-wide EVCS Siting Plan.

Using the Siting Plan as a foundation, guiding principles are then used to expand EVCS installations to other publicly accessible chargers on both public and private properties. The Siting Plan will become a living document, and will be instrumental for private property owners in understanding where public agencies are planning to install EVCS, as well as where they believe the high-priority private properties are located. The Siting Plan will be a key reference document for residents, local agencies, businesses and visitors. To be most effective it will

require regular updates, retrievable data on each installation and be available on the internet and to local businesses. The County of Sonoma PRMD should work with other planning agencies in constructing and maintaining the public charging station data base. The County of Sonoma is encouraging charger manufacturers to ensure compatibility of card readers with other manufacturers, and to build usage, availability, energy consumption, and complaint-tracking software into their product lines. It is expected third-party vendors or non-profit organizations will take publicly accessible information and regularly update social media outlets for the benefit of EV owners, auto manufacturers, businesses, and other stakeholders.

The limits of Sonoma County are referred to as the "EVCS Program Area" and the limits of a single County-owned or leased parking facility is referred to as an "EVCS Location". As required by the Americans with Disabilities Act (ADA) public agencies cannot discriminate on the basis of a person(s) having a disability. Currently, there are no specific accessibility requirements in either the ADA or Title 24 for EVCS. Therefore, Sonoma County developed these guidelines to assist both private and public sectors within the County with the design and implementation of accessible EVCS. These guidelines are not standards or regulations, but rather a resource that may be used to assist architects, engineers, and permitting agencies in developing plans and installing accessible EVCS.

These guidelines recognize that each regulatory agency will manage the plan review, permit process, and on-site and final inspection processes as deemed necessary by the agency. Therefore, it is recommended that when the designer and/or property owner identifies site conditions that prevent a complete accessible EVCS from being installed that the permitting authority be engaged in the problem solving process. When the owner believes that removing identified access barriers creates a hardship, many code enforcement jurisdictions have provisions that allow them to consider hardship in determining the level of barrier removal that would be necessary in a construction project. This can be a means of mitigating the hardship and thereby enabling installation of an EVCS.

Electric Vehicle Charging Station Siting Plan—Initial Phase

As mentioned in the EVCS Program—Background and Current Status earlier in these guidelines, the County has developed an initial charger deployment plan to distribute Level 1 & Level 2 EV chargers throughout the County. It is the County's intent to develop an initial infrastructure of both restricted and public chargers on all the major highway corridors of the County to support EV transportation to as much of the County as feasible. After this initial deployment, the County will focus on deployment of chargers to support the County fleet and encourage the private sector and other public agencies to continue deployment of chargers to support the public's needs.

The initial siting plan is supported by grant funds from the Metropolitan Transportation Commission (MTC), Northern Sonoma County Air Pollution Control District (NSCAPCD), Bay Area Air Quality Control District (BAAQMD) and the Department of Energy Charge Point America Program. Matching funds for some of these grants are provided by the County of Sonoma,

Sonoma County Water Agency and the City of Santa Rosa. Below is a brief description of the County's four key highways which serve as the backbone of the initial siting plan:

- Highway 101: the North/South main corridor through the County and through the Cities of Petaluma, Cotati, Rohnert Park, Santa Rosa, Windsor, Healdsburg and Cloverdale.
- Highway 12: runs from the Southeast corner of the County at the Napa County Line through Sonoma and Santa Rosa to Sebastopol.
- Highway 116: runs from Sonoma through Petaluma, Cotati, and Sebastopol to the Russian River area at Guerneville.
- Highway 1: runs from the Marin County line in the South to the Mendocino County Line in the North along the Pacific coastline of the County.

The plan for initial deployment of chargers is to place chargers at critical locations along these transportation corridors and at other key destination centers to accelerate the use of plug-in vehicles by the County, surrounding counties and other local agencies and to develop a baseline public charging network for the County's residents, businesses and visitors. This network will make it possible to drive anywhere in the County with charging available within a reasonable distance and to identify Sonoma County as "EV Friendly" to the rest of the Bay Area and State.

The County of Sonoma has taken a community leadership position by developing the initial phase of the Siting Plan for local government EVCS installations. While the specific locations have not all been identified, for the most part the parking facilities have been selected. It is the County's goal to install these initial chargers at locations that will achieve high usage by government vehicles as well as the general public. As a prelude to developing the infrastructure network, the County, SCWA, NSCAPCD, and City of Santa Rosa started installing chargers for their fleet vehicles in 2009 and have continued into 2011.

Current charger deployment includes 13 chargers at the County Administration Center, nine at SCWA main offices on Aviation Blvd, one at NSCAPCD on Matheson St in Healdsburg and 13 at City of Santa Rosa facilities and parking garages. The County is installing three more chargers at Norton Center in the Chanate Rd. complex and two at The Lakes Office Buildings off Sebastopol Road in Santa Rosa. There are also six more designated for County offices in downtown Santa Rosa and near the Sonoma County Airport. When all these chargers are deployed there will be 47 active chargers around the greater Santa Rosa area and in Healdsburg. As will be identified in the Siting Plan, many of these are designated as public agency fleet chargers with restricted use, but several will also be available to the public when not being used by fleet vehicles.

The second part of the initial phase includes funding from two grants awarded to Bay Area-wide partnership through the MTC. The first grant is for Fleet Charging. The County, SCWA, and City of Santa Rosa are part of a broader Bay Area grant to place fleet chargers and deploy electric vehicles throughout the nine-county region. The County has 22 vehicles and chargers allocated, SCWA has five vehicles and chargers and Santa Rosa has four vehicles and chargers funded by this grant. The total for these agencies is 31 all-electric vehicles and chargers by the end of 2011. The second grant is to install 25 publicly accessible chargers at several County owned

properties that have a high level of public use. This grant is part of another Bay Area wide application to the MTC. The properties include Veterans' Memorial Buildings in Santa Rosa, Sonoma, Petaluma, Cotati, and Sebastopol and County Regional Parks in Sonoma, Santa Rosa, and Sebastopol. These grant funds are placed in a reserve pending the development of an electric vehicle strategy(ies), which may include site suitability analysis. MTC, ABAG, and BAAQMD will collaborate and develop an electric vehicle strategy(ies) to inform upcoming regional planning and funding efforts needed to support electric vehicle deployment.

In conjunction with the Northern Sonoma County Air Pollution Control District, the County is working on the placement of 12 to 20 public chargers in the District. These chargers will be conveniently located along the Highways 1, 116, and 101 corridors. All locations have yet to be determined, but several under consideration are at Doran Park in Bodega Bay, Guerneville, Healdsburg, Geyserville, and Cloverdale. The first two of these chargers will be installed in July 2011 in Geyserville at the Coppola Winery. This project will be matched by 12 to 20 more public chargers in the South County supported by the Charge Point America Program (CPA). Working with the County, CPA would cover most, if not all of the cost, of installing two or more chargers in Rohnert Park, Cotati, Petaluma, Sebastopol, and Sonoma. These chargers would become owned and operated by each City after installation. Evaluation of final locations will be done in the summer of 2011 with installations starting in the fall and projected completion in the first quarter of 2012. Table 1 is intended to give a general overview of the EVSE programs

EVSE Program	No. of Chargers (Public or Restricted)	Agency	Locations	Comments
MTC Fleet Grant	31 (restricted) ➢County 22 ➢Santa Rosa 4 ➢SCWA 5	County of Sonoma, City of Santa Rosa and SCWA	Agency offices, corporati on yards	Grant includes 31 EVs ➢County 22 ➢Santa Rosa 4 ➢SCWA 5 Completion 2012
Public Chargers Grant	25 (public)	County of Sonoma	Veterans' Halls & Reg. Parks	Five Vets' Halls ; 3 regional parks
Charge Point America Grant	35 (public)	Public agencies, businesses & reg. parks	15 in north Co.; 20 in south Co.	Partially funded by NSCAPCD
Fleet Grant (current)	9 (restricted/public)	County of Sonoma	Three County offices	DHS (downtown) 3 Health Services 3 DHS (Norton Ctr.) 3
Active or Purchased	38 (restricted/public)	County of Sonoma, Santa Rosa, NSCAPCD and SCWA	Multiple public locations	25 active, 13 to be active by December 2011

Table 1. Summary of Initial Phase of EVSE Programs

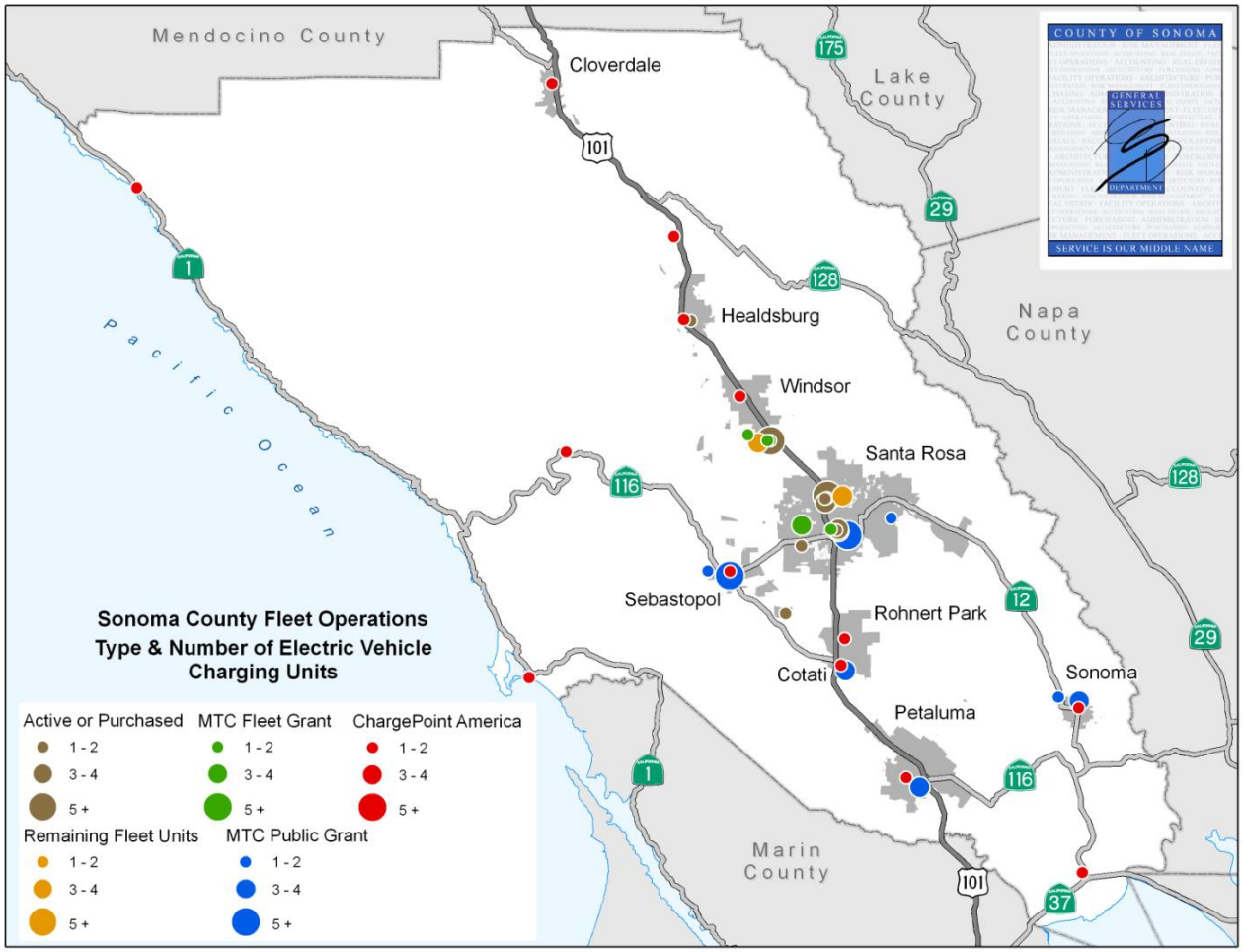


Figure 1. Sonoma County Electric Vehicle Charging Station Siting Plan—Initial Phase

Siting Plan Expansion—Guiding Principles

Before public agencies or private parties decide to install additional stations beyond the approximate 130 that have been identified in the initial phase, guiding principles should be developed by local agencies to allow for an orderly, effective, and efficient installation of a system of safe and convenient chargers. Some businesses may not be concerned about factors that are listed below and will install charger systems because they are fully committed to sustainable transportation. For others, a careful examination of many of the factors listed below will help determine if charging stations are viable, when they may be or possibly not at all. The three areas around which such guiding principles should be developed *are* ***site location, expected user base, and parking facility characteristics***.

A. Site Location

Knowing if charging stations are planned or already exist in nearby facilities will give the property owner a good indication of existing supply, potential demand and the aggregate user base. Knowing if charging systems are planned in nearby facilities allows

an owner to proceed in a strategic, phased approach and match site characteristics and user demand to the level of investment and schedule. Important site location factors are:

- Is the site a desirable location from a county- or region-wide context?
- Does the site have convenient connections to heavily traveled corridors?
- Distance and relationship to other parking facilities and land uses
- What is current zoning and typical distances to residential zones?
- Evaluation if site already has or can easily obtain sufficient electrical energy
- Examine communications availability, such as cellular phone service, wi-fi, etc.
- Review day and nighttime visibility and ease of driving and walking access to the parking facility
- Occurrences of flooding or ponding of water in proximity to charging sites

B. Expected User Base

Parking lots have multiple types of users, such as short-term, monthly permit holders, etc. A shopping mall would generally provide convenient customer parking as well as more remote long-term employee parking. A downtown surface lot owner will often provide short-term hourly parking for shoppers and a means to provide longer term (daily, weekly or monthly parking) for employees. When considering the addition of charging equipment on a parking lot the operator has an opportunity to grow its customer base significantly. For instance a nearby multi-family residential complex may not have charging equipment for residents, thus the opportunity to charge overnight in a nearby facility may be an attraction to an EV buyer. The key user-base considerations are:

- Hours and days of parking facility operations
- Customers' typical driving distances and frequency of use
- Likely peak use days/times and duration of stay
- Day and night walking conditions and distances to nearby attractions
- Perceptions of site safety
- Method of assessing and collecting charging fees

C. Parking Facility Characteristics

The third important planning consideration is the nature of the parking facility and its operations. Having a clean, safe and secure lot, that provides convenient access to charging equipment, pedestrian exits and building entrances, is much likelier to be used, than one that is remote, dimly lit and has vandalism problems. Having assurance the charging equipment will be available for use upon arrival, or that a valet service will move and charge the car for a certain period of time is a convenience that will attract regular users. If the parking lot is provided primarily for nighttime parking; for instance hotel guest parking, having the guarantee of a fully or partially charged vehicle the next morning is critical to the success of any overnight charging service. Many on-site factors need exploration when considering charger installations, and key ones are:

- Will clustering chargers in one area be better than dispersing them?
- Will the desired charger locations be highly visible or more remote?

- Locating current accessible parking spaces and determining location of accessible charging equipment
- Ensuring cords are not draped over walkways and high pedestrian traffic areas
- Are solar panels planned anywhere on the lot and will they augment power to charging systems?
- How will charging electric vehicles change the nature of the existing operations?
- Should lighting, shelter, signage or pedestrian improvements be installed with new charging stations?

Clearly, many factors must be considered when developing a master plan of publicly accessible charging stations. Utilizing mapping systems and GPS and applying many of the factors discussed above, regarding location, user base and parking lot features, will be an excellent process to build from.

Data Collection

The collection of information from chargers is extremely important. The EV owner will want to know how much electricity is being used, when it is being used, and at what cost. As well, the utility company supplying the electricity collects usage data for a variety of reasons including billing, distribution system monitoring, and planning system upgrades such as smart metering, transformer replacements and energy storage systems. Grantors, such as the MTC require a certain amount of data collection on chargers installed, such as usage, performance and fuel displacement.

There is much more data though, that public agencies need to collect to benefit EV owners, fleet managers, the local business community, State regulators and third-party information suppliers. This section will focus on the type of data that Sonoma County and other public agencies should be collecting during the permitting process as well as operational and usage data on chargers being used for fleet operations. The role of government in releasing data may be limited, and that is believed that the private sector will create business models to serve consumers' and owners' needs as the EV industry grows.

A. Data Collection for Private Permit for Public-Use Charger

When a private party seeks a permit to install a charger for public-use, the County is in essence permitting a private property or business owner to sell or give away electricity in the form of motor fuel. The County is not in the business of regulating the manner in which electricity supplied or used on private lands, however the PRMD is responsible for issuing permits and inspecting installations, just as they would be if it were a gasoline station permit. As the market for plug-in electric vehicles grows, demand for conventional fuel (gasoline and diesel) will lessen and impact the amount of taxes collected for the purposes of operating and maintaining public transportation systems, such as road maintenance or public bus service. At some point, State and federal regulators will need to address the shift from liquid fuel to electric fuel. Local agencies like Sonoma County should prepare for the basic solicitation of data from utility

companies or State regulators. The following data should be collected on all private permits for public-use chargers.

- Address and Geographical Location (GPS coordinates)
- Name on Permit and Name of Property Owner
- Date of Permit Final Inspection
- Number of Chargers installed
- Type and make of charger (i.e., Pedestal mount, Johnson Charger Company)
- Number of Charge Ports and Charging Level(s) (i.e., Single port, AC Level 1 120V/20A)
- Separate Meter (yes/no)
- Intended Use and Hours of Operation
- Communications (internal phone modem, wireless fidelity [wi-fi], etc.)

B. Data Collection for Public Agency Restricted-Use Charger

When Sonoma County or any of the other local agencies install chargers for internal operations only, a certain amount of data needs to be collected at the permitting stage and during the life of operations of the equipment. The amount of data will vary among agencies, but at a minimum the following data should be collected.

- Address and Name of Facility
- Type of Parking Facility (surface parking lot, garage, etc.)
- Configuration of EVCS (angle, perpendicular, parallel)
- Accessible EVCS (yes/no)
- Equipment Protection (yes/no)
- Communications (card reader, wi-fi, hard wire, cell modem, etc.)
- Intended Use (general fleet, public safety, etc.)
- Type and make of Charger (i.e., Wall mount, Johnson Charger Company)
- Number of Charge Ports and Charging Levels (Dual-port, AC Level 1/2 240V/40A)
- Usage by: amount of electricity, vehicle ID, time of use, etc.
- Vehicle Miles Traveled by Fuel Type (monthly, between charges, etc.)
- Fuel Displacement, GHG reduction, cost savings, etc. (formula based)
- Maintenance and Inspection History

Signage

Any sign on a public street or highway open to public travel that is intended to regulate, warn or guide traffic is considered a traffic control device. The Code of Federal Regulations recognizes the Manual on Uniform Traffic Control Devices (MUTCD) to be the national standard for all traffic control devices. The California Manual on Uniform Traffic Control Devices (CA MUTCD) is published by the State of California and is issued to adopt uniform standards and specifications for all official traffic control devices in accordance with the California Vehicle Code (CVC). Traffic control signs in public or private or private parking facilities are not considered to be “open to public travel” for purposes of MUTCD applicability. However, local agencies normally utilize standard signs in public parking facilities to be consistent with those used on adjoining public roadways.

Electric vehicle charging station signage for public charging purposes needs to exist in two forms; ***general service*** (guidance) and ***regulatory*** (enforceable). Both types of signs are required to meet the retro reflectivity or illumination requirements, and be sized, placed and oriented as called for in the CA MUTCD.

General Service Signs

General service signs that are currently contained in the MUTCD and CA-MUTCD are intended to provide general guidance to the charging station and should be installed at a suitable distance in advance of the turn-off or intersecting roadway, or at the charging station and should be considered for use when meeting the qualifying criteria in chapter 2F of the CA MUTCD. The color format for general service signs is as follows:

Letters	Symbols	Arrows	Borders	Background
White	White	White	White	Blue

Figure 2 shows the General Service Signs with recommended sizes currently approved in the CA MUTCD. The G66-21 (CA) sign was added to the CA MUTCD to be used on conventional roads or at the battery charging station.

 G66-21 (CA)	 D9-11bP	 D9-11b
Charging Station 12” x 12” 18” x 18” Conventional Road 24” x 24”	Freeway 30” x 24” Expressway 30” x 24” Conventional Road 24” x 18”	Freeway 30” x 30” Expressway 30” x 30” Conventional Road 24” x 24”

Figure 2. California MUTDC EVCS General Service Signs

On April 1, 2011, the Federal Highway Administration (FHWA) issued an Interim Approval for use of an alternate D9-11b sign (Figure 3) to the States of Oregon and Washington. The FHWA considered the substitution of the electrical cord in place of the gas hose and nozzel as a more appropriate representation of a battery charging station. The use of this sign as an alternate to the D9-11b will be granted to other states or public agencies that submit a request to FHWA. When, and if an official rule making occurs and the sign is included in the MUTCD, then it can be

used as a permanent sign on public roadways by any agency in the United States. The same dimensions of the D9-11b apply to the alternate sign.

Figure 3. D9-11b (Alternate)

Below, Figure 4 shows the typical types of advance turn and directional arrow signs used with the electric vehicle charging signs:

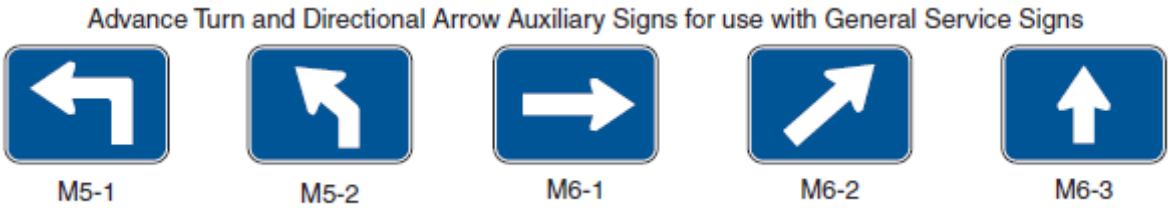


Figure 4. Advance Directional Arrows

Regulatory Signs

Regulatory signs are required for enforcing the time duration and days that electric vehicles are permitted to park and/or charge at public charging stations. Qualifying electric vehicles should be defined in local codes, as well as if being plugged in and charging is required when a vehicle is parked at an electric vehicle charging station. **Currently, no regulatory signs exist for electric vehicle charging purposes in either the CA MUTCD or the federal MUTCD**. However, signs have been developed for testing in Oregon and Washington, and it is recommended that those signs be utilized in Sonoma County until such time as California adopts standard signs. New signs can be added to the MUTCD or CA MUTCD through the "experimentation" process which is described in each manual.

Regulatory signs are generally prohibitive or permissive, and there are certain color designations for each. Green/white regulatory parking signs are considered permissive signs and are intended to provide motorists with the allowable time and days to park. Red/black/white regulatory parking signs are prohibitive and are intended to advise motorists of an action that shall not be taken.

To be enforceable, each of the signs in figure 5 should be no smaller than 12"W x 18"H and placed immediately adjacent to the electric vehicle charging station at heights as prescribed in the CA MUTCD and CBC Title 24, Part 2. The sign on the right would allow for the parking of an

electric vehicle without being plugged in, whereas the sign in the center requires the electric vehicle to be plugged in and charging (see definition for "charging"). Both of the prohibitive

Figure 5. Sample Regulatory Signs (for guidance purposes)

signs are developed with the intent to make it unlawful for any vehicle other than an electric vehicle to occupy the space. If a permissive sign is used in combination with a prohibitive sign it shall be installed below or to the right of the prohibitive sign.

Local authorities or property owners, after notifying the police or sheriff's department may cause the removal of an unauthorized vehicle from an electric vehicle charging station. The process for posting and notification is described in the California Vehicle Code (CVC) Section 22511. Below are photographs of various combinations of general service and regulatory signs installed at electric vehicle charging stations in public and private parking facilities.

Figure 6. Public Charger in Downtown Santa Rosa (with maximum 4-hour charging time limit during specified days and hours)
Parking Lot under U.S. 101 operated by City of Santa Rosa, Photos by LightMoves

Figure 7. Accessible EVCS in parallel space on opposite side of two accessible parking spaces.

Figure 8. Combination sign permitting short-duration parking for any vehicle **and** no time-limit on charging in Figure 7.

Ecology Action Parking Lot, Santa Cruz, Ca. Photos by LightMoves

Figue 9. Van Accessible ADA Parking Space equipped with charger
San Jose, Ca. Photo by LightMoves

Figure 10. Non-standard EV charging sign on 120V Level 1 charging station in park-n-ride lot in King County, Washington
Photo by Plug in America

Figure 11. Series of 120V Level 1 Chargers in King County, Washington (entry sign-charging by reservation only) *Photo by Plug in Ameria*

INSTALLATION GUIDELINES—GENERAL

Existing Parking Facilities

EV charging is a service that is distinct from other services. These guidelines have been prepared at a time when federal and California laws and regulations, as well as accepted practices involving electric vehicles and how to plan for, install, identify, provide access to, regulate and enforce public electric vehicle charging infrastructure are continuing to develop and undergo change. To meet the objective for installing at least one accessible EVCS (where equipped with card readers, the CBC requires the first two to be accessible) at each EVCS location, a charger may be installed at an existing standard parking space. However, the space width must be modified to provide for a path of travel to the charger. When the first charger in an EVCS location is installed, the charger shall comply with the accessibility requirements in CBC Title 24 and ADA. When such modifications require a reduction in the number of existing parking spaces to allow for an accessible EVCS, it is recommended that the number of standard stalls required for the building(s) served by the parking lot be confirmed to assure the modifications do not reduce the required number of parking spaces.

The first charger may also be installed at an existing accessible parking space that is also part of the required number of accessible stalls for that parking lot; provided signage clarifies that this stall can be used for accessible parking and/or electric vehicle charging by vehicles displaying a DP placard or license plate.

Since the point of service is the EV charger itself, installing an EV charger does not trigger the removal of barriers that may or may not exist between the EV charger and the path of travel to other services, programs, or building entrances.

New Buildings, Site Construction or Redevelopment

When EV charging stations are planned as part of a new building, a redevelopment or major site reconstruction at least one EVCS in ten (10) shall comply with the accessibility requirements in the CBC Title 24 and ADA. The one in ten ratio is not an ADA requirement, but one developed by the County of Sonoma PRMD. When equipped with card readers, the CBC requires the first two EVCS to be accessible. The dimensions and surface slope of the EVCS shall also comply with the more restrictive of either the California Building Code Title 24, or ADA.

Since the point of service is the charger, installing an EVCS does not trigger the need to provide a path of travel from the charger to other services, programs, or building entrances. However, where feasible, a connecting path of travel to other services for convenience is highly recommended.

When an EV charger is installed in either a new or existing parking area/lot for the sole purpose of charging vehicles and not to also meet the minimum number of required accessible parking spaces or standard spaces that serve a building or program parking requirement, at least one EVCS shall be accessible per the CBC Title 24 and ADA. CBC Chapter 11C states that when more than one EVCS is installed, a minimum of two shall have accessible features. In such instances,

signage may be installed clarifying that the designated EVCS shall be used for vehicle charging only.

ELECTRIC VEHICLE CHARGING STATION INSTALLATIONS—RESTRICTED

In these guidelines, chargers that are not intended for general public access are referred to as "restricted". The chargers are installed and intended to be used by a designated vehicle or driver, such as public and private fleet vehicles, an assigned employee or by an EV owner at home. These chargers are restricted from public use, space size and signage (if used) and other installation and operational considerations vary widely; therefore, at a minimum, the standards that should apply are health and safety related; such as electrical, fire and building codes. It is recommended that whenever possible as much of remaining guidelines be included in each installation, to allow for expanded service should the usage need to change in the future. In the figures that illustrate typical electric vehicle charging station and parking lot configurations, a *comments* section follows each figure to provide further explanation pertaining to the illustration.

Public and Private Fleets

Government, commercial and utility fleets are expected to make up a large portion of the initial EV sales market. Fleet managers will be required to make very tactical decisions to maximize their return on investment when determining which are the best EVs or PHEVs suited for their needs and how to optimally charge them during daily duty cycles.

Fleet vehicles are generally parked in surface parking lots in perpendicular or angled parking spaces. Parking spaces are often numbered or posted with signs and/or markings that designate which vehicles or staff are assigned to that space.

Figure 12. Restricted Electric Vehicle Charging Station
(County of Sonoma Corporation Yard) *Photo by LightMoves*

The fleet manager of a publicly or privately owned fleet must take many factors into consideration when developing a comprehensive or strategic plan to determine when and where to install battery charging stations. One of the first and major considerations is if the parking facility is leased or owned, and how long the agency is planning to remain at the site. Once owner approval is given for the installation of chargers, and relocation of operations is not

planned, the fleet manager should begin to investigate the number, type, expected range requirements and charging schedules of the EVs or PHEVs that will be added to the fleet.

Table 2 lists several key considerations that both fleet and facilities managers must take into account once the decision has been made to proceed with EV charging station installations. Key among these is the distance from the power supply to the planned chargers, and if an upgrade to the electrical service is needed. Fleet managers should fully investigate automated charging systems that allow sequencing of charging so as to spread the available power systematically to reduce electrical service upgrade costs.

If existing parking spaces are being converted to EV charging stations, the fleet manager must determine if there is adequate remaining parking for non-electric vehicles if the EV charging stations are to be restricted to EV use only. If PHEVs (which have an internal combustion engines to extend driving ranges) are planned for purchase the fleet manager should examine the necessary charging times for a fully depleted batteries and determine if a lower voltage current will satisfy the typical driving patterns of those vehicles. If certain fleet vehicles require a very fast recharging time (1 hour or less), then the fleet manager needs to determine if the much costlier Level 3 fast charger(s) is the right strategic investment.

If employees or the public will have access to an EV charger in a restricted parking space, accessibility to the EV charger and quantity shall be the same as required for Accessible EV Charging Stations. Title 1 of the Americans with Disabilities Act of 1990 requires employers to make reasonable accommodations to any qualified employee with a disability if it does not impose an undue hardship on the operation of the employer's business. While job restructuring or modification of work schedules may be temporary methods of satisfying Title 1 requirements, making the equipment accessible may provide the most beneficial long-range solution for the business or government agency.

Figures 13 and 14 illustrate sample installations of restricted-use EV charging stations for fleet operations. Figure 15 demonstrates how a multi-port charging station can service up to four fleet vehicles simultaneously in two parking bays. This type of installation can minimize underground construction and material costs and be the least costly to provide signage, protection, shelter and lighting if desired.

Item	Consideration
Property Ownership	Whether the property is leased or owned, planned occupancy period, and any relocations, expansions, or consolidations being considered, property address, building number., GPS, etc.
Vehicle Issues	Estimating the number and type of vehicles, vehicle duty cycles, conversions of existing hybrids to PHEVs, and range requirements, etc.
User Base	Understanding if charger is restricted, open to general use, accessibility, accommodations for those with disabilities, work schedules, access to building entrances
Time of Charging	Knowing if vehicles will be charged overnight, during the day, and if vehicles need to be moved manually to free up charging stations, EV rate structures
Source of Electrical Power	Distance from power supply, if service and panel upgrades are required, and if separate metering is required
Construction Issues	Permitting, budget, construction components such as: distance to power, trenching, landscape removal/replacement, paving, signage, painting, lighting, ramps, and walkways,
Automated Charging	Will equipment and software be needed to automatically sequence charging operations among available chargers to maximize capacity of electrical supply?
Public Access and General Use	Understanding additional design features that may be required, such as signage, lighting, accessibility, etc. if general public is to have access to the equipment
Tracking Software	Ensuring systems are planned or in place to track use, performance, maintenance, VMT by type of fuel, etc.

Table 2. Fleet EVCS Installation Considerations

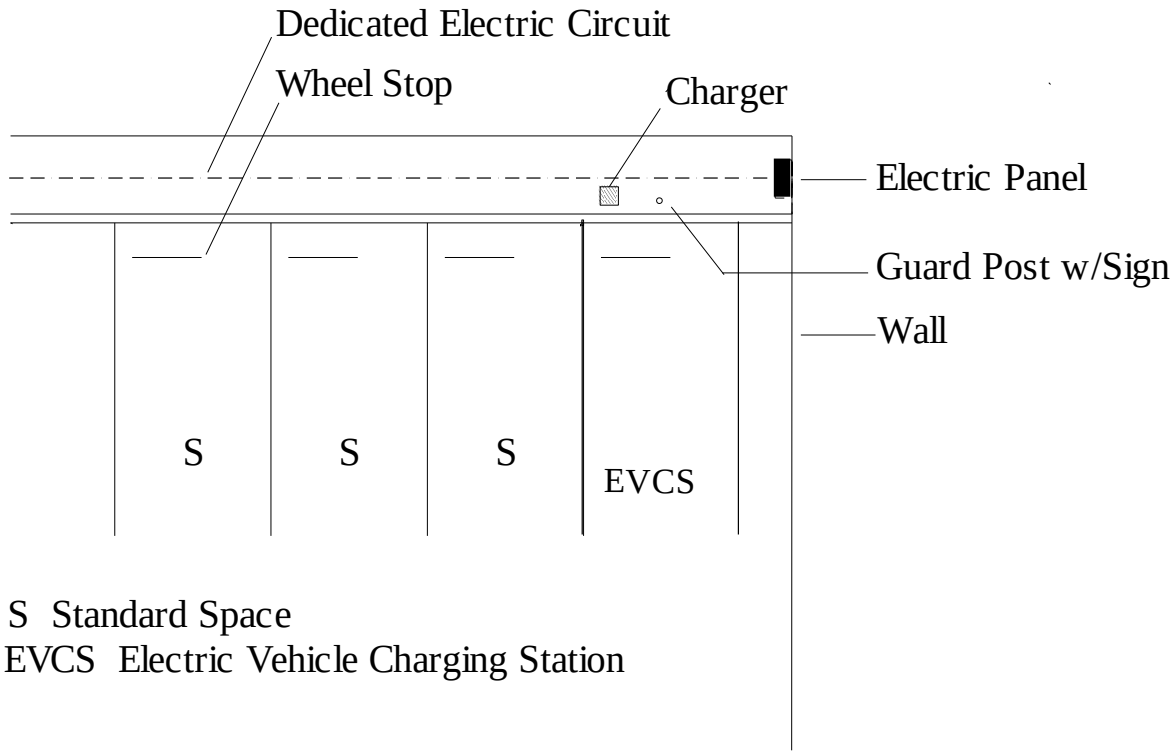


Figure 13. Single Charger (perpendicular)

Comments on Figure 13. This figure illustrates a single EVCS installed in close proximity to an electrical service panel. Since EV charging inlets can be on the left, right, front or rear of the vehicle; having additional clearance on either side of the EVCS allows the driver to position the vehicle to most easily access the charging equipment and inlet. In this example, the stripe on the right-hand side of the EVCS is optional. By installing the first EVCS closest to the wall or fence line also minimizes pedestrian traffic passing over the cord. Consideration should be given to sizing the electrical panel and extending underground conduit with properly spaced junction boxes for ease of future EVCS installations. In this example, positioning the charger toward the left side of the EVCS simplifies conversion to a dual port charger in the future. If the charger is in front of the EVCS and on a raised surface, consideration should be given to installing a wheel stop and/or guard post for extra protection from vehicle damage. If the charger is installed in front of and on the same surface as the electric vehicle, protective guard posts ***shall*** *be installed as required by Part 9, Title 24 (California Fire Code).*

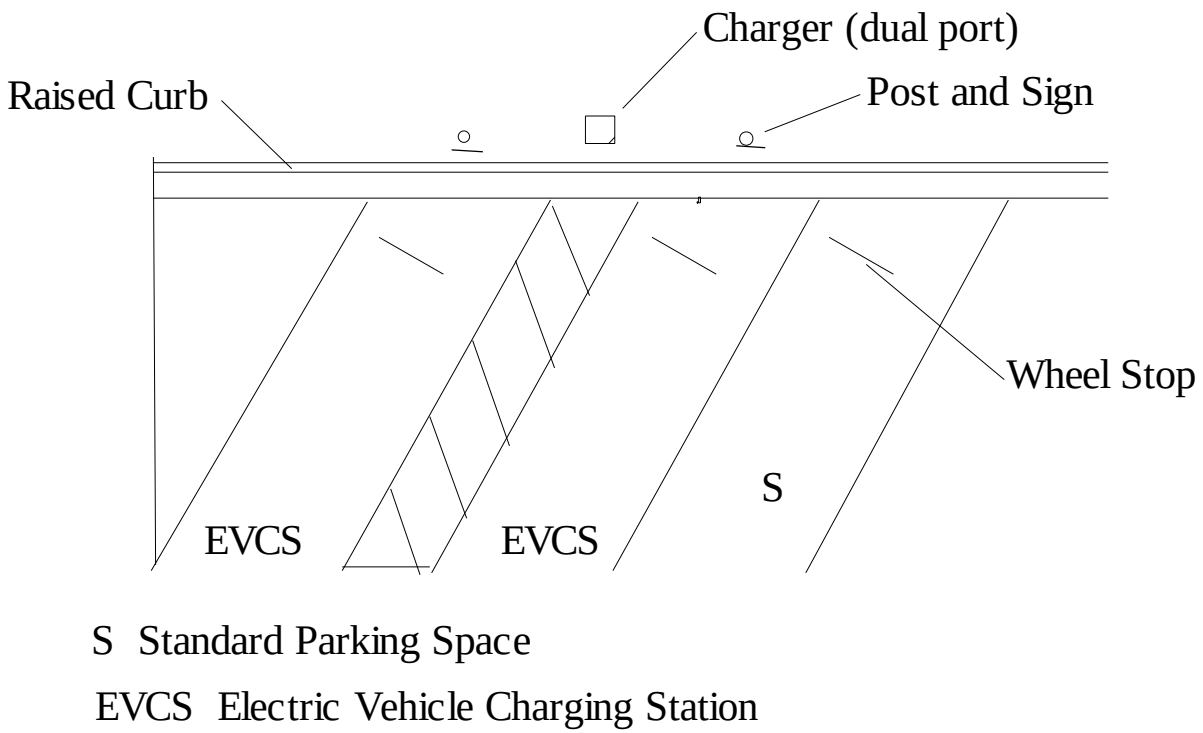


Figure 14. Dual Port Charger (angle)

Comments on Figure 14. This example illustrates a dual port charger servicing two electric vehicle charging stations in an angle configuration. If space is available, providing a clear path of travel between the charging stations improves access to and from the equipment and vehicle charging inlets. By installing the dual charging station in line with the path of travel and on a raised surface, exposure of the equipment to vehicle damage is minimized. Installing the front controls of the charging station no greater than 10 inches behind the face of the curb provides accessible reach. If wheel stops are installed, keeping a minimum clearance of 3 feet to the face of curb provides good access around the front of the vehicle. Signs with language restricting charging station use to designated fleet vehicles can be installed on standard sign posts or protective guard posts.

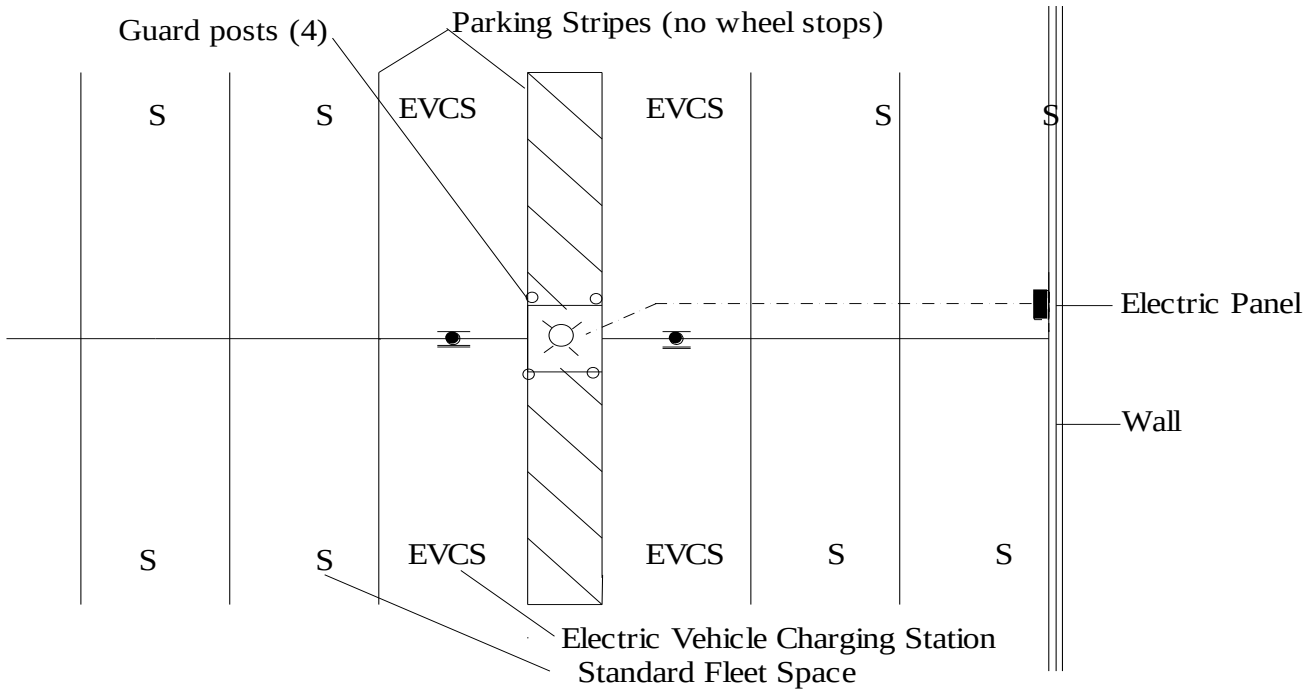


Figure 15. Multi-Port Charger (opposite parking bays)

Comments on Figure 15. This example demonstrates a typical public agency fleet parking lot, with no wheel stops, raised islands or sidewalks. The lack of these features maximizes the fleet manager's flexibility to locate large and small pieces of equipment in multiple parking configurations. In this example, the multi-port charger can service four electric vehicles simultaneously if enough electrical power is provided, or sequentially if automated charging system software is installed. If sequential charging can satisfy the needs of the fleet manager then the cost of electrical service upgrades may be reduced. The example above illustrates how two wide paths of travel (5 feet minimum recommended), four guard posts and two sign posts/with four signs can accommodate four EV charging stations.

<u>*Designated Employees*</u>

In both publicly owned and/or operated, as well as privately owned parking facilities, some parking spaces are often designated for use by a designated employee. This is a form of restricted (reserved) parking, in that the space is not available for use by the general public or any other employee. Assignment of the space is often designated by the job function or position that the employee holds. For instance, a parking space may be reserved for a Traffic Superintendent or the Maintenance Manager as shown in the illustrations below. In each case the space is reserved for the person holding that position, and not the type of vehicle being driven. If it is determined that the designated employee will be assigned a plug-in electric vehicle, then the space may be converted to an electric vehicle charging station. However, it may be more advantageous to relocate the designated employee to a location more conducive to the installation of an EVCS. Any public agency or private company installing one or more

EVCS for designated employees should make every effort to install at least one in each EVCS location meeting the accessible EVCS guidelines.

Figure 16. Examples of designated employee parking spaces

Residential—Single Family

A potential EV consumer should take many factors into consideration before acquiring a plug-in vehicle. The two most important decisions are the **type of plug-in electric vehicle** (including charging ventilation requirements) and the **power supply** (voltage and amperage) of the home charging system. In selecting the type of EV, the educated buyer will be able to compare the range of one's current vehicle on a full tank of gas based upon fuel efficiency (miles per gallon) in different driving conditions against the range of a plug-in electric vehicle based on battery capacity (kilowatt hours), the charging source measured in voltage and different load and driving conditions. Table 3 demonstrates that charging times vary significantly based upon vehicle battery size and the amount electrical power being supplied. It also shows how the overall range can vary with a BEV and PHEV.

Vehicle	**Battery Capacity**	**Electric Power**	**Charging Time[1] (hours)**	**Range[1] [extended range]**
Nissan Leaf	24KwH	120 V/20 A 240V/40A	15 hours 4 hours	100 miles
Chevrolet Volt (Extended Range Electric Vehicle)	16KwH	120V/20A 240/40A	10 hours 2.5 hours	40 miles [plus 300+ miles on gas]
Toyota Prius (Plug-in Hybrid Electric Vehicle)	5.2KwH	120V/15A 120V/20A 240V/30A	4.3 hours 3.2 hours 1.2 hours	13 miles [plus 450+ miles on gas]

[1]Charging times will vary based upon electrical efficiency and load factors and range will vary based on carrying load, topography, average speed and other factors (all charging times and ranges illustrated are approximate)

Table 3. Electric Vehicle Battery Capacity Comparisons

Battery Electric Vehicles generally require larger battery capacity because the battery provides both acceleration and range and is the only fuel source. PHEVs normally have smaller batteries

because they have more than one fuel source. Table 3 shows that using the smallest electrical circuit normally available in a residence (120V/15A) a Toyota Prius PHEV could fully charge in a little over four hours, yet the all-electric range is only about 13 miles. A Nissan Leaf also takes about four hours to fully charge on dedicated 240V/40A electrical circuit or about 15 hours on a 120V/20A electrical circuit. Consumers wishing to charge with 240V/30-40A (Level 2) may need to upgrade their electrical system. This can be expensive and is a very important factor when considering the overall expense of the initial purchase price.

Residential Charger Installation

A web-based EV Consumer Survey of BEV owners conducted in 2010 by Plug-In America suggests that about 81% of charging occurs at home and 10% and 7% at the workplace and in public charging facilities respectively (http://psrc.org/assets/4334/EVI_append_D.pdf). However, determining when to charge and where to install residential charging equipment takes considerable research to help avoid making costly mistakes or missing key opportunities. The act of charging can be as simple as plugging a special Level 1 cord set (supplied with most new EVs) into a standard receptacle with no other electrical loads on the same circuit. The special cord set consists of a standard 3-prong plug on one end, an in-line Charge Current Interrupting Device (CCID), and the J1772 vehicle connector on the other end. Installing a dedicated electrical circuit with a 240 Volt charger, on the other hand is much more expensive as electrical load assessments must be made, panel capacity evaluated, permits obtained and the cost of labor and material to install the equipment. Every EV buyer should consult with their EV dealer to determine if a site evaluation and any of this work or material is provided as part of the vehicle purchase. Many EV dealers are also now creating lists of certified electrical contractors trained to evaluate and recommend as well as install equipment in the best locations.

Because charging inlets on EVs are appearing on any of the four sides of the car, the actual location to “plug-in” has to be made on a case-by-case basis. The certified contractor will be able to advise the consumer on every aspect of the installation. The type of vehicle and normal driving ranges will be the key factors as to where to plug in and what to plug into, however several other considerations listed in Table 4 below will help in the decision-making process. The electrical code NEC Section 625 for EV charger installations is attached as appendix D.

Figure 17 illustrates an EV charger installed on a garage wall and Figure 18 on a carport panel. Figure 19 shows a typical single-car garage and charging equipment location near the electrical panel and not in the direct path between the driver’s door and the home entry door. The auto dealer and charger manufacturer should both provide installation guidelines beyond those discussed in this section.

Item	Installation Consideration
Cable	Maximum Length of Level-1 cable supplied with new vehicle is 25’ (NEC Requirement)
Charger Installation	• Floor-mount is preferred in driveway or carports • Wall- or Ceiling-Mount is preferred in a garage • Select location to minimize risk of vehicle damaging it
Vehicle Orientation & Charging Inlet	• Determine if vehicle is normally backed-in or head-first • On which side of the vehicle is the charging inlet located?
Walking paths	Avoid to the extent possible having the cord cross common walking paths
Clearances & Height	• Keep a clear area of a minimum of 36 inches wide and 30 inches deep in front of the charger • Maintain a clear height of 6’6” from floor to a point above the charger; mount the connector at a height between 36-inches and 48 inches above the floor (never install a receptacle below 18 inches for charging purposes)
Lighting	Automatic garage door lighting or motion sensor lighting is recommended when walking around vehicles charging

Table 4. Residential Charger Installation Considerations

Figure 17. Garage Charger (Wall Mount)
Photo by Clean Fuel Connection

Figure 18. Carport Charger (Wall Mount)
Photo by Dan Davids, Plug In America

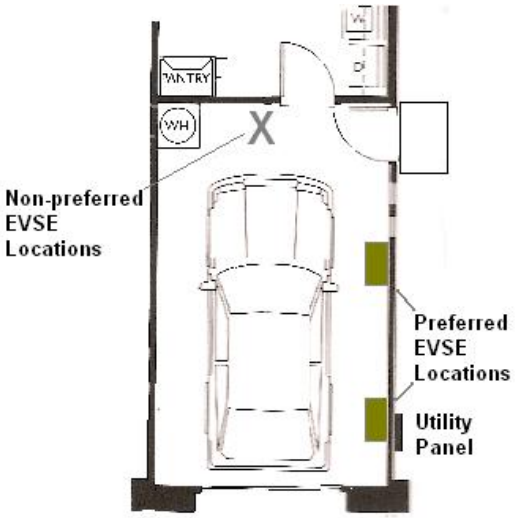


Figure 19. Single-Car Garage and Electric Vehicle Supply Equipment (typical)
(Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis, and Eugene)

Residential—Multi-Unit Dwelling

Installing EVSE in multi-family residences is more complex than in a single-family residence garage or carport because the home owner or renter (EV consumer) is not necessarily the owner of the land or of the parking area. The key issues are listed below in Table 5, and should be carefully considered before deciding to purchase a plug-in vehicle.

Item	Installation Considerations
Ownership of Electrical Work and Circuit	Decide who will authorize, pay for and own the permanently installed circuit from the meter to the charger
Charger	Location and ownership
Metering	How will electricity be metered and payments made?
Insurance	Determine responsibility for any increased insurance
Construction	Project design, engineering, and construction costs
Site Improvements and Operations	Signage, landscaping, equipment protection, ADA improvements, enforcement

Table 5. Multi-Unit Dwelling Residential Charger Installation Considerations

ELECTRIC VEHICLE CHARGING STATION INSTALLATIONS—PUBLIC

Electric Vehicle charging stations intended for public use can occur in two configurations, in a parking facility or on-street (curbside). Parking facilities will either be publicly owned or privately owned, but in each case the charging station is intended for public or private use. Off-street EVCS will occur in all types of parking facilities, such as long-term airport parking, hotel parking, retail malls and municipal surface parking lots and parking structures. EVCS will usually be installed in perpendicular or angled parking spaces, but in some cases parallel spaces. On-street EVCS will normally occur in parallel parking spaces, but in some cases may be in angled parking stalls. When these EVC are intended for public use, both guide signs (way finding) and some form of regulatory signage will be necessary, and accessibility and reasonable accommodation provisions must be considered in the planning, design, installation, and operation of the EV charging stations.

Accessibility standards specific to the installation of publicly accessible electric vehicle charging stations are not currently established in the California Code of Regulations, except in limited form in *Standards for Card Readers at Gasoline Fuel-Dispensing Facilities*, contained in Chapter 11C of the 2010 California Building Code. Chapter 11C includes electricity and many other fuels besides gasoline as a motor fuel. The 11-C Standard provides explicit detail on accessible height, reach, clearance to obstructions and allowable slope, but no indication of space size and configuration. There also exists an internal State policy, *97-03—Accessibility Guidelines for Electric Vehicle Charging Stations* issued by the State Department of General Services. Policy 97-03 provides guidance by the State Architect on the size and number of accessible charging stations and placement of an access aisle and signage, but no guidance on accessibility to the battery charging station controls. The Division of the State Architect (DSA) refers to the State policy as "interim guidelines" and encourages their use at buildings and facilities under DSA jurisdiction. Policy 97-03 states: *"Local authorities may or may not adopt similar methods of administering current code requirements, determining equivalent facilitation or defining acceptable parameters when enforcing the California Building Standards Code".*

The inconsistencies between the State standard on motor fuel dispensers with accessible card readers and the guidelines on accessible electric vehicle charging stations leaves local authorities the challenge of deciphering between a set of conflicting standards and guidelines. This is resulting in broadly different interpretations and inconsistent practices. **The matter is further complicated by the fact that the vast majority of EVCS being installed over the next several years will occur in existing parking facilities where the source of electrical power, location of accessible parking spaces, natural terrain, landscaping and other features already exist.** Until such time that a clear and uniform set of standards are developed for the installation of electric vehicle infrastructure in the State of California, these guidelines have been prepared to assist Sonoma County to provide reasonable accommodations and accessibility to chargers intended for both restricted and public use. The goal of these guidelines is to provide a universal solution. Using the ADA and CBC accessible parking space standards would call for a 17-foot width for the first EVCS. Recognizing it is important to strive for a universal solution so everyone can use the EVCS, there may be site conditions that will not

feasibly allow for a 17' wide EVCS. Therefore the guidelines recommend an EVCS between 17 and 12-feet (min.). Working with the County of Sonoma PRMD and other local permitting agencies, a solution as close to 17-feet is desirable. The same condition exists with grade variance. The universal solution is a maximum slope of 2%. However, if site conditions prevent 2% or less, then up to 5% slope with the goal of getting the slope as close to 2% as conditions allow is desirable.

Table 6 compares an Accessible Electric Vehicle Charging Station with a standard Electric Vehicle Charging Station, using criteria from Chapter 11C and the ADA whichever is more restrictive.

In the following sections, typical examples of EVCS installations intended for public use will be illustrated. A *comments* section follows each figure to provide further explanations pertaining to the illustration. In all off-street examples it is assumed that standard parking and accessible parking spaces already exist in the parking facility (or are planned for in new facilities), thus battery charging, not parking is the primary purpose of the electric vehicle charging station. The examples illustrate typical parking configurations (perpendicular, angle and parallel), as well as identification of sidewalks, path of travel (see definition) and source of electrical power. It should be noted for the next several years, that the vast majority of public charging stations will be retrofitted into existing parking lots. Therefore, plan checkers, chief building officials and inspectors will need to apply their best professional judgment when determining applicability to local and statewide codes.

Off-Street Electric Vehicle Charging Stations

Owners and developers of private off-street parking facilities and public agency parking operators have many factors to consider before deciding to install EVCS and equipment for general public or employee use. Prior to addressing any of the site specific installation, operational and maintenance considerations listed below, the question of who owns the lot and has the authority to make all decisions must be answered. Business owners, who lease building space but only have access to common customer parking, must make financial, legal and operational arrangements with the property owner to the satisfaction of all parties. Public agency managers should ensure the property is intended for long-term parking use, and not subject to sale or conversion to other public uses.

The key considerations involving installation and operations for public charging are listed in Table 7. Addressing each of the considerations early in the planning and decision-making stages will result in the best overall end product for the property owners and public agencies, as well as positive user experiences for EV owners.

	Accessible Electric Vehicle Charging Station	Electric Vehicle Charging Station
Station Size	12 ft. wide[1] (min) to 17 ft. wide (max) x 18 ft. deep (min)	9 ft. wide (min) x 18 ft. deep (min)
Number	first two[2]	third, fourth, etc.[3]
Highest operable part	48 inches above level accessible area	n/a
Maximum distance to face of controls	10 inches from level accessible area to face of controls	n/a
Level accessible area	Minimally 30 inches by 48 inches (long side parallel and centered with controls +/- 9" either way)	n/a
Slope	Level accessible area not to exceed 2% in any direction[4]	n/a
Obstructions	User-controlled cable may overlap required path of travel and level accessible area	n/a
Path of travel	Clearance requirements stated in Chapter 11B, CBC for wheelchair passage[5]	n/a
Signage	Standard G66-21 (CA)	Standard G66-21 (CA)

Table 6. Comparison of Accessible EVCS with EVCS

[1] This width is based upon the assumption that existing ADA parking spaces exist in the EVCS location; that the point of service is the charger; that the accessible stall width is 9 feet and the minimum path of travel on either side of the vehicle is 3 feet.

[2] If first charger is a dual port charger, contains a card reader and can simultaneously charge two electric vehicles at any voltage then it qualifies as the servicing the first two Accessible EVCS.

[3] After a total of 10 EVCS are installed at an EVCS location (including the first two Accessible EVCS), the eleventh (11th) EVCS will be accessible, and every 10th EVCS thereafter, 21st, 31st, etc. (Sonoma County requirement)

[4] The CBC allows the slope to increase to 5% due to unusual site conditions, if 2% is not obtainable and the agency having jurisdiction approves. The maximum slope in any direction in the ADA is 2%.

[5] The minimum clear width or single wheelchair passage shall be 32 inches at a point and 36 inches continuously. *CBC Chapter 11B, Section 1118B.1.*

Item	Consideration
Electrical Supply	Identify the source of electricity, calculating current loads and if sufficient power exists for EV charging purposes
Identifying Potential Users	Examine charging needs for potential users and review of average parking durations
Safe Walking Environment	Minimize cord obstructions and maintaining clear, barrier-free pedestrian walkways
Access to Equipment	Providing safe, convenient access to the charging equipment while also protecting it from vehicle damage
Communications Needs	If using card readers, ensure cell phone, wi-fi or wired communications to charging station equipment is available card?
Renewable Energy Issues	Determine if renewable energy, and/or energy storage is planned for the parking facility and its physical relationship to EV charging
Operations and Maintenance	Address how chargers will be operated, maintained, and regulated?

Table 7. Public EVCS Installation Considerations

Figure 20 shows an example of installation of two chargers to service three electric vehicle charging stations in an angle configuration with the charger closest to the sidewalk being an accessible charger.

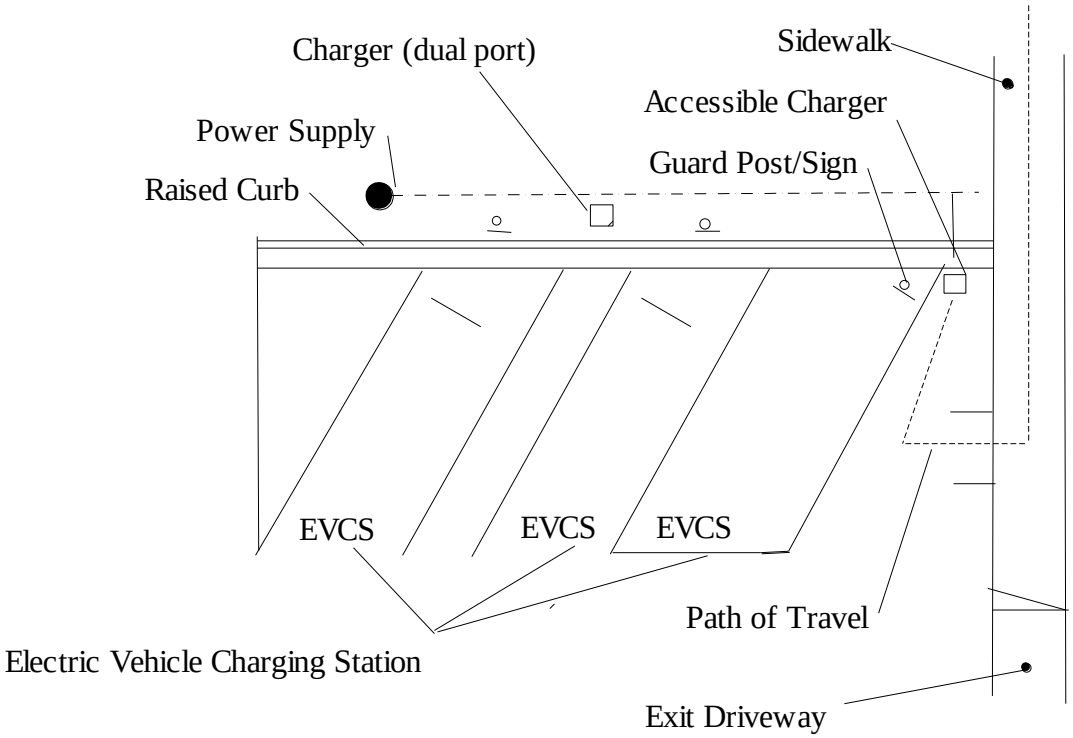


Figure 20. Installation of Accessible EVCS (near sidewalk)

Comments on Figure 20. This example illustrates a public or private parking facility with angle parking against a curb. Three electric vehicle charging stations are shown serviced by two chargers. Each charger is in close proximity to the underground source of power, and each is assumed to have card reader controls. The charger on the left is a dual port charger and the one on the right is a single charger. The charger on the right is designated as an accessible charger. Therefore the EVCS should be a minimum of 12 feet wide to provide convenient access to inlets on any side of the vehicle. The level accessible area in front of the charger and path of travel to the adjacent sidewalk should not exceed 2% and have a minimum clearance of 3 feet to any obstructions. Note that the accessible charger is installed at the same grade as the parking lot and sidewalk, and therefore requires a guard post for protection. The electrical cord may cross the path of travel when connected to the vehicle, however cords should not be placed in high pedestrian traffic areas and never extend over sidewalks. The dual port charger on the left is placed behind the raised curb and is in line with a desirable 36-inch clear area between the two standard size electric vehicle charging stations. If this were the only other charger in the lot, modifications would be required to ensure one of the two EVCS is accessible.

Figure 21 provides an example where two perpendicular accessible parking spaces and a path of travel already exist and an EVCS is installed across the island in front of the accessible space with a dual port charger placed adjacent to the path of travel.

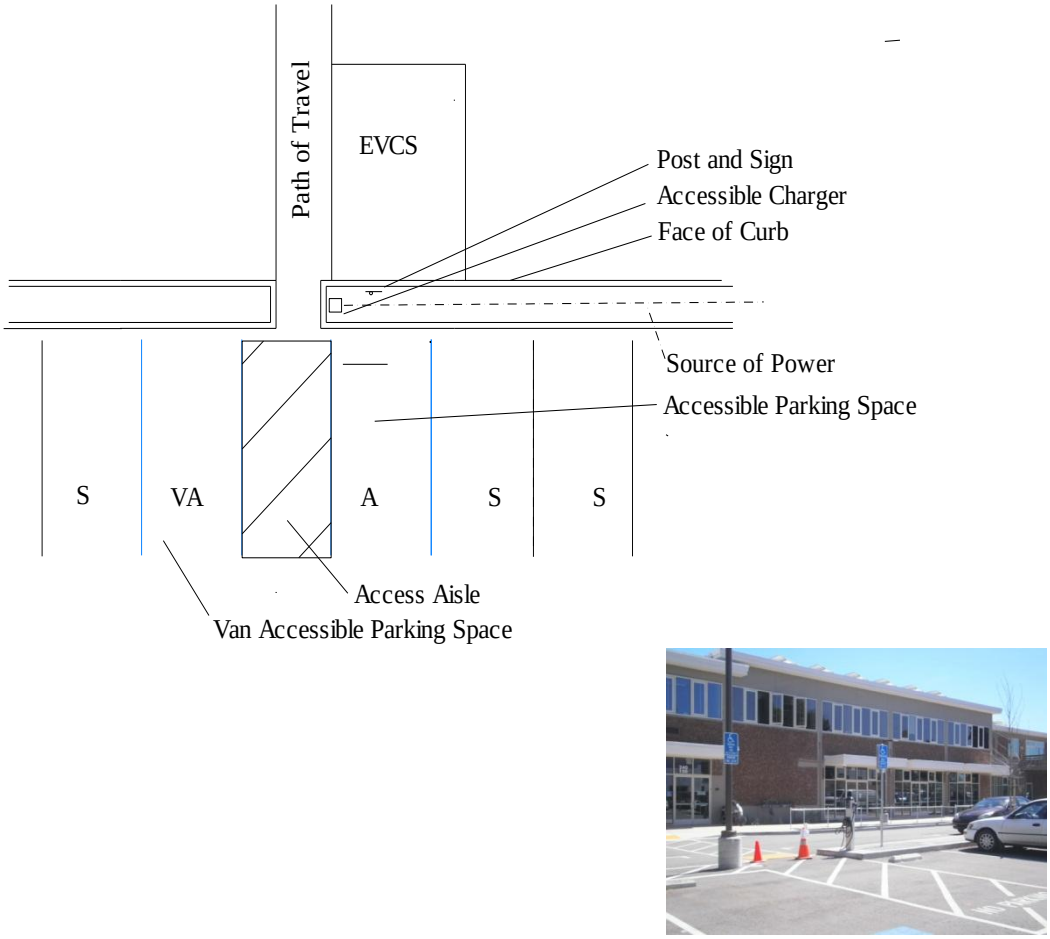


Figure 21. Installation of an Accessible EVCS (near accessible parking)

Comments on Figure 21. This example illustrates how placement of dual port charger can accommodate an accessible EVCS on one side of an island, as well an accessible parking space on the opposite side. Any vehicle displaying a Disabled Person (DP) placard or DP license plate may occupy the accessible parking space including an electric vehicle that could utilize the accessible charger. A sign identifying the accessible parking space as an "electric vehicle charging station" could be added. The accessible charger is one that meets the reach, height, clearance and slope requirements of accessible fuel-dispensing equipment (Chapter 11C, CBC).

Accessible EVCS will not always be installed near accessible parking spaces. In fact, because of power source, desire for long-term charging and cable management issues in high pedestrian areas, accessible EVCS will often be installed some distance from the front entrance. Figure 22 illustrates two accessible EVCS in an angle configuration serviced by a dual-port charger.

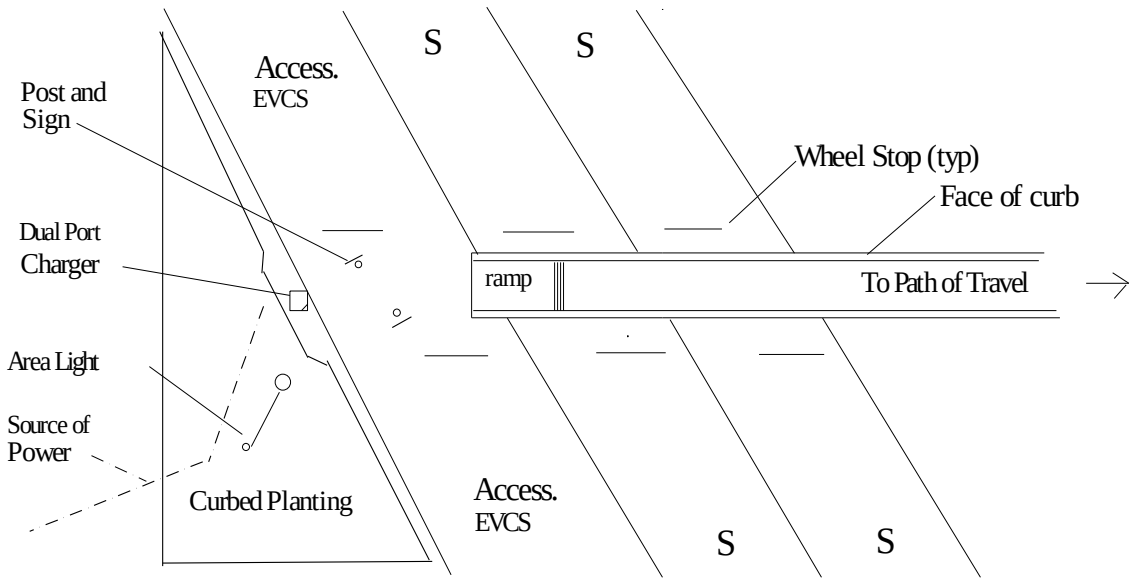


Figure 22. Installation of Two Accessible EVCS (angle parking, near path of travel)

Comments on Figure 22. This example takes advantage of a planted island at the end of a parking bay, where a dual port charger is installed in a recessed section behind the curb line. The two accessible EVCS are a minimum of 12 feet wide, and have an unobstructed route from any side of the vehicle to the charger and to the ramp leading to the path of travel. Because the charger is installed at the same elevation as the parking lot surface, guard posts containing signage are installed to protect the equipment and keep the ramp clear.

On-Street Electric Vehicle Charging Stations

There will be instances where on-street public EVCS will be installed due to lack of off-street facilities or convenience and cost savings of connecting to higher voltages of electricity in the public right-of-way. Since EV manufacturers have not standardized on the location of the charging inlet, cord management, equipment damage, as well as traffic and pedestrian safety become very important considerations before installing on-street EVCS.

Because on-street parking is not considered the primary purpose of the roadway, it is important to determine if due to; vehicle capacity, turning requirements, sidewalk expansion, bicycle lanes, or other reasons if the parking spaces are likely to be removed. Any on-street location that is planned for significant rehabilitation or realignment should not be strongly considered as a viable on-street EVCS candidate. Table 8 below presents several issues to consider before installing on-street charging facilities.

Item	Installation Consideration
EV Charging Inlets	In parallel parking locations, cords may be exposed to moving traffic
Parking configuration	Angle parking is preferred over parallel or perpendicular parking, because equipment is easier to protect and cord management is less an issue
Pedestrian Clearances	Ensure that sufficient space exists to meet ADA clearance requirements on sidewalk after installation of equipment (4' minimum)
Single or Dual Charging Ports	Single port charging equipment is recommended for parallel parking, and charger should be installed near front of space Dual port chargers should be placed between two EVCS in angle or perpendicular configurations
Location	The last space on the block in the direction of travel will usually minimize cord management issues, and places user closer to crosswalks and curb ramps
Signage	Guide signs identifying the space as an EVCS and any regulatory signage needs to be installed immediately adjacent to and visible from the EVCS
Clearance and Protection	Charger should be 24" clear from face of curb Charger should be protected by guard posts in angle and perpendicular configurations
Area Lighting	Good lighting lessens risk of tripping or damage to equipment from vehicle impact
Maintenance	Contact information must be provided on equipment to report problems
Cord Management	Charger should have a retraction device and/or place to hang connector and cord sufficiently above pedestrian surface

Table 8. On-Street EVCS Installation Considerations

Figure 23 illustrates a typical on-street EVCS installed in the last space on a block-face in the direction of travel.

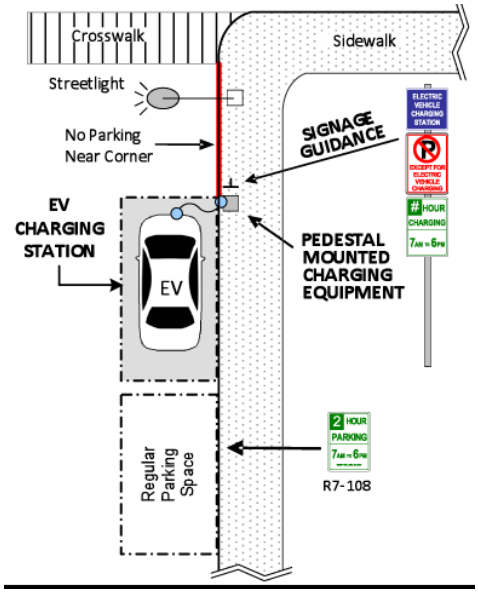


Figure 23. On-Street EVCS (parallel space-end of block)
Electric Vehicle Infrastructure: A Guide for Local Governments in Washington State

Figure 24. On-Street EVCS (angle space, charger left of center)
San Francisco; Photo by LightMoves

Figure 25. On-Street EVCS (charger & signs on streetlight pole)
San Jose; Photo by LightMoves

Permitting Process

There are multiple permitting scenarios that will occur when a consumer buys an EV and needs to recharge the batteries, or a business or public agency installs EVSE for customer or employee use. A homeowner purchasing a NEV or PHEV with a small battery pack may not need a permit since the existing garage or carport circuit may satisfy his or her basic charging needs. On the other end of the spectrum there may be a commercial entity that wants to install several EVCS for customer and employee use that will trigger electrical upgrades, earthwork and restriping of a parking lot. This section will provide basic information on the Sonoma County permitting process and working with PG&E on metering & service upgrades and rate selection. More information on Electric Vehicle Charging Permits is available on-line at the Sonoma County Permit and Resource Management Department (PRMD) http://www.sonoma-county.org/prmd/vh/ca-index.htm and at PG&E
http://www.pge.com/includes/docs/pdfs/shared/environment/pge/cleanair/electricdrivevehicles/pev_home_installation.pdf

Residential Installations—Single-Family

An EV buyer who plans to charge at home will want to understand if electrical upgrades will be required for the type of vehicle being considered. No upgrade may be necessary or expensive rewiring, panel upgrades and meter installations may need to take place primarily depending upon the type of vehicle and the time and frequency of use. If an existing garage circuit is available and serves as a convenient location to charge the EV, the homeowner may choose that option temporarily and monitor electrical consumption for several weeks before deciding on which type of improvements to make. Some homeowners may choose to explore solar systems simultaneously to offset their on-going electrical expenses. Many EV dealers and solar companies will offer charging station installation advice, incentives and home inspections at

little or no cost. Before deciding what vehicle to buy or action to take, potential EV buyers should seek outside advice from EV and solar system experts.

If an electric receptacle upgrade is not necessary then an electrical permit is not required. However, if a dedicated 120V or 240V receptacle and circuit is needed a minor electrical permit needs to be issued by the County. If the electrical contractor concludes that the existing electrical panel cannot meet the charging needs of the consumer, then an additional permit to either upgrade the electrical panel or install a new separate EV-only panel and meter will be needed. When panel upgrades and and/or a dedicated panel and EV-only meter are needed, PG&E will also have to be involved in the permitting process.

Pacific Gas & Electric Company (PG&E) wants to assist its customers to make a smooth transition to charging an electric vehicle at home. By following PG&E's *Getting Started Guide* [1] below, customers will know if they need to perform electrical upgrades for the type of vehicle they are considering. Figure 26 is a PG&E "Getting Started" guide for homeowners planning to buy an EV. In addition consumers should review PG&E's website on EV charging rates and economics:
(http://www.pge.com/about/environment/pge/electricvehicles/fuelrates/index.shtml)

Commercial & Multi-Unit Dwelling Installations

Commercial or multi-dwelling unit EVCS installations are much more complex than installing a charger in a garage. Issues such as property ownership, tenant covenants, public/restricted use, accessibility and insurance all come into play. Consultation with Sonoma County PRMD Department is needed throughout the process, and working with trained contractors who understand all the technical and legal requirements of commercial installations is highly recommended. The permitting process will require detailed plans and specifications. Review times will be greater and the cost will be higher than a single-family installation. Coordination with multiple departments and agencies such as the Fire Marshal, Public Works and PG&E will be required. More information can be found on-line at the Sonoma County Permit and Resource Department. (http://www.sonoma-county.org/prmd/vh/ca-index.htm)

Currently the State of Hawaii is the only state that has a law that requires homeowner associations in multi-unit dwellings to allow an EV consumer to install charging equipment with many provisions. California currently has a bill that has been introduced in 2011 (SB-209) that would contain similar requirements.

1. Apply to PG&E 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 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.
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.

1 http://www.pge.com/includes/docs/pdfs/shared/environment/pge/cleanair/electricdrivevehicles/pev_home_installation.pdf

Figure 26. *PG&E Getting Started Guide—Plug-in Electric Vehicles*

PUBLIC OUTREACH

Sonoma County businesses and government agencies have demonstrated strong leadership in the transition to electrically powered vehicles and clean, renewable energy. Not only has the County been the home of a neighborhood electric vehicle manufacturing company for years, it is also home to businesses that have pioneered and produced advanced renewable energy systems. The County's fleet division of the General Services Department is recognized nationally as one of the best managed, most innovative and efficiently operated government fleets. Currently, a very high 30% of the light-duty fleet is powered by hybrid, PHEV or BEVs, with a goal to replace all light duty vehicles to battery electric technology. It is one of the few fleets in the United States that can have its electric fleet charged indirectly from a Stationary

Fuel Cell. In June of 2011, the County of Sonoma was recognized by the Bay Area Climate Collaborative and the Silicon Valley Leadership Group as the "Most EV-Ready Community" in the Bay Area. The development of this County of Sonoma EVCS Program and Installation Guidelines is further testament to the County's leadership and commitment to achieve the goals contained within its Climate Protection Action Plan adopted by the Board of Supervisors in 2006. With several major automakers now mass producing PHEVs and BEVs, Sonoma County is poised to bring its environmental entrepreneurial experience together with its local government leadership to establish Sonoma County as the Northern California EV-destination hub.

While many jurisdictions across the United States are just now beginning to benefit economically in the form of job creation by designing and building component parts for new plug-in electric vehicles and charging systems, Sonoma County is positioned possibly better than any other locale in the nation to create significant job growth related to EV travel and eco-tourism.

Nearly seven million people reside in the San Francisco-Oakland-San Jose metropolitan areas within a two-hour (100^{+} mile) driving range to Sonoma County. The greater San Francisco Bay Area also sports the highest hybrid and EV ownership rate in the State. Each year millions of visitors cross the beautiful San Francisco Bay bridges to drive Sonoma County's historic trail, its wine roads, or the picturesque Highway 1 along the Pacific Coastline. This combination of eco-friendly tourism, close proximity to millions of visitors, the grape growing & wine industry, and breath-taking coastal and mountain vistas is what sets Sonoma County apart from most every other location in the Country. Add to this equation the projected rapid growth in the EV industry and ownership in the greater Bay Area and you have the formula for job creation. This historic wine tasting region will be a draw to EV owners or EV renters flying into Sonoma County or nearby International Airports for daytrips or weekend stays. To achieve this vision, many things must occur, but the heavy lifting has been done, due to the County's proactive efforts now underway to install approximately 130 public and private electric vehicle charging stations by the end of 2012.

As earlier noted, the vision of the County of Sonoma's EVCS Program is **to provide a comprehensive network of distributed chargers throughout the County which services both public agencies and the private sector and inspires other communities to initiate their own EVCS programs**. Three collaborative and coordinated efforts must occur between Sonoma County's local governments, the Economic Development Board and the local chambers of commerce, business associations, and visitors' and tourism bureaus. The actions and relationships might be best shown in figure 27.

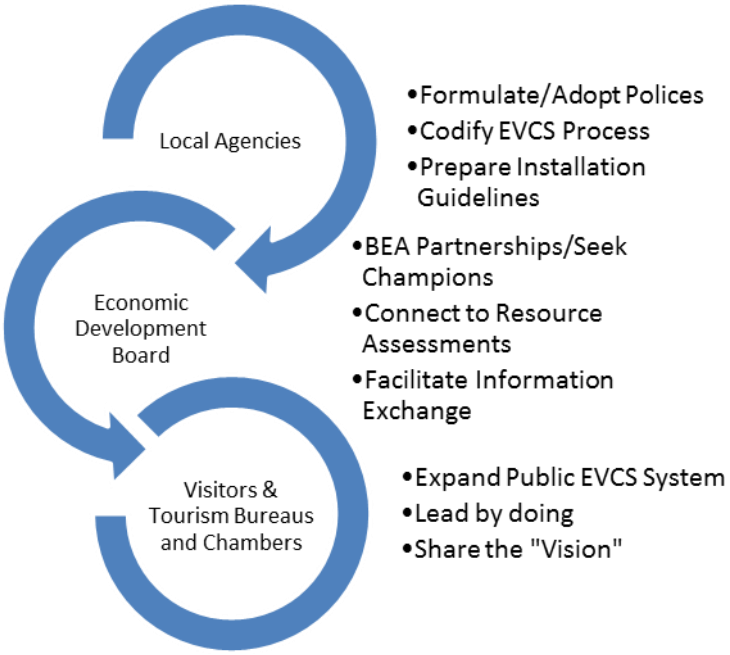


Figure 27. Achieving the Vision with Public-Private Partnerships (PPPs)

With the County's EVCS Program and Installation Guidelines in place, the Sonoma County Local Government Electric Vehicle Partnership formed in 2008 and co-led by the County's General Services Department and Sonoma County water Agency are now perfectly positioned to utilize the guidelines to shape policy and create codes for each local government adoption. The planning and community development arms of each local agency should now fill leadership roles in the Partnership. With strong participation they can develop and introduce ordinances, amend zoning and building codes, and recommend regulatory provisions. Coordinating these efforts closely with the economic development teams and building and planning officials of each local jurisdiction will ensure a fair and consistent set of county-wide policies, development standards and enforcement practices. Expanding countywide efforts with Sonoma's four surrounding counties will harmonize efforts region-wide. With the world now experiencing a brand new auto industry, Sonoma County will again be the State's pioneer to achieve the EV-vision as its settlers were with the Bear Flag revolt which helped lead to California's statehood and creation of its world-renowned wine industry.

While the policy and regulatory provisions are being developed economic development efforts should also get underway by forming new partnerships within the Business Environmental Alliance. An example partnership would be for the auto dealers, electrical contractors, renewable energy and architectural/engineering firms to utilize the guidelines to establish a training and assessment program. With businesses joining hands and helping other businesses, the end result will be a stronger economy, increased tourism and clean energy jobs; all fully aligned with the 2008 *Community Climate Action Plan* (CCAP) target—to reduce annual GHG emissions from transportation county-wide to 1.755 million tons by 2015, which is 25% below

the 1990 level of 2.34 million tons through the electrification of transportation powered to the greatest extent possible with renewable sources of electric energy.

There will be businesses that will naturally want to demonstrate strong EV-readiness leadership as already is regularly demonstrated through BEA's Best Practice Awards. An example would be a Bed-and-Breakfast or hotel offering package overnight stays that include a fully charged customer's EV that the guest will awaken to the next morning. Local chamber and tourism offices should consider leading by example, and installing chargers in their own lots, thus employees and visitors set a positive, forward-looking example for others to follow. Another example would be installing levels 1 and 2 chargers every couple of miles at wineries and restaurants on local wine trails providing an extended driving range of 3 to 5 miles for each 30 minutes of charging. Reaching out to Bay Area car rental and car share firms is another partnership that will encourage clean energy driving into and through Sonoma County. Partnering between a solar, wind or geothermal energy system providers, battery-based energy storage producers and software developers could create 100% renewable energy charging opportunities in some key destination points or during peak energy load periods.

It will require Sonoma County businesses' active involvement to strategically expand the Sonoma County EVCS Siting Plan, market it electronically as well as in brochure from, and to steadily spread the message to the world, to visit and be accommodated in Sonoma County via clean, sustainable transportation.

Commercial EVCS Installation Guide

Each City and the County should coordinate their efforts in the formation of EVCS Installation Guides. Following the lead of the Puget Sound region in Washington State, two model guides should be developed, one for residential installations and one for commercial installations (http://psrc.org/assets/4326/EVI_full_appendices.pdf). The guides would be developed in such a way that the message would be the same, but the style and logo would be customized to each individual agency. The Commercial Guide should be no longer than a two-sided/tri-fold brochure, and contain three basic messages:

- Types of Chargers and Charging Times
- How to Assess Your Parking Lot and Energy Supply
- How to Obtain a Permit for Commercial Charging

A draft Commercial EVCS Installation Guide is illustrated in Appendix D. Development of the two guides should be led by the Sonoma County Local Government EV Partnership with expanded participation of local planning and building officials.

Branding Sonoma County's EV Tourism

Next, the business community and Tourism Bureau should come together and create a theme or brand involving EV tourism in Sonoma County. Expanding upon the "Historic Trail" or "Wine Road," local chambers of commerce, grape growers and wineries associations, the Wine Road and Visitors and Tourism Bureaus could create a theme such as Washington, Oregon, and

California have done. By joining forces, the governors of the three western states have pledged to build the "West Coast Green Highway" spanning from Canada to Mexico through the three states along the I-5 Corridor.

Sonoma County officials may wish to create the "Electric Trail" as they have done with the "Historic Trail". A map showing the location, charger levels and hours of operation and any associated costs or incentives could be included in the existing Wine & Visitors Map produced by the Tourism Bureau or could be a separate brochure in print and electronic form.

An example of such a brochure is included as Appendix E.

Presentation Material

Local governments, private businesses, and community-based organizations must be using clear, concise, easy-to-understand language. They should monitor and evaluate the effectiveness of the messages, and work collectively to enhance communications collateral as the EV industry matures. A computer-generated presentation showing multiple aspects of various types of equipment and installations, different types of plug-in vehicles, installation guidelines and partnership opportunities will be highly desirable. Again, the Sonoma County Local Government Electric Vehicle Partnership should initiate the effort to create such a presentation that can be modified to meet each set of stakeholders.

Examples of several computer slides are shown in Appendix F.

APPENDICES

APPENDIX A: GLOSSARY OF TERMS AND ACRONYMS

- **A** or **Ampere—**The standard unit for measuring the strength of an electrical current
- **AC —** Alternating current, an electric current which changes direction with a regular frequency
- **AB32 —** Assembly Bill 32-California Global Warming Solutions Act of 2006
- **ABAG —** Association of Bay Area Governments
- **AFV —** Alternative Fuel Vehicle
- **AHJ —** Authority Having Jurisdiction
- **ARRA—**American Recovery and Reinvestment Act
- **BAAQMD —** Bay Area Air Quality Management District
- **BEV —** Battery Electric Vehicle (see definitions)
- **CA MUTCD**—California Manual on Uniform Traffic Control Devices
- **CARB** or **ARB —** California Air Resources Board
- **CBC**—California Building Code
- **CBSC —** California Building Standards Commission
- **CCAP**—Community Climate Action Plan
- **CCID—**Charge Current Interrupting Device
- **CCR, Title 24**—California Code of Regulations, Title 24 (commonly known as the California Building Standards Code)
- **CEC**—California Electrical Code
- **CEC —** California Energy Commission
- **CEQA —** California Environmental Quality Act
- **CFC**—California Fire Code
- **CO_2**—Carbon Dioxide
- **CPUC** or **PUC**—California Public Utility Commission
- **CTP**—Comprehensive Transportation Plan
- **CVC —** California Vehicle Code
- **Continuous Load —** A load where the maximum current is expected to continue for 3 hours or more
- **Current —** The flow of electricity commonly measured in amperes
- **DC —** Direct Current, an electric current that moves in one direction from anode to cathode
- **DOE —** United States Department of Energy
- **DOT —** United States Department of Transportation
- **EPRI —** Electric Power Research Institute, a utilities industry-based research group
- **EREV —** Extended Range Electric Vehicle (see PHEV)
- **EV —** Electric Vehicle (see definitions)
- **EVCS—**Electric Vehicle Charging Station
- **EVI —** Electric Vehicle Infrastructure (see definitions)
- **EVSE —** Electric Vehicle Supply Equipment, industry acronym for charging hardware located at charging stations provided for the purpose of charging electric vehicle batteries (see definitions)
- **FHWA —** US Federal Highway Administration
- **GHG —** Greenhouse Gases
- **GSD**—General Services Department
- **ICC—**International Code Council
- **ICE —** Internal Combustion Engine (see definitions)
- **J1772 —** Industry-wide standard EV connector

- **kWh —** Kilowatt hour, a unit of energy commonly used for measuring the energy capacity of a battery; this is a unit of energy equal to 1000 watt hours, and is commonly used as a billing unit for energy delivered to consumers by electric utilities
- **LEED**—Leadership in Energy and Environmental Design, an internationally recognized green building certification system
- **Lithium-ion —** Type of chemistry used in batteries in most modern electric vehicles
  MTC — Metropolitan Transportation Commission
- **MUTCD —** Manual on Uniform Traffic Control Devices, maintained by the U.S. Department of Transportation (Federal Highway Administration)
- **NEC —** National Electrical Code, a code/guideline used for the safeguarding of people and property from hazards related to the use of electricity. It is sponsored and regularly updated by the National Fire Protection Association
- **NEV —** Neighborhood Electric Vehicle (see definitions)
- **NFPA —** National Fire Protection Association
- **NiMH —** Nickel metal hydride, a popular battery type for hybrid electric vehicles
- **NREL —** National Renewable Energy Laboratory, a Colorado-based unit of the U.S. Department of Energy
- **NSCAPCD—**Northern Sonoma County Air Pollution Control District
- **OHS**—Occupational Health and Safety Act
- **PRMD**—Permit and Resource Management Department
- **PG&E—**Pacific Gas and Electric Company
- **Phase —** Classification of an AC circuit, usually single-phase, two wire, three wire, or four wire; or three-phase, three wire, or four wire **PHEV —** Plug-in Hybrid Electric Vehicle (see definitions)
- **RCPA—** Sonoma County Regional Climate Protection Authority
- **RFID**—Radio Frequency Identification subscription service
- **SAE —** SAE International, formerly the Society of Automotive Engineers
- **SCAPOSD**—Sonoma County Agriculture Preservation and Open Space District
- **SCS**—Sustainable Communities Strategy (as described by California Senate Bill 375-2008)
- **SCTA—**Sonoma County Transportation Authority
- **SCWA—**Sonoma County Water Agency
- **SEA**—Sonoma Energy Agency
- **TFCA**—Transportation Fund for Clean Air
- **TOU —** Time of Use, an electricity billing method with rates based upon the time of usage
- **V** or **Volt—**An electrical term meaning the electrical potential difference or pressure across a one ohm resistance carrying a current of one ampere
- **VMT —** Vehicle Miles Traveled
- **V2G —** Vehicle-To-Grid, the concept of using electric vehicles as energy storage devices for the electric grid
- **Watt —** A unit of power equal to the rate of work represented by a current of one ampere under a pressure of one volt
- **ZEV**—Zero Emission Vehicle

APPENDIX B: Resource Documents

- Bay Area FasTrak; http://www.bayareafastrak.org/
- California Air Resources Board; http://drivelclean.ca.gov/, http://www.arb.ca.gov/msprog/carpool/carpool.htm#vehicles
- California Building Code—Title 24
- California Department of Transportation
- California Electrical Code
- California Fire Code
- California Vehicle Code
- California Plug-In Electric Vehicle Collaborative, December 2010; http://www.evcollaborative.org/evcpev123/wp-content/uploads/2010/07/Taking_Charge_final2.pdf
- Charging Station Handbook; North Carolina Advanced Energy Corporation 2011
- Clean Fuel Connection
- Coulomb Technologies; http://www.coulombtech.com/
- ECOtality—The EV Project; http://www.ecotalityna.com/PHEV-activities/the-ev-project.php
- Nissan Corporation; http://www.nissanusa.com/
- Pacific Gas & Electric Company; http://www.pge.com/about/environment/pge/electricvehicles/fuelrates/index.shtml
- Pike Research LLC.; Executive Summary: Electric Vehicle Information Technology Systems http://www.pikeresearch.com/research/electric-vehicle-information-technology-systems
- Plug In America; www.pluginamerica.org (2010 web-based electric vehicle consumer survey conducted for Puget Sound Regional Council)
- Puget Sound Regional Council; http://www.psrc.org/assets/4325/EVI_full_report.pdf
- Rocky Mountain Institute; Project Get Ready www.projectgetready.org
- Rocky Mountain Institute; Smart Garage Charrette Report http://projectgetready.com/docs/SmartGarageCharretteReport_2.10.pdf
- Society of Automotive Engineers (SAE)
- Sonoma County Climate Action Protection Plan—2006
- Sonoma County Chamber of Commerce; http://sonomachamber.org/
- Sonoma County Economic Development Board; www.sonoma-county.org/edb
- Sonoma County Community Climate Action Plan—2008
- U.S. Department of Energy; http://www.afdc.energy.gov/afdc/
- U.S. Department of Transportation; http://mutcd.fhwa.dot.gov/
- Virginia Get Ready: Initial Electric Vehicle Plan; October 13, 2010
- West Coast Green Highway; www.westcoastgreenhighway.com/electrichighways.htm
- Zoning Practice July 2010: Practice Electric Vehicle Infrastructure, American Planning Association, http://www.planning.org/zoningpractice/index.htm

APPENDIX C: National Electric Code, Article 625 ***(partial--general; scope; definitions)***

ARTICLE 625 Electric Vehicle Charging System

Summary of Changes

• **625.2,** Electric Vehicle: Revised definition to correlate with restrictions against the use of neighborhood electric vehicles (NEVs) on highways.

• **625.23**: Added requirement on the type of locking provision to be provided as part of the installed equipment.

I. **General**

A variety of street- and highway-worthy electric and combination electric/fossil fuel vehicles are becoming available to consumers. New and proposed legislation in several regions around the United States calls for increasing deployment of electric vehicles as a way to reduce air pollution. Other states have adopted similar requirements. In addition, the Clean Air Act Amendments of 1990 and the National Energy Policy Act of 1992 regulate public and private purchases of clean-fuel vehicles and alternatively fueled vehicles, respectively. Electric vehicles fulfill both of those requirements. It is apparent that electric vehicle charging will be occurring in all occupancies, including residential, commercial, retail, and public sites.

Article 625 sets forth installation safety requirements for typical hard-wired conductive connections of battery charging equipment, as well as the safety concerns of the new "smart" inductive coupling connections of battery charging equipment. In particular, this article covers the wiring methods, equipment construction, control and protection, and equipment locations for automotive-type vehicle charging equipment. Throughout Article 625, the intent is to prevent the users of electrical equipment associated with the vehicle charging system from being exposed to energized live parts and to provide for a safe vehicle charging environment.

625.1 Scope.

The provisions of this article cover the electrical conductors and equipment external to an electric vehicle that connect an electric vehicle to a supply of electricity by conductive or inductive means, and the installation of equipment and devices related to electric vehicle charging.

FPN: For industrial trucks, see NFPA 505-2006, Fire Safety Standard for Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operation.

The scope of Article 625 is intended to cover all electrical wiring and equipment installed between the service point and the skin of the automotive-type electric vehicle. Automotive-type electric vehicles are emphasized because they are much different from other electric vehicles commonly used today. Most existing electric vehicles are off-road types, such as industrial forklifts, hoists, lifts, transports, golf carts, and airport personnel trams. The charging requirements and other exterior electrical connections are usually serviced and maintained by trained mechanics or technicians. The NEC has adequate provisions to allow the authority having jurisdiction to make interpretations that provide the safety levels needed for these installations.

Article 625 specifically excludes off-road vehicles, to avoid conflict with existing articles. Motorcycles are not covered by Article 625 because motorcycles typically have smaller propulsion systems that operate at lower voltages, 12 to 24 volts dc versus 100 to 350 volts dc for electric automotive vehicles. Typically, motorcycles are charged from standard 120-volt, 15-ampere receptacles due to lower battery capacity. GFCI protection is not mandatory for charging electric motorcycles. However, 210.8(A)(2) and (A)(3) require GFCI protection of receptacles in the locations where an electric motorcycle would typically be charged.

625.2 Definitions.

Several of the definitions in 625.2 correlate with industry standards such as those from the Society of Automotive Engineers, SAE J1772, SAE Electric Vehicle Conductive Charge Coupler, and SAE J1773, SAE

Electric Vehicle Inductively Coupled Charging; and from Underwriters Laboratories, UL 2231-1, Standard for Personnel Protection Systems for Electric Vehicle Supply Circuits: General Requirements, and UL 2231-2, Standard for Personnel Protection Systems for Electric Vehicle Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems.

Electric Vehicle. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array, or other source of electric current. For the purpose of this article, electric motorcycles and similar type vehicles and off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like, are not included.

The primary difference between electric vehicles as defined in Article 625 and electric vehicles covered by other sections in the NEC is in their road and highway worthiness. The automotive electric vehicles under consideration are comparable in performance and function to the conventional automobiles and light trucks in use today. The automotive electric vehicles under development must be capable of complying with the Federal Motor Vehicle Safety Standards and other Department of Transportation, National Highway Traffic Safety Administration, and U.S. Environmental Protection Agency requirements.

The definition of electric vehicle was revised for the 2005 Code to include neighborhood electric vehicles, which are low-speed, limited-use electric vehicles similar to golf carts but provided with automotive-grade headlights, seat belts, windshields, brakes, and other safety equipment. Neighborhood electric vehicles are increasing in popularity as low-cost, energy-efficient, zero-polluting alternatives to traditional automobiles. Under National Highway Traffic Safety Administration guidelines, the intended use for these vehicles is shopping and recreation in inner-city areas and planned and retirement communities where the street speed limit is 35 mph or less. Electric vehicles such as lift trucks and golf carts are not covered by Article 625.

Electric Vehicle Connector. A device that, by insertion into an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of charging and information exchange. This device is part of the electric vehicle coupler.

Electric Vehicle Coupler. A mating electric vehicle inlet and electric vehicle connector set.

Electric Vehicle Inlet. The device on the electric vehicle into which the electric vehicle connector is inserted for charging and information exchange. This device is part of the electric vehicle coupler. For the purposes of this Code, the electric vehicle inlet is considered to be part of the electric vehicle and not part of the electric vehicle supply equipment.

Electric Vehicle Nonvented Storage Battery. A hermetically sealed battery, comprised of one or more rechargeable electrochemical cells, that has no provision for the release of excessive gas pressure, or for the addition of water or electrolyte, or for external measurements of electrolyte specific gravity.

Electric Vehicle Supply Equipment. The conductors, including the ungrounded, grounded, and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle.

Electric vehicle supply equipment, as illustrated in Exhibit 625.1, comprises the components between the skin of the electric vehicle and the premises wiring, including any flexible cable, disconnecting means, enclosures, power outlet, and electric vehicle connector. The definition of electric vehicle includes all off-vehicle charging equipment and does not include charging equipment installed on the vehicle.

APPENDIX D: Commercial EVCS Installation Guidelines Brochure (sample)

Get Charged!

Sonoma County's Guide for Commercial Electric Vehicle Charging Station Installations

[Your Agency or Economic Development Board Logo here]

Congratulations! You are considering the installation of an electric vehicle charging system in your customer or employee parking lot. In doing so, you will be benefitting your employees and customers, and helping **[Your Agency]**, its partnering agencies and other businesses create an expansive system of public charging stations throughout Sonoma County. You'll also be a good steward to our local air quality, as we continue to strive to reduce the harmful effects of greenhouse gas emissions from the vehicles we drive.

This guide should provide you with enough information to get you started and to address some of those first questions you may have, like the following:

What size charger should I consider installing?
or
Where is the best place in my parking lot to install one?

It is questions like these that we hope to begin to answer with this guide, and then refer you to more comprehensive planning material or the appropriate professional or agency for more information if you need it. The three primary areas covered in this guide are:

Types of Chargers and Charging Times

How to Assess Your Parking Lot and Energy Supply

How to Obtain a Permit for Commercial Charging

Types of Chargers and Charging Times

There are several companies making battery charging stations (chargers). They can be mounted on the wall as shown here, but in

parking lots, most chargers will be installed on pedestals or posts.

Commercial chargers are equipped with credit card readers, vandal-proof doors, waterproof housings, and wireless communications. So motorists approaching your business should be able to locate your charger from their dashboard or handheld navigation system and see how many chargers you have, their availability, hours of operation, and what fee you may charge.

Photo: Courtesy of Coulomb Networks

Commercial chargers also include a special cable and plug that that comes attached to the charger and will stretch as far as 25-ft. to reach the charging inlet that may be on any side of the vehicle.

The J1772 connector will be the standard charging plug for all new electric vehicles.
Photo: Courtesy of Nissan.

Depending upon your electrical supply capacity, you'll provide slower charging (Level 1) with 120V or faster charging (Level 2) with 240V electrical circuits. Depending upon the size and make of the EV, charging times vary widely. A plug-in hybrid electric vehicle (PHEV), with a back-up gasoline engine will have a smaller battery and likely fully charge in less than four hours. An EV that relies entirely on its battery for power will have a much larger battery and will take several hours to charge, even at the higher Level 2 voltage.

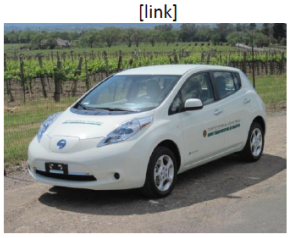
Some chargers can supply electricity to two EVs at once, but when doing so they both may be charged at slower Level 1 speeds. With most utility company metering plans, charging during the day will cost more than charging at night, so depending upon your business, you may want to establish variable charging rates. More information on charging rates can be provided by contacting PG&E by at (**1-877-743-7782**). Before calling you should have your Account # (page 1) and Meter # (page 3) of your monthly bill ready.

How to Assess Your Parking Lot & Energy Supply

Sonoma County, Air and Water agencies, and local cities are planning to install over 100 public charging stations by the end of 2012. Knowing where those chargers are planned and where future chargers are likely to be installed, will help you understand how your parking facility fits into the broader picture.

The County of Sonoma has created an Electric Vehicle Charging Station Program and Installation Guidelines that lists those 100+ locations, plus provides valuable information on the types of considerations residents, landlords, public agencies and business owners must make before installing charging units. The Guidelines can be accessed at:

[link]



Electric Vehicle Charging Station Program and Installation Guidelines—2011

Two of the most important considerations for business owners are:

- Is my parking lot well-suited for vehicle charging?
- Do I have enough electrical power given my current use?

If you lease your parking area or if it is a common parking lot for multiple businesses, then significant planning will need to occur, and agreements and protections will need to be put in place before you continue. You will need to determine if your chargers will be free or will a fee be assessed to your customers? Will they be available to customers only or the general public, or are they going to be restricted for employee use only? Knowing your likely user base, the typical distances they drive to your business and when and how long they typically stay, will be key considerations in your planning process.

The Sonoma County Economic Development Board (EDB) can help you by putting you in touch with local volunteers and professionals that can help you address these questions, and provide you with information on any grants, rebates or other local, state or federal incentives. By contacting the EDB at www.sonomaedb.org or by calling us at 707.565.7170 and asking for Business Environmental Alliance (BEA) staff we can help you get started.

How to Obtain a Permit for Commercial Charging

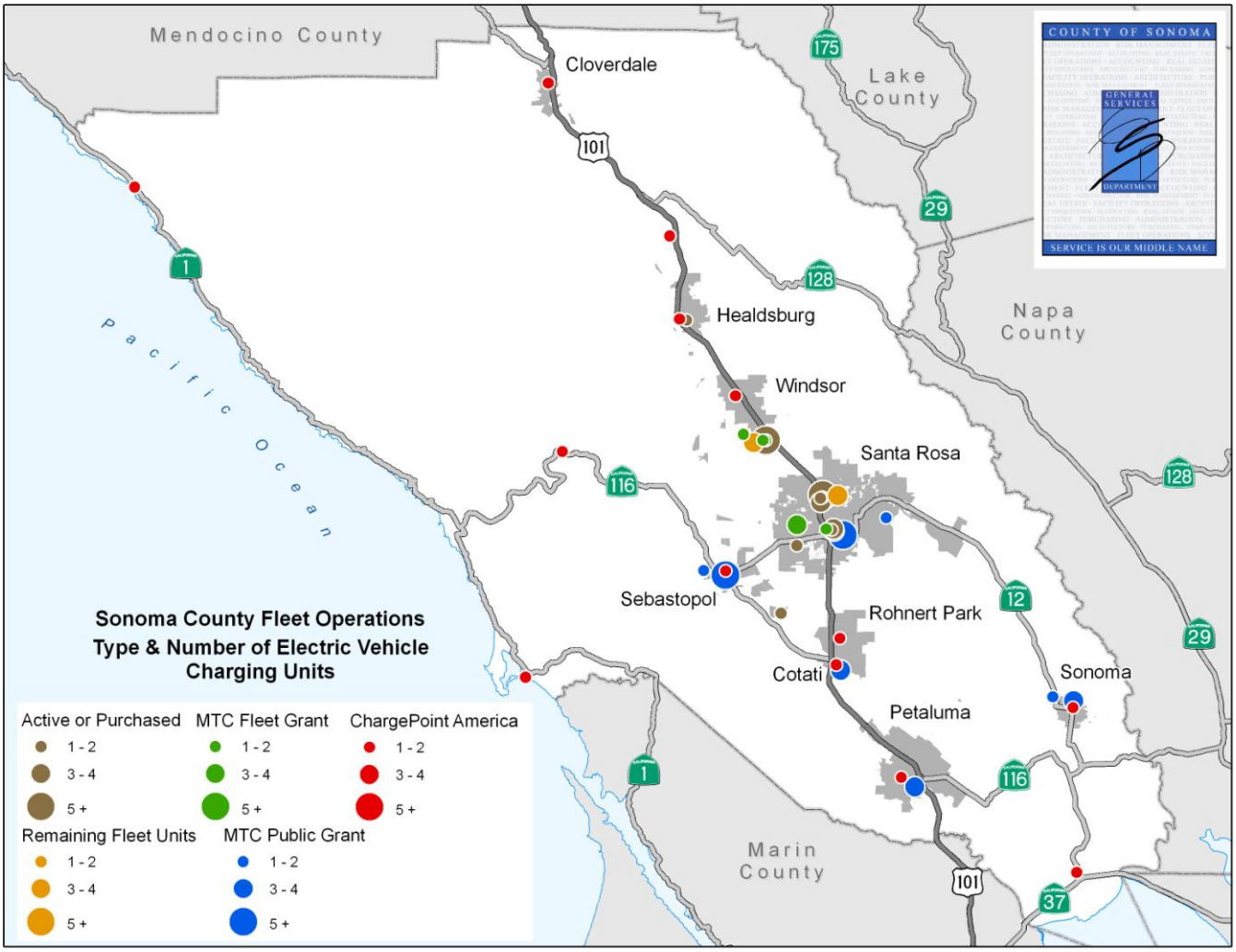
All of the Sonoma County cities and the County are working together with PG&E and other agencies to develop streamlined permitting procedures. You can obtain information on required permits and inspections by contacting your local planning and building division at:

[List agency contact information here]

Good luck and congratulations on helping Sonoma County retain and expand upon its reputation as being the most "EV-Friendly Community in the Bay Area".

Appendix F: The Sonoma County "Electric Trail" Map

The Sonoma County "Electric Trail"



Sample

- **Colorful Map Depicting *"The Electric Trail"***
  - Incorporate into existing maps, tourism information
- **About *"The Electric Trail"*** (background, purpose and description)
- **Listing of *"Hitching Posts"*** (charging locations)
  - Destination, Charging levels, hours/days of operation
  - Walking Tours, Visitor Centers, attractions, etc.
- **Distribution**
  - Visitor Centers, Tourism Centers, hotels, etc.
  - Web-sites and print form

APPENDIX F: Presentation Material (Sample)

Building Sonoma County's "Electric Trail"

A Public-Private Partnership

VISION

--to provide a comprehensive network of distributed EV chargers throughout the County which services both public agencies and the private sector and inspires other communities to initiate their own programs--

Why a Sonoma County Electric Trail?

- *EVs are a national economic and environmental priority*
- *California and Bay Area will have high EV ownership rates*
- *Public charging stations will be an every day necessity*
- *Sonoma County governments are committed and leading by example*
- *Sonoma County is within 100 miles of 7 million people and three International Airports*
- *Eco Tourism—Sonoma Co. accommodates EVs*

The Partnership in Action!

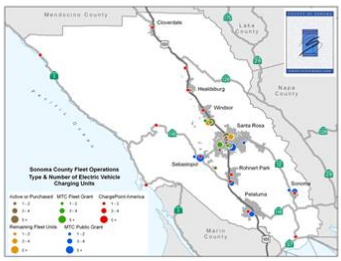
PUBLIC AGENCY ROLE

- ***Prepare EVCS Installation Guidelines***
- ***Convert Fleets and Build Public Infrastructure***
- ***Formulate/Adopt Friendly EV Policies***
- ***Create Codes & Development Regulations***
- ***Streamline Permitting Process***
- ***Partnership with Private Sector Training***

WHY COMMERCIAL CHARGING?

- *Not all EV charging can occur at home*
  - *(estimated 81% at home, 10% workplace, 7% shopping, 2% other)*
- *Gas Stations are not designed for "charging"*
- *EVs charge at end of trip-ICEs charge during*
- *Electrical Grid is Source of Power (renewables)*
- *EV drivers need services while charging*
  - *Hotel, restaurants, golf course, workplace, malls, wineries, etc.*
- *Lead by Example—Reduce Carbon Footprint*

EVCS Siting Plan—Initial Phase (130+ CHARGERS 2009-12)



Get Charged!

Sonoma County's Guide for Commercial Electric Vehicle Charging Station Installations

[Your Agency or Economic Development Board Logo here]

Congratulations! You are considering the installation of an electric vehicle charging system in your customer or employee parking lot. In doing so, you will be helping [Your Agency], its partnering agencies and other businesses create an expansive system of public charging stations throughout Sonoma County. You'll also be a good steward to our local air quality, as we continue to strive to reduce the harmful effects of greenhouse gas emissions from the vehicles we drive.

This guide should provide you with enough information to get you started and to address some of those first questions you may have, like the following:

What size charger should I consider installing?
or
Where is the best place in my parking lot to install one?

It's questions like these that we hope to begin to answer with this guide, and then refer you to more comprehensive planning material or the appropriate professional or agency for more information if you need it. The three primary areas covered in this guide are:

Types of Chargers and Charging Times

How to Assess Your Parking Lot & Energy Supply

How to Obtain a Permit for Commercial Charging

Types of Chargers and Charging Times

There are several companies making battery charging stations (chargers). They can be mounted on the wall as shown here, but in parking lots, most chargers will be installed on pedestals or posts.

Commercial chargers are equipped with credit card readers, vandal-proof doors, waterproof housings, and wireless communications. So motorists approaching your business should be able to locate your charger from their dashboard or handheld navigation system and see how many chargers you have, their availability, hours of operation, and what fee you may charge.

Photo: Courtesy of Coulomb Networks

Commercial chargers also include a special cable and plug that that comes attached to the charger and will stretch as far as 25-ft. to reach the charging inlet that may be on any side of the vehicle.

The J1772 connector will be the standard charging plug for all new electric vehicles.
Photo: Courtesy of Nissan

Depending upon your electrical supply capacity, you'll provide slower charging (Level

APPENDIX F: Presentation Material (Con't)

CHARGER INSTALLATION GUIDES

- *ELECTRICAL SUPPLY*
- *IDENTIFICATION OF USERS*
- *WALKING ENVIRONMENT*
- *ACCESS TO EQUIPMENT*
- *COMMUNICATIONS*
- *RENEWABLE ENERGY*
- *OPERATIONS & MAINTENANCE*

Priority Public Charging Station Locations

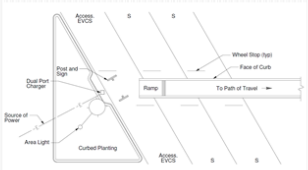
Methodology

- *Determine where EV owners partially charge their vehicles, and model areas of activity, popularity, and places where it is reasonable to assume that an EV owner would be for 1 to 3 hours (Level 2 charging)*
- *Determine where EV owners fully charge their vehicles, and model areas of activity, popularity, and places where it is reasonable to assume that an EV owner would be for 4-12 hours (Level 1 or 2 charging)*
- *Perform Suitability Analysis for Each Scenario*

Provide Parking Lot and Energy Supply Assessments

- *Existing Parking Lot Signing/Striping*
- *Slopes, Grades, Drainage and Lighting*
- *Walking Patterns and Cable Management Issues*
- *Accessibility (reach, height, clearance, slope, etc.)*
- *Source of Power (meters and rates, renewable energy)*
- *Electrical Load Assessments*

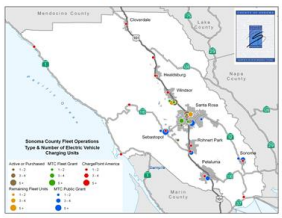
Provide Sample Installations & Cost Estimates



Facilitation Through Permit Process

- *Over the Counter/Quick Permits*
- *Charger Installation vs. Electrical Upgrades*
- *Coordination with PG&E*
- *Coordination with Auto Dealers*
- *Coordination with Charging Station Companies & Certified Installers*
- *Economic Development Board Resources & Incentives*
- *Facilitate Information Exchange*

The Sonoma County "Electric Trail"



MARKETING THE "ELECTRIC TRAIL"

- Colorful Map Depicting *"The Electric Trail"*
  - Incorporate into existing maps, tourism information
- About *"The Electric Trail"* (background, purpose and description)
- Listing of *"Hitching Posts"* (charging locations)
  - Destination, Charging levels, hours/days of operation
  - Walking Tours, Visitor Centers, attractions, etc.
- Distribution
  - Visitor Centers, Tourism Centers, hotels, etc.

THANK YOU

- *[Contact Information]*
- *List of Permitting Agencies (cities and County)*
- *Links to Websites*
- *Link to EVCS Charging Station Program & Installation Guidelines*
- *Link to EDB, Chambers, Visitors & Tourism Bureaus*
- *Link to PG&E, Energy Calculators, EV Charging Station OEMs*