



Zero-Emission Vehicles in California: **COMMUNITY READINESS GUIDEBOOK**

Toward 1.5 Million
Zero-Emission Vehicles
on California Roadways by 2025

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This Guidebook is intended to be an accessible informational resource that supports the expansion of zero-emission vehicles. It may be reproduced and distributed without permission. Please acknowledge this Guidebook as a source of information when using its content in other documents or presentations.



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Bay Area Air Quality Management District:

[Bay Area and Monterey Area Plug-In Electric Vehicle Readiness Plan](#)

Bay Area Climate Collaborative:

[Ready, Set, Charge, California!](#)

California Center for Sustainable Energy:

[San Diego Plug-In Electric Vehicle Readiness Plan](#)

California Fuel Cell Partnership:

[A California Roadmap: Bringing Fuel Cell Electric Vehicles to the Golden State](#)

California Plug-In Electric Vehicle Collaborative:

[A Toolkit for Community Plug-In Electric Vehicle Readiness](#)

Governor's Interagency Working Group on Zero-Emission Vehicles:

[2013 ZEV Action Plan](#)

Southern California Association of Governments:

[Southern California Plug-In Electric Vehicle Readiness Plan](#)

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Summary of Acronyms

The following are key acronyms used throughout this Guidebook. Additional acronyms are explained directly within the Guidebook text.

AC: alternating current

BEV: battery electric vehicle

CEQA: California Environmental Quality Act

DC: direct current

EVSE: electric vehicle supply equipment

FCEV: fuel cell electric vehicle

MUD: multi-unit dwelling

PEV: plug-in electric vehicle

PHEV: plug-in hybrid electric vehicle

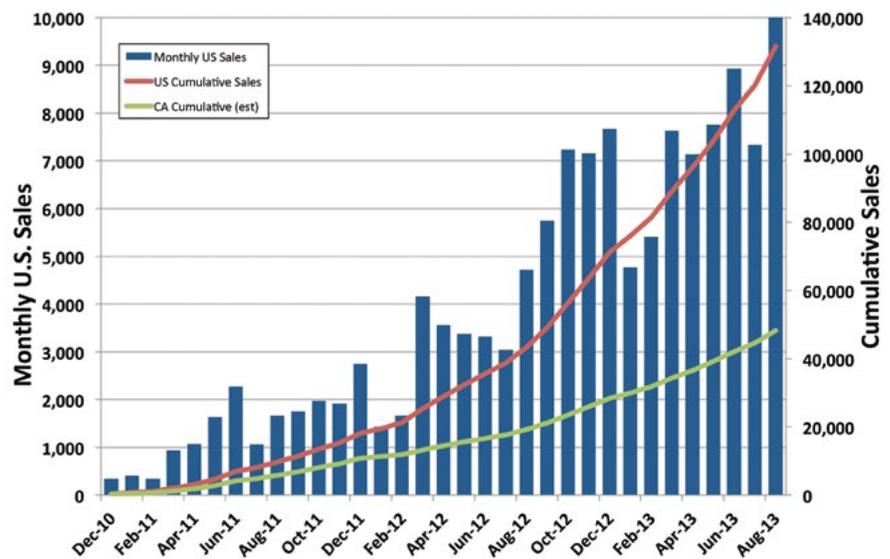
ZEV: zero-emission vehicle



Preface

Zero-emission vehicles (ZEVs) promise to transform California by offering residents and visitors new transportation choices. Across the state, ZEVs are improving air quality by reducing local pollution and greenhouse gas emissions while saving consumers money and helping new companies grow and create jobs. California cities and towns are already home to tens of thousands of plug-in electric vehicles, and the state currently represents 30 to 40 percent of the national market.

Plug-in Electric Vehicle Sales



Note: Approximation assumes CA sales were 60% of U.S. sales in 2011 and 33% in 2012 and 2013. Reference: www.hybridcars.com

ZEVs include plug-in electric vehicles (PEVs) and hydrogen fuel cell electric vehicles (FCEVs). PEVs are currently widely available and include both pure battery electric vehicles and plug-in hybrid electric vehicles, which use both a battery and a conventional engine to power driving. FCEVs, which make electricity from hydrogen and oxygen on board the vehicle, are on California's roads in smaller quantities through limited vehicle leasing programs. Major automakers have announced plans to deploy FCEVs more widely in California as early as 2015. State government supports the development of both vehicle technologies.

Accelerating the market for ZEVs is a cornerstone of California's long-term transportation strategy. Recognizing the great benefits of ZEVs, as well as the challenges to expanding the ZEV market, Governor Edmund G. Brown issued an Executive Order in March 2012 to "encourage the development and success of zero-emission vehicles." The Governor's Executive Order directs state government to meet a series of milestones toward a long-term target of 1.5 million ZEVs on California's roadways by 2025. The Governor's Office followed up this Executive Order with its California ZEV Action Plan, which details more than 100 specific actions that state government is taking to accelerate the ZEV market.

👉 **More Info**

Governor Brown's [Executive Order](#) about ZEVs and the [ZEV Action Plan](#).

State government has made it their priority to help California communities become “ZEV ready,” since it is vital to encouraging more ZEV drivers. When purchasing or leasing a ZEV, in addition to traditional factors that influence automobile purchase, such as vehicle cost and performance, potential ZEV drivers must also consider whether their home, community and state can accommodate ZEV usage. Governor Brown’s Executive Order recognizes this consideration and calls for California’s major metropolitan areas to complete infrastructure plans, improve permitting and complete other actions to accommodate ZEVs by 2015.

California communities of all sizes have already taken important actions to accommodate local ZEV usage. Many local governments have facilitated the building of electric vehicle charging stations and hydrogen fueling stations. Some local elected leaders have educated their constituents on the benefits of these types of cars, and building departments have improved permitting to expedite this new infrastructure. This Guidebook showcases many of these actions and shares additional information to help communities become ZEV ready.



Purpose and Use of the Guidebook

Several state agencies and ZEV experts have collaborated to prepare this Guidebook, which provides helpful information to local and regional governments, community leaders and residents. Its purpose is to help communities across the state support their residents and businesses making the switch to ZEVs.

The Guidebook highlights many aspects of ZEV readiness, including necessary infrastructure, planning and zoning, permitting guidelines, greening local fleets and encouraging consumers through incentives and outreach. California communities are in various stages of enabling ZEV usage, so communities and stakeholders will likely find different uses for this Guidebook.

State government supports expansion of both plug-in electric vehicles and fuel cell electric vehicles. However, much of the information in this Guidebook focuses on plug-in vehicles, as these vehicles are currently commercially available, and several opportunities and challenges for PEV infrastructure have already emerged.

In addition to promoting ZEVs, state agencies strongly support the development and use of low-carbon fuels to meet California's goals for clean air and reduced vehicle emissions. The state has also prioritized the planning and building of more environmentally sustainable communities that reduce unnecessary vehicle travel and traffic congestion. The Guidebook, however, focuses on zero-emission vehicles, recognizing the timely opportunity to accelerate the ZEV market.

The guidebook is divided into three main sections:

- Background information
- Recommended actions for local communities
- Practical tools and templates

Each recommendation in the Guidebook includes a brief snapshot of the issue, a series of key steps that communities can take related to that topic and, when applicable, a featured resource that provides more information. Examples and case studies are included throughout the document. The Guidebook is written as a "living document" that can be updated as new resources become available and as ZEV technology and the market for these vehicles evolve.



Helpful Information

This section of the Guidebook includes background information on zero-emission vehicles:

- ▶ Overview of Zero-Emission Vehicles
- ▶ Benefits of Enabling Zero-Emission Vehicle Infrastructure in Communities
- ▶ Current State Policy on Zero-Emission Vehicles
- ▶ Funding and Financing for Zero-Emission Vehicle Readiness

Overview of Zero-Emission Vehicles

Snapshot: Zero-emission vehicles (ZEVs) are vehicles with no harmful tailpipe emissions and include plug-in electric vehicles (PEVs) and fuel cell electric vehicles (FCEVs). Zero-emission vehicle technology is developing rapidly with several vehicle models presently available and more in development.

Zero-Emission Vehicle Ecosystem: Consumers report that ZEVs are fun to drive, more affordable to operate over time than conventional vehicles, more convenient to refuel and require less maintenance. Unlike other vehicle purchases, the decision to buy a ZEV will not be made based only on a particular vehicle's cost, appearance and performance. The decision will also be significantly influenced by the infrastructure and policies within a community that exist to support ZEV usage. In other words, a potential ZEV driver will consider whether their homes, communities and regions are "ZEV ready." This consideration can include several questions:

- ▶ How long does it take to charge my plug-in electric vehicle? How much will it cost?
- ▶ Do I need charging equipment in my home? If so, is it easy and affordable to add this?
- ▶ Where can I find a hydrogen fueling station in my community?
- ▶ How easy is it to fuel my car with hydrogen?
- ▶ How many charging and fueling stations are available in my area? Are stations sufficient to enable the use of my ZEV in my everyday life?
- ▶ Will I enjoy any special benefits by driving a ZEV — such as carpool/HOV lane access or preferred parking?

In addition to infrastructure, community readiness includes ZEV-related policies, incentives and communication that inform the total ZEV customer experience. All of these elements are important to "ZEV readiness" and addressed throughout the Guidebook.

 **More Info**

More Info: The **U.S. Department of Energy** summarizes ZEV technology and information about how the vehicles operate.



Plug-In Electric Vehicles: A PEV can operate on battery power and recharges from the electrical grid. Two types of PEVs are currently commercially available: battery electric vehicles and plug-in hybrid electric vehicles. Each technology offers a range of attributes and functions for consumers.

- ▶ Battery electric vehicles (BEVs) run completely on electricity stored in batteries and have an electric drive motor to operate the vehicle. These vehicles may also be referred to as all-electric vehicles or electric vehicles (EVs). Many BEV models are already available in California and more are coming soon. Currently, most BEVs have a range of 50–100 miles on a single charge.
- ▶ Plug-in hybrid electric vehicles (PHEVs) combine an electric drive system with an internal combustion gasoline engine. These vehicles plug into the electrical grid to recharge the onboard battery, but also have a refillable gasoline tank. PHEVs operate in electric mode first and then switch to or blend with gasoline power as necessary. These vehicles release emissions when running on their internal combustion engines and require maintenance comparable to a traditional gasoline vehicle. PHEVs typically have an electric range between 10 and 40 miles, because they have smaller battery packs than those used in BEVs. However, PHEVs may be driven for hundreds of miles on their internal combustion engine in a single driving experience after the battery is depleted.

PEV Charging: Charging any PEV is fairly simple, similar to the way people charge their cordless lawn and garden equipment. In fact, many PEV drivers simply charge their PEV every day by plugging into a standard 120-volt wall outlet.

PEV charging stations come in many shapes, sizes and brands and are built and sold by a range of companies. Charging equipment is often referred to by industry experts as electric vehicle supply equipment or EVSE. PEV charging is broadly separated into levels based on the amount of electricity that is transferred to a vehicle battery in a certain period. Generally, three charging categories are used to describe PEV charging:

- ▶ **AC Level 1 Charging:** The most basic and common form of vehicle charging, Level 1 charging transfers 120 volts (1.4–1.9 kW) of electricity from the electrical grid to vehicle batteries, equivalent to the electricity provided by a common wall receptacle. PEVs typically come with a 120-volt charging cord that enables PEV owners to plug in their vehicles to any conventional 120-volt, three-pronged outlet. Level 1 charging can also occur through dedicated Level 1 charging equipment built specifically for PEVs. Because Level 1 charging involves a fairly low transfer of electricity, this category of charging is usually the easiest to implement, but takes the longest to recharge the vehicle's battery. Level 1 is a good solution for home charging and for workplace charging with longer dwell times, especially for plug-in hybrids. Typically, a PEV gains 4-6 miles of range for every hour of charge.
- ▶ **AC Level 2 Charging:** This level of charging transfers 240 volts (up to 19.2 kW) of electricity to vehicles, and therefore, can recharge vehicles faster than Level 1. Typically, a PEV gains 10-20 miles of range for every hour of charge. This amount of electricity is what is commonly required to power a hot tub or large air conditioner. Because it operates at higher voltage, Level 2 charging typically requires the purchase and installation of dedicated charging equipment. Level 2 chargers currently comprise the majority of publicly available charging equipment across California. Many owners of PEVs, particularly BEVs, have installed Level 2 charging in their homes.
- ▶ **DC Fast Charging:** This level of charging provides the fastest battery recharge currently available for PEVs. Fast charging transfers a high voltage (typically 400-500 volts or 32–100 kW, depending on the electrical current) of direct current (DC) to vehicle batteries. Fast charging can raise the state-of-charge (SOC) to about 75 to 80 percent in as little as fifteen to thirty minutes and can top-off a battery to extend a vehicle's distance in a similarly short period of time. These chargers are typically located in publicly available locations near major transportation corridors to maximize the use of BEVs and to attract an adequate number of vehicles that can charge during a short period. Only a few DC fast chargers are currently installed in California, but the number will increase over time.



Fuel Cell Electric Vehicles: FCEVs create electricity from hydrogen and oxygen. Hydrogen, stored on board the vehicle as a compressed gas, is safe and currently available for industrial uses. When running low, the tank is filled at a hydrogen fueling station. FCEVs take 3 to 7 minutes to fill and have a range similar to gasoline vehicles (250-400 miles).

In a FCEV, hydrogen is 2-3 times more efficient than gasoline in a conventional vehicle. Hydrogen is nontoxic, noncorrosive and environmentally benign and can be produced locally from a variety of sources including natural gas, water and biogas.

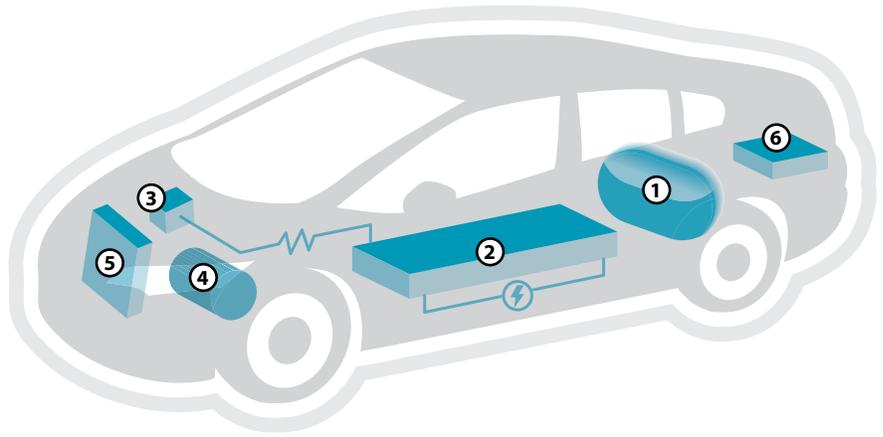


Hydrogen Fueling Stations: Hydrogen fueling stations operate similarly to traditional natural gas fueling stations and are usually located at an existing gas station. Hydrogen dispensers at a retail gasoline or natural gas station appear very similar to gasoline dispensers, with a slightly different nozzle. Hydrogen is delivered at 35 MPa or 70 MPa (5,000 psi or 10,000 psi) to the vehicle's tank.

A hydrogen fueling station consists of equipment for storing, compressing and dispensing hydrogen. Hydrogen can be delivered to the site as a compressed gas or as cryogenic liquid. Hydrogen may also be produced at a station using additional

How a Fuel Cell Vehicle Works

1. **Hydrogen Tank** supplies hydrogen to the fuel cell stack
2. **Fuel Cell Stack** generates electricity that flows to the power module
3. **Power Module** distributes the electricity throughout the vehicle including the motor
4. **Electric Motor** turns the wheels
5. **Radiator** dissipates heat
6. **Battery** supplies extra torque and stores energy from regenerative braking



equipment. Filling the car's tank is similar to dispensing compressed natural gas or filling a propane tank. The driver connects the nozzle to the vehicle's receptacle to form a tight seal. Once the connection is firm, fuel is dispensed from the station's storage into the vehicle through the dispenser.

A regional network of hydrogen stations is being developed to support early commercialization of fuel cell electric vehicles. Through the California Fuel Cell Partnership, stakeholders published a *Road Map* (2012) to locate and operate stations in early adopter communities as well as key destination and connector areas.



Hydrogen Dispenser at Shell Station. Newport Beach, CA.
Source: FuelCellWorks.com

Benefits of Zero-Emission Vehicle Community Readiness

Snapshot: Zero-emission vehicles benefit individuals and California's towns, cities, counties and rural communities. For individuals, ZEVs provide new vehicle choices, fun and smooth electric driving, reduced noise and, typically, lower the total cost of car ownership. Significant potential savings can result for ZEV drivers through lower costs to charge/fuel the vehicle and less required maintenance over time because ZEVs do not have many of the internal components of traditional engines that may require maintenance, repair or replacement. ZEVs benefit communities by reducing local pollution from vehicle tailpipes, helping local governments meet goals to combat climate change and enabling residents to transform their lifestyles using these new vehicle technologies.

Specific community benefits of ZEVs

ZEVs reduce pollution in communities: Increased numbers of ZEVs on the road reduce tailpipe pollution and its harmful effects on local residents. The ZEVs' quieter engines also reduce localized noise pollution.

ZEVs reduce climate change-causing greenhouse gas emissions: With zero tailpipe emissions, the carbon footprint of a ZEV is significantly less than a conventionally powered vehicle. While climate change is a global issue, its impact is often felt in local communities.

People with ZEVs are attracted to ZEV-ready communities: Installing public charging equipment and hydrogen fueling stations ensures that local communities are an attractive place for ZEV drivers to live, shop and do business. Locating public charging equipment in shopping centers, for example, can attract drivers to shop there.

Enabling ZEVs improves constituent service for residents: Although a growing number of Californians are driving ZEVs, many potential drivers are uncertain whether infrastructure and other ZEV services are available in their communities. By providing infrastructure and other local support (such as efficient permitting) and by publicly promoting such services, communities expand consumer choice and encourage residents that want to make this transition.

ZEVs enhance energy reliability and independence: The use of electricity and hydrogen to power vehicles supports domestically produced sources of energy. This can reduce reliance on imported energy sources and uncertainty over fuel costs. In addition, as "vehicle-to-grid" technologies develop, they will enable car batteries and fuel cells to provide electricity back to the grid, allowing ZEVs to become an important source of distributed energy storage in communities, especially during emergencies.

ZEVs provide access to new and convenient fuels: Becoming ZEV ready offers new, clean and economical fuel choices to local residents and businesses. PEVs, for example, enable the convenience of charging at home over night.

 [More Info](#)

[DriveClean.ca.gov](https://driveclean.ca.gov) is a comprehensive buying guide for ZEVs.

Recognition Opportunity

Governor Brown honors communities for their innovative ZEV readiness efforts in his **Environmental and Economic Leadership Awards Program**.

Is your community ready to apply?

Integrating ZEVs into both private and public fleets saves money: Adding ZEVs into fleets leads to both potential cost savings and environmental benefits and further establishes a community as a leader in ZEV readiness.

Taking ZEV readiness actions today enables communities to utilize state and federal incentives, grants and loans: Taking action now saves on overall costs for community readiness. It is possible that many of these incentives will be in place for only a finite amount of time. For more information about available incentives, refer to the Funding and Finance section of the Guidebook.

Becoming a model for other communities: California is taking a leadership role in accelerating the market for ZEVs. Communities have the opportunity to be a state and national leader in the transition to cleaner transportation.





Current State Policy on Zero-Emission Vehicles

Snapshot: California has enacted several laws, regulations, incentives and programs to support zero-emission vehicles. These efforts began in 1990 with the California Air Resources Board's ZEV Regulation (see California's ZEV Regulation) and most recently with Governor Brown's **Executive Order** calling for 1.5 million ZEVs on California roadways by 2025. California's state policies and U.S. national policies, in parallel with decades of advanced vehicle research and development by auto manufacturers, have led to the current ZEV market's success.

Governor Brown's Zero-Emission Vehicle Executive Order

Recognizing the benefits of ZEVs, as well as challenges to growing the market, Governor Brown issued **Executive Order B-16-2012** in March 2012 that directs California to "encourage the development and success of zero-emission vehicles to protect the environment, stimulate economic growth and improve the quality of life in the state." The Governor's Executive Order establishes several milestones organized into three time periods.

By 2015

- ▶ The state's major metropolitan areas will be able to accommodate ZEVs through infrastructure plans and streamlined permitting
- ▶ Private investment and manufacturing in the ZEV sector will be growing
- ▶ The state's academic and research institutions will contribute to ZEV market expansion by building understanding of how ZEVs are used

By 2020

- ▶ The state's ZEV infrastructure will be able to support up to 1 million vehicles
- ▶ The costs of ZEVs will be competitive with conventional combustion vehicles
- ▶ ZEVs will be accessible to mainstream consumers
- ▶ There will be widespread use of ZEVs for public transportation and freight transport

By 2025

- ▶ Over 1.5 million ZEVs will be on California roadways and their market share will be expanding
- ▶ Californians will have easy access to ZEV infrastructure
- ▶ The ZEV industry will be a strong and sustainable part of California's economy
- ▶ California's clean, efficient ZEVs will annually displace at least 1.5 billion gallons of petroleum fuels

The Executive Order also directs state government to begin purchasing ZEVs. In 2015, 10% of state departments' light-duty fleet purchases must be ZEVs, climbing to 25% of light-duty purchases by 2020.

Laws and Regulations Promoting Zero-Emission Vehicles

California's ZEV Regulation: Initially adopted by the California Air Resources Board (ARB) in 1990, the ZEV Regulation requires car manufacturers to produce ZEVs and advanced technology vehicles proportional to total sales volumes in California. In December 2009, ARB staff worked on incorporating the state's goal of reducing greenhouse gas emissions to 80 percent below 1990 levels by 2050 in the ZEV regulatory revisions. The ZEV Regulation amendments adopted in 2012 as part of **California's Advanced Clean Cars Program** increase the requirements for ZEVs between 2018 and 2025. ARB anticipates that ZEVs will reach over 15% of new cars sold in California in 2025.

Assembly Bill 118 (Nuñez, Chapter 750, Statutes of 2007): Titled the "California Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act of 2007," this law provides \$1.4 billion through the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) for clean vehicles and their associated infrastructure from 2008 to 2015. Revenue for this program is collected through vehicle license and smog abatement fees. Annual funding from ARFVTP enables the state's vehicle rebates for ZEVs, infrastructure and grants for ZEV-technology companies. It is scheduled to sunset in 2015 unless reauthorized. Funding for the ARFVTP was extended to 2024 by Assembly Bill 8 (Perea, Statutes of 2013). AB 8 also extends the Air Quality Improvement Program, the Enhanced Fleet Modernization Program and the Carl Moyer Memorial Air Quality Standards Attainment Program.

Low Carbon Fuel Standard (LCFS): A set of regulations established pursuant to Assembly Bill 32 and **Executive Order S-01-07 (2007)** requires fuel providers in California to reduce the carbon content of the fuels they sell in California by 10% by 2020. Growing the ZEV market can be a key way to achieve requirements of low carbon fuel standards.

Senate Bill 454 (Corbett, Statutes of 2013): Creates the Electric Vehicle Charging Stations Open Access Act, which makes it easier to charge electric vehicles by making PEV charging stations both easier to locate and useable by all electric vehicle drivers regardless of network subscription.

Vehicle license fees levied by local air districts: A number of legislative bills provided the authority for the state's local air districts to increase vehicle license fees in their jurisdictions to provide funding for air pollution reduction, including clean vehicle programs. The programs vary by district; a directory of local air districts can be found [here](#).

Senate Bill 71 (Padilla, Chapter 10, Statutes of 2010): Authorizes certain sale and use tax exemptions on manufacturing equipment for ZEVs and other advanced or alternative transportation or energy technologies. This law, which enables these tax exemptions through 2020, provides an incentive to locate ZEV manufacturing within California.

More Info

Alternative and Renewable Fuel and Vehicle Technology Program. Funds are allocated to two programs created by this act, the **Air Quality Improvement Program** (administered by the California Air Resources Board) and the **Alternative and Renewable Fuel and Vehicle Technology Program** (administered by the California Energy Commission). Visit each program's homepage for more information.





More Info

Clean Vehicle Rebate Project. This program is designed to accelerate widespread commercialization of ZEVs by providing consumer rebates up to \$2,500 to partially offset the higher cost of these advanced technologies. The program has provided more than 23,500 rebates since its creation. It is funded by the California Air Resources Board and managed by the California Center for Sustainable Energy.



More Info

The Plug-In Electric Vehicle Collaborative (PEVC) maintains a list of **Current California Plug-In Electric Vehicle Policies**. View the PEVC website for up to date information about PEV laws and policies.

Laws and Programs Incentivizing Zero-Emission Vehicles Purchases

Consumer rebates: State government currently administers the **Clean Vehicle Rebate Project**, which provides direct rebates to consumers for the purchase of qualifying ZEVs.

Carpool access: ZEVs currently benefit from access to the state's carpool or high-occupancy vehicle (HOV) lanes. Two bills enable use of these carpool lanes by ZEVs: **Senate Bill 535 (Yee, Chapter 215, Statutes of 2010)** and **Assembly Bill 2405 (Blumenfield, Chapter 674, Statutes of 2012)**. Certain ZEVs, including pure BEVs and hydrogen FCEVs, are eligible for white-colored carpool stickers. The cleanest PHEVs are currently eligible for green-colored carpool stickers, which have a limited distribution of 40,000. Assembly Bill 266 (Blumenfield, Statutes of 2013) and Senate Bill 286 (Yee, Statutes of 2013) extend the white and green sticker programs until 2019, or until federal authorization expires.

Assembly Bill 2405 (Blumenfield, Chapter 674, Statutes of 2012): Also known as the Choose Clean Cars Act of 2012, this law permits ZEVs to use high-occupancy toll lanes without paying toll charges. It is scheduled to sunset in 2015 unless reauthorized.

Assembly Bill 2502 (Blumenfield, Chapter 675, Statutes of 2012): Allows car dealers to include the cost of electric vehicle charging equipment within electric vehicle purchase financing, making it easier for PEV purchasers to get in-home charger installations.

Assembly Bill 475 (Butler, Chapter 274, Statutes of 2011): Authorizes local government to require that cars located in a parking space with PEV charging equipment must be plugged into the charger in order to ensure that the space is being used for PEV charging.

Senate Bill 880 (Corbett, Chapter 6, Statutes of 2012): This bill outlines the rights and responsibilities of homeowner associations (HOAs) and PEV owners for charging in common-interest developments (condominiums, co-ops and certain other multi-unit dwellings). The basic purpose is to ensure that PEV drivers are not unreasonably prohibited from installing charging equipment, either in their deeded or designated parking spaces or in common areas.

Zero-Emission Vehicles Codes and Standards

California maintains building codes and standards to ensure that buildings meet uniform safety and performance requirements. While codes specify certain legal requirements for buildings, standards dictate how to meet those requirements. Codes and standards become legally enforceable when jurisdictions adopt them by reference or direct incorporation into their regulations.

State Code Requirements: California's building codes provide uniform requirements for buildings throughout the state and are contained in Title 24 of the California Code of Regulations (CCR). Title 24 applies to all building occupancies and related features and equipment. It is organized into twelve separate parts that contain the requirements for a building's structural, mechanical, electrical and plumbing systems, in addition to measures for energy conservation, sustainable construction, maintenance, fire and

life safety and accessibility. For a complete list of the Title 24 parts, visit the [Building Standards Commission website](#). The State of California is continuing to develop new code requirements for ZEVs. Assembly Bill 1092 (Levine, Statutes of 2013) requires the California Building Standards Commission and the Department of Housing and Community Development to develop standards for PEV charging infrastructure in multi-unit dwellings and non-residential developments.

Specific parts within Title 24 identify certain requirements for ZEV installations, such as the California Electrical Code (Part 3), the California Building Code (Part 2), the California Residential Code (Part 2.5) and the California Green Building Standards Code (Part 11).

CALGreen Code (Part 11, Title 24): California's green building code promotes environmentally sustainable building practices and includes both mandatory requirements and voluntary measures. Currently, all ZEV-related measures in the CALGreen Code are voluntary. However, municipalities can make these measures mandatory by adopting them through ordinance. Local governments can also incentivize developments that voluntarily incorporate ZEV-related measures. The following voluntary measures contained in the CALGreen Code can be implemented by local ordinance.

- ▶ *A4.106.6¹*: Provides standards for supporting PEVs, including wiring for future electrical vehicle charging installations in residential buildings.
- ▶ *A5.106.5.3*: Offers a standard for wiring for future electrical vehicle charging installations at commercial, retail and other nonresidential locations. It also includes information about minimum parking requirements.

City and County Code Requirements: Cities and counties in California are required by state law to enforce Title 24 building standards. However, cities and counties may adopt local laws (also called ordinances) to modify these state building standards under limited circumstances to accommodate local climatic, geological or topographical conditions. This limited allowance means that a city or county may have local ordinances that modify or add to the provisions of Title 24 for ZEV readiness. The California Building Code (Sections 1.1.8, 1.1.8.1 and 1.8.6) outlines the specific findings that a city or county must make for each amendment, addition or deletion to the state building codes. For more information about modifying CALGreen, visit the [Building Standards Commission Website](#).

Technical Codes and Standards for ZEV Technologies

ZEV industry stakeholders have developed standards that set voluntary technical specifications for zero-emission vehicles. Various professional organizations and associations have developed such standards, often in collaboration with each other. The primary source of vehicle-related standards is the Society of Automotive Engineers (SAE), which issues Standards and Technical Information Reports based on a collaborative process involving experts from government, industry, regulatory agencies and academia. The Institute of Electrical and Electronic Engineers, the International Code Council, the National Institute of Standards and Technology, the National Fire

¹ In the 2013 edition of the CALGreen code (effective Jan. 1, 2014), these provisions are found in section *A4.106.8*.

Case Study

The City of Los Angeles has adopted PEV requirements based on the CALGreen Code for both high- and low-rise residential units ([Los Angeles Municipal Code, Chapter IX, Art. 9](#)). They are also working on simplifying the entitlement process for hydrogen station installations. View the complete [Los Angeles Green Building Code](#).



More Info

To learn about electric vehicle standards development, visit the [UL Website](#).

Protection Association and Underwriters Laboratories are key organizations that develop broader codes and standards for ZEV infrastructure, such as for charging equipment and its installation or the communication protocols for smart grid devices.

Although standards are not binding, they may become legally enforceable if referenced or enacted through state or local regulations. For example, SAE J2719, which defines the hydrogen purity at the dispenser, is enforceable in California because it was adopted through the Department of Agriculture, Division of Measurement Standards. Furthermore, voluntary technical standards are often used by funding agencies, like the Energy Commission, when designing solicitations and issuing awards. The Department of Energy's [Alternative Fuels Data Center](#) provides a directory of codes and standards relating to ZEVs. The Society of Automotive Engineers is a key source for hydrogen station fueling protocols and electric vehicle recharging.

Federal Laws and Programs

The federal government is actively working to promote ZEVs from the highest level. President Barack Obama has called for one million electric vehicles on U.S. roadways by 2015 during his 2011 State of the Union Address. A number of specific federal laws and programs support the ZEV market in California.

National Greenhouse Gas and Corporate Average Fuel Economy Standards for Vehicles: Federal standards require that passenger cars, light-duty trucks and medium-duty passenger vehicles sold in the U.S. meet certain fuel economy and greenhouse gas emission standards. ZEVs are one way auto companies can lower greenhouse gas emissions and meet the requirement.

Energy Policy Act: This act sets goals and mandates to increase clean energy use and improve energy efficiency in the nation. It also requires certain public-sector fleets to acquire alternative fuel vehicles and establishes incentives for the private sector.

Renewable Fuel Standard: The federal Renewable Fuel Standard requires that 36 billion gallons of total renewable fuel be used as transportation fuel by 2022 in the U.S. This requirement promotes the use of alternative fuels.

Electric Vehicle Everywhere Workplace Charging Challenge: The Department of Energy initiated a program in early 2013 that promotes employers placing electric vehicle chargers in their workplaces. Many businesses, including national and international companies, have already signed on to this program. See a [current list of all companies](#).



Plug-In Electric Vehicle Program: The Department of Defense has announced it plans to commit \$20 million to launch electric vehicle fleet pilot projects at six military installations. Two of these pilots are planned for California: Los Angeles Air Force Base and China Lake Naval Weapons Station.

H2USA: The Department of Energy recently launched H2USA, a new public-private partnership focused on advancing hydrogen infrastructure to support more transportation energy options for U.S. consumers, including fuel cell electric vehicles.

Leadership in Energy and Environmental Design and PEV Charging

Leadership in Energy and Environmental Design, or LEED, is the most widely recognized and used green building program across the globe. LEED is a certification program for buildings, homes and communities that guides the design, construction, operations and maintenance. More than 53,000 projects are currently participating in LEED, encompassing more than 10.1 billion square feet of construction space.

Installing an electric vehicle charger in a home or commercial building can earn points toward LEED certification at all levels (Basic, Silver, Gold or Platinum). Commercial buildings of any size and multifamily residences over four stories can earn up to 3 LEED points under the New Construction Sustainable Sites Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles, or 3 to 15 LEED points under the Existing Building Sustainable Sites Credit 4 Alternative Commuting Transportation for installing one or more EV chargers. Multifamily residences under four stories and single-family residences that are new or under major renovation may earn one credit under LEED for Homes Credit 3 Innovative Design for installing one or more EV chargers.

In addition to points available for installing chargers, LEED New Construction and Existing Building tracks both offer a number of opportunities to earn points in other categories related to EVs and other low-emission/fuel-efficient vehicles (LE/FEs). Buildings designed to encourage the adoption of cleaner alternative fuel vehicles and change our ingrained commuting habits may earn the following points.

1. Providing preferred parking for LE/FEs for employees, tenants or paid parking customers. Examples of preferred parking include designated spaces closest to the building, designated covered spaces and discounted parking passes where parking is fee based.
2. Providing LE/FEs for a minimum of 3% of employees or tenants along with preferred parking for drivers of those vehicles. This may include company or fleet vehicles as well as those provided by a property owner for tenant use.
3. Instituting a vehicle sharing program for employees or tenants to share LE/FEs for a two-year period along with preferred parking.

For more information about LEED certification and electric vehicle infrastructure, visit the [U.S. Green Building Council website](#).

Funding and Financing for Zero-Emission Vehicle Readiness

Snapshot: A wide range of financing and funding options exists for individuals, commercial fleets and local governments to further zero-emission vehicle readiness including grant, rebate and voucher programs.

Zero-Emission Vehicle Funding Resources: Several websites provide a comprehensive list of funding options available to Californians.

- ▶ **California Energy Commission:** The Energy Commission provides funding (grants and contracts) for alternative fuel production and infrastructure; vehicle manufacturing, demonstration and deployment; workforce training and development; and regional planning projects in California, primarily through a competitive solicitation process.
- ▶ **California Air Resources Board:** The **Air Quality Improvement Program** funds clean vehicle and equipment projects, research on biofuels production and the air quality impacts of alternative fuels and workforce training
- ▶ **DriveClean.ca.gov:** Find out information about rebates, discounts, tax breaks and other incentives available for clean technology vehicles.
- ▶ **FundingWizard:** Search this aggregator website for ZEV funding opportunities.
- ▶ **Alternative Fuels Data Center:** Learn about federal and state incentives for ZEVs.

Plug-In Electric Vehicle Financing Strategies: In addition to funding opportunities, several financing strategies are available.

▶ Infrastructure Planning

- **Public/Private Partnerships:** A combination of private and government funding can facilitate a wider variety of public and private EV charger installations.
- **Public/Nonprofit Partnerships:** Nonprofits such as **Adopt a Charger** work with organizations and the public to donate funds to install fee-free public EV chargers. Nonprofits can also help with outreach and consumer awareness.
- **Funding for Local Code Updates:** The International Code Council is working with the Department of Housing and Urban Development to help code officials



Adopt a Charger, a nonprofit organization, accelerates the widespread adoption of PEVs through the proliferation of public, fee-free chargers that are adopted by sponsors. Corporations, organizations and individuals, donate funds to install and maintain EV chargers in parks, museums, beaches and other widely used public places. [Learn more.](#)



understand how they can use HUD's **Community Development Block Grant** funds to support local code programs. View the recently completed "ICC Guidebook on HUD Block Grants for Local Code Programs." This financing may fund code updates addressing ZEV readiness.

Vehicle Financing

- **Subscription-based Charging:** Several companies have established public charging equipment in major metropolitan areas that can be accessed by purchasing a monthly access package, which reduces the up-front cost of purchasing an EV.
- **Incentives for Sharing Data:** Programs such as the one offered through the **EV Project**, provide residential chargers at no cost in exchange for charging and vehicle data.
- **Miles Purchase Agreement:** To reduce the fluctuating costs of energy, some companies have tested a "miles purchase agreement," where solar panels are built in sync with PEV charging equipment. This combination presents a service approach where customers pay a monthly fee that would cover the initial installation and maintenance costs.
- **Car Share Stations:** UC Irvine and City Carshare have tested EV car sharing stations where users pay a monthly fee for work-based or home-based driving needs — similar to the services offered by ZipCar.

Electric Vehicle Charging Infrastructure Funding: The California Energy Commission currently administers grant funding for alternative fuels and vehicles through its Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP), including funds for EV charging infrastructure. Four solicitations for EV infrastructure and related planning activities will provide over 7,000 new chargers in California.



ARFVTP Funding and Financing

	Residential	Commercial (Public), Fleet and Workplace	DC Fast Chargers	Total
Installed	2,211	2,179	3	4,393
Planned	1,666	1,204	74	2,764
Total	3,877	3,203	77	7,157

There is \$6.6 million (FY 2012-13) and \$7 million (FY 2013-14) identified in the Energy Commission Investment Plan for additional electric vehicle charging infrastructure. Anyone interested in upcoming solicitations can sign up for email notices on the Energy Commission's **list servers** website.

Hydrogen Station Funding: Hydrogen infrastructure received one round of grant funding from ARFVTP in 2010, totaling approximately \$16 million. That money was awarded to two companies to build eight new hydrogen stations and upgrade three others. Air Products was awarded six new stations and two upgrades and Linde was awarded two new stations and one upgrade. Both companies' proposals for new hydrogen fueling were to provide hydrogen fueling capability at existing gasoline/ diesel retail stations. Historically, the hydrogen equipment providers or station



operators have been the lead on project proposals to the Energy Commission to secure grant money. They have sought out dealers/operators who are interested in adding alternative fuels to their existing stations and worked out partnering agreements.

The Energy Commission also is funding upgrades to legacy hydrogen stations in the southern California area. In June 2013, the commission approved a \$6,690,828 contract to South Coast Air Quality Management District to assess, upgrade, test and evaluate existing publicly accessible hydrogen fueling stations. They additionally granted approximately \$12 million to four companies for seven hydrogen fueling stations.

The fiscal year 2013-2014 Investment Plan for ARFVTP identifies an additional \$20 million for hydrogen fueling infrastructure. Anyone interested in upcoming solicitations can sign up for email notices on the Energy Commission's [list servers](#) website. Please note that requirements to apply change with each solicitation so applicants should not base their proposal on any previous solicitations.

Incentives and Funding Opportunities

Following is a summary of programs for incentives and funding opportunities. These programs are subject to change. For the most up-to-date information, visit the Plug-In Electric Vehicle Collaborative [Resource Center](#).

Programs	Description	Amount	Eligibility
Federal Programs			
Plug-In Electric Vehicle Tax Credit	A tax credit for the purchase or lease of a new PEV, ZEV, PHEV, ZEM or NEV	\$2,500 – \$7,500	Individuals
Fuel Cell Vehicle Tax Credit	A tax credit for the purchase of a new light-duty FCEV; credits are based on vehicle weight	\$4,000 – \$40,000	Individuals
Low Speed, 2/3 Wheel PEVs Tax Credit	Tax credit for low speed and 2/3 wheel vehicles	10% of Vehicle \$2,500 Limit	Individuals
Employee Corporate Incentives	Private companies and organizations offering employees assistance with purchasing new ZEVs	\$1,000 – \$5,000	Individuals
Alternative Fuel Vehicle Refueling Property Credit	A 30% tax credit is allowed for any qualified alternative fuel vehicle refueling property	\$1,000 – \$30,000	Individuals/ Property Owners
State Incentive Programs			
Alternative and Renewable Fuel, Vehicle Technology, Clean Air, and Carbon Reduction Act			
Clean Vehicle Rebate Project	Available rebate for ZEVs, PHEVs, NEVs and ZEMs	\$900 – \$2,500	Individuals/Private Fleets/Public Fleets/ Nonprofit Fleets
California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project	Vouchers to help fleets reduce the initial costs of converting fleets to PHEVs and ZEVs	\$8,000 – \$45,000	Public/Private Fleets

Hybrid Off-Road Equipment Pilot Project	Vouchers to integrate hybrid off-road construction vehicles into California	\$28,500 – \$75,000	Public/Private Fleets
Air Resources Board Grant Programs			
Enhanced Fleet Modernization Program	Voluntary retirement of passenger or cargo trucks with a vehicle weight rating of 10,000 pounds or less	\$500 – \$1,500	Individuals/Private Fleets
Carl Moyer Program: On-Road Heavy-Duty Voucher Incentive Program	Funding for fleets with 10 or fewer vehicles to replace or retrofit older heavy-duty diesel vehicles	\$5,000 – \$10,000	Private Fleets
Carl Moyer Program: Off-Road Voucher Incentive Program	Vouchers to partially offset the cost of replacement equipment that reduces emissions	\$2,500 – \$20,000	Individuals
Good Movements Emission Reduction Program:	ARB working with local agencies to reduce air pollution and health risks associated with heavy freight movement	Up to \$50 million	Local Agencies
PLACE Program	Loans for fleets that can be used for fleet modernization, e.g., retrofitting diesel engines with emission control systems	\$1 million	Private Fleets Less than 500
Energy Commission Grants			
Alternative and Renewable Fuel and Vehicle Technology Program	Encourages the establishment of alternative transportation fuels infrastructure	\$75,000 – \$500,000	Public/Private Agencies, ESVE Manufacturers
Local Programs			
Residential Home Charger Rebate: Los Angeles Dept. of Water and Power	Provides rebates for residential, workplace and public customers who install Level 2 EVSE	\$750 – \$1,000	Residential and commercial LADWP customers
Southern California Edison (SCE) PEV Charging Rate	Provides rate reductions for SCE customers charging PEVs during off-peak and super off-peak hours	Peak time Rebates	SCE customers with residential PEV chargers
City of Corona Alternative Fuel Vehicle Rebate Program	Money toward the purchase of a new or used alternative fuel vehicle	\$1,000 – \$2,000	Customers living in the City of Corona
City of Riverside Rebate	Rebate for the purchase of a natural gas vehicle, AT-PHEV, PHEV or EV	\$2,000	Resident of the City of Riverside
City of Riverside Employee Rebate	Rebate for Riverside City employees to purchase new or used hybrid, PHEV, ZEV, AT-PZEV or natural gas vehicle	\$1,000 – \$2,000	Employees of the City of Riverside
San Joaquin Valley Emission Reduction Incentive	Rebates for reducing emissions in light- and medium-duty vehicles	\$1,000 – \$3,000	Residents of San Joaquin Valley

Utility Rate Discounts (Wholesale and Dedicated TOU)			
LADWP	Discount per kWh for EVs charged during off-peak hours and free DC fast charging	2.5 cents per kWh 500kW/month limit Free DC Fast Charging at 12+ DCFC sites	Customers of LADWP All
Pacific Gas and Electric	Discounted rate to charge BEVs, PEVs and natural gas vehicles	Variable, depending on times of use	Customers of PG&E
SMUD	Discount per kWh off residential rate during off-peak hours; monthly service charge waived for PEV charging rate	2.43 cents per kWh winter 2.71 cents per kWh summer	SMUD customers with residential PEV chargers
SCE	Discount rate available for EV charging	7.825 cents per kWh for charging PHEVs, BEVs, electric golf carts and NEVs during off-peak hours	Customers of SCE
SDG&E	Lowest time-of-use rates during super off-peak hours for EV charging and natural gas vehicle refueling	0.145 cents per kWh (current rates)	Residential customers with A DMV registered EV or natural gas vehicle
Parking Incentives			
City of Hermosa Beach	EVs and natural gas vehicles with identifying stickers	Free metered parking	Individuals
City of Santa Monica	All vehicles with white HOV access sticker	Free metered parking	Individuals
LAX Parking	Free charging station at lower level of parking structures 1 and 6	Free charging	Individuals
City of Sacramento	EV parking	Free EV parking in designated spots	Individuals

Recommended Actions

This section includes recommended actions to promote zero-emission vehicle readiness. Readers can learn more about:

- ▶ Plug-In Electric Vehicle Readiness
- ▶ Fuel Cell Electric Vehicle Readiness
- ▶ Growing the Zero-Emission Vehicle Market in Local Communities





Plug-In Electric Vehicle Readiness

Snapshot: There are numerous actions that local governments can take to become plug-in electric vehicle (PEV) ready.

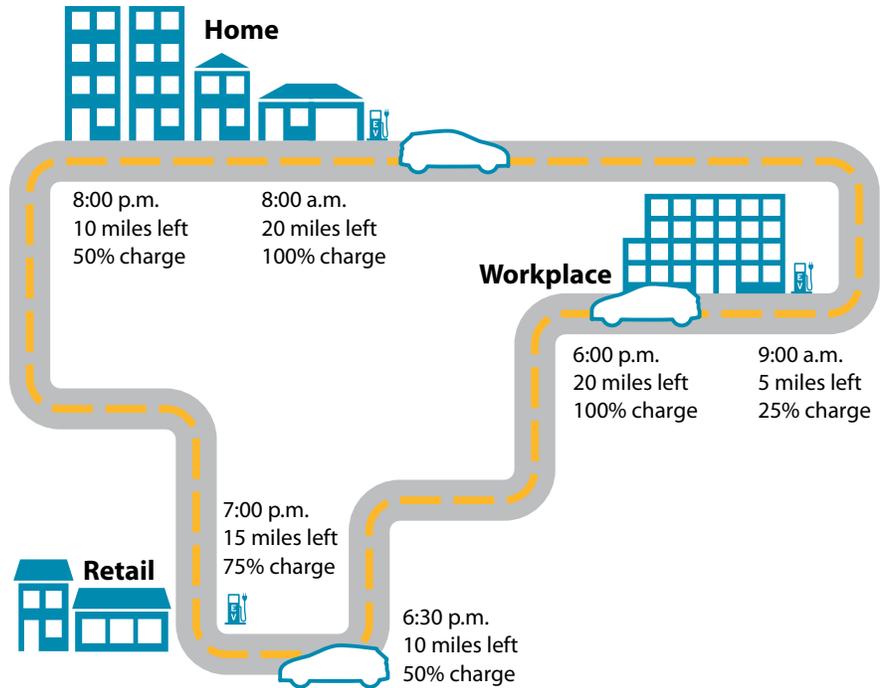
- ▶ Identifying what amount and type of publicly available charging stations are needed
- ▶ Establishing zoning and code requirements that enable ZEV driving and parking
- ▶ Improving permitting for charging stations
- ▶ Coordinating with the local utility
- ▶ Developing policies to enable access to and use of charging equipment

Background: PEV drivers may have different driving patterns compared to drivers of conventionally powered cars in order to accommodate charging their vehicles.

The following table illustrates the way PEV drivers commonly prioritize charging locations: a majority of the time is spent charging at home, followed by workplace charging and then retail and interstate charging. These priorities are collectively known as the “charging pyramid” and illustrate the perspective of PEV drivers seeking charging opportunities that best support their needs cost effectively. Cost-effective charging can also include refueling at off-peak times (such as overnight), which may result in additional savings.

Location	Charge Time	Price	Level	Driver
Interstate Travel	Travel 20 min	\$\$\$\$	Fast Charging	Parked
Entertainment/ Shopping/ Recreation	Public 0.5 – 3 hours	\$\$\$	L2/L3	Parked
Work/Transit Parking/Airport	Workplace 4 – 8 hours	\$\$	L1/L2	Parked
At Home	Residential 8 – 10 hours	\$	L1/L2	Sleeping Parked

The following graphic offers a view of how the charging pyramid looks when put into practice during a PEV driver's daily commute.



Source: UCLA Luskin School of Public Affairs



Identifying Plug-In Electric Vehicle Infrastructure Needs in Communities

Snapshot: A local community's network of electric vehicle charging infrastructure supports convenient use of plug-in electric vehicles by local residents. Ensuring adequate charging equipment and appropriate charging locations for PEVs helps expand the statewide zero-emission vehicle market.

Background: Developing an adequate network of vehicle charging equipment for PEV drivers is among the most important tasks for local communities to become ZEV ready; however, it is also one of the trickiest. Public agency commitment to site and install PEV charging stations during the early market development helps to build consumer confidence that this technology is ready for use and helps to reduce consumer range anxiety. If local governments do not have funding to deploy electric vehicle infrastructure, they can still work on selecting prime locations for charging stations and work with private site hosts who may be interested in electric vehicle charger installations.

Since PEVs can be charged at different times and locations, a convenient charging network for each driver depends on that driver's specific daily schedule and travel patterns. For example, many drivers have access to home charging while others who live in apartment buildings may not have access to nighttime charging. Some drivers can plug in at work to recharge their vehicles, while others work in places without charging infrastructure. In addition, daily commute patterns differ greatly among PEV drivers.

The differing charging needs of a community's PEV drivers can make it difficult to understand how many chargers are adequate to enable convenient mobility of PEV drivers. Furthermore, it is challenging to know what amount of infrastructure will help encourage additional drivers to transition to PEVs. Early adopters of PEVs may have purchased a vehicle reliant on private charging, such as a home garage. To expand the PEV market, options will need to be available to those who do not have easy access to charging outside their home or work.

Interoperability

One of the strategies in the Governor's ZEV Action Plan is to "enable universal access to ZEV infrastructure for California drivers." This concept is known as interoperability and is similar to the way that bank customers can use almost any ATM machine regardless of membership. A core concept of interoperability is to have standards in place that allow PEV drivers to locate and reserve public charging stations and receive billing regardless of a driver's membership in or subscription to a particular charging network.

Interoperability is impacted significantly by a site host's decision about the type of charging station that is installed. By installing stations that use open standards, a site host can easily switch the back-end management software platform to a new vendor and avoid having to purchase new charging stations. For more information about what the state is doing to ensure universal access, view the strategies highlighted in the infrastructure section of the [ZEV Action Plan](#).

Understanding the charging preference and behavior at various locations allows for effective PEV infrastructure planning. Overnight residential charging is the most cost-effective charging scenario, because it capitalizes on the long periods of time that the PEVs are parked and allows owners to take advantage of cheaper off-peak electricity rates. Currently, most PEV charging takes place at home or at the workplace. Retail or public charging provides additional opportunities, including topping off the battery throughout the day.

The following table summarizes the typical dwell times (length of time a vehicle is parked) and charging characteristics for each type of charging site. Utilities offer different off-peak rates and hours. This is an example of one utility’s rate structure and off-peak hours.

Site Type	Typical Dwell Times (hours)	Charging Hours
Residential	14	10 p.m. – 6 a.m. (optimal, varies)
Workplace	8–9	9 a.m. – 2 p.m. (optimal)
Retail	1–3	11 a.m. – 8 p.m.

Source: Southern California PEV Readiness Plan

One goal of municipal PEV readiness planning is to plan for the market expansion of PEVs and charging equipment. In pursuit of this goal, PEV planners would ideally like to know:

- ▶ How many parking spaces are there in my jurisdiction?
- ▶ On what parcels are the parking spaces in my jurisdiction located?
- ▶ At what times of day and night do drivers use those spaces?
- ▶ How long are cars typically parked in those spaces?

The characteristics of parking spaces determine both how long PEVs can charge and what the cost of electricity will be during the time that PEVs remain in these spaces. Planners can acquire information on parking utilization patterns over time by identifying the types of land uses (e.g., residential, workplace, retail) associated with the parcels that host these parking spaces. Knowing the distribution of land uses within a jurisdiction is also helpful because different land uses are also associated with distinctive parking, electrical and building configurations that can greatly and systematically affect the cost of installing charging equipment on that parcel.

Understanding the distribution of parking spaces across land uses is the foundation for all subsequent municipal PEV planning. It enables planners to understand the number and type of potential charging sites within their jurisdiction and to prioritize PEV planning for dominant local land uses. A parking-oriented land use analysis also enables them to anticipate when during the day or during the night PEV drivers charge at these parcels. This will help utilities track changes in the electrical load over space and time as the PEV market grows. Finally, a land use analysis of parking enables planners to anticipate roughly where the high- and low-cost charging opportunities will be and how many of each type their jurisdiction is likely to have.



Learn More

The EV Project is an infrastructure study. The EV Project will deliver to ECOtality, the government and the general public a wealth of directly applicable technical and professional experience for jumpstarting regional EV adoption and replicating business models that lead to sustainable, market-based charge infrastructures. One element of the EV Project included the development of [Electric Vehicle Charging Infrastructure Deployment Guidelines for the Greater San Diego Area](#).

Identifying Potential Charging Station Locations: PEVs charge while they are parked. Parking spaces are distributed over local land uses such as single-family residential, multi-unit residential, hotels, workplaces and retail establishments. The type and availability of parking spaces at these land uses will vary across municipalities. Variation in these parking resources will shape local PEV readiness efforts by defining the opportunities and limitations on where, when and how much PEV charging can occur locally. Identification of the most effective locations for PEV charging will continue to improve as more data is collected on topics such as PEV usage and transportation patterns.

Identifying Existing Charging Stations Locations: Planners can inventory existing publicly accessible charging equipment using several informational sources.

The Department of Energy's [Alternative Fuels Data Center](#) lists PEV charging locations by geography, ownership type, charge levels and payment systems.

[PlugShare](#) is a user-generated site that allows drivers to add new charge locations, offer their private chargers for public use and alert other drivers about whether equipment at publicly accessible locations is nonoperational.

Network providers generally display their charge stations with information on pricing and real-time availability. Members can reserve a charging station in advance of their arrival at the location.

Public Transit Parking Lots and Plug-In Electric Vehicle Charging

Public transit parking lots can provide a convenient location for EV charging stations, allowing drivers to charge their vehicles while using public transportation for commuting or other travel. PEV infrastructure planning at public transit parking lots can function in a similar way to the workplace charging section of the PEV Charging Pyramid. Many local governments have existing park and ride lots that can be used for PEV readiness and that are often located near highways, offering convenient access for commuting PEV drivers.

As part of the Department of Energy's EV Project, the California Department of Transportation is conducting a park and ride PEV charging demonstration project in Escondido. The Del Lago Park and Ride facility is conveniently accessible from the HOV lane on Interstate 15. The project involves collaboration between several stakeholders:

- ▶ Caltrans will provide state-owned park and ride land at the Del Lago Park and Ride in Escondido.
- ▶ Blink/ECOtality, an EVSE company, will provide the electric vehicle chargers, including several Level 2 charging stations and one DC fast charging station.
- ▶ San Diego Gas & Electric will provide support infrastructure, including a photovoltaic solar canopy for the charging facility area and signage.
- ▶ The Department of Energy will provide funding for the charger installations.

Plug-In Electric Vehicle Readiness in Rural Communities: The strategies and recommended actions throughout the Guidebook apply to the range of community types throughout California. However, rural communities have some distinct challenges and opportunities when it comes to PEV readiness planning. What works in a large urban setting may require a modified approach in a rural location. There is a variety of issues that rural governments are working on to become PEV ready.

- ◉ **Communications infrastructure:** Cellular or broadband coverage can be limited in rural communities. A lack of access to digital communications may require a different billing system for EV charging than the current practice in most urban areas.
- ◉ **Electrical infrastructure:** In remote areas, sites with sufficient electrical distribution infrastructure to support a Level 2 charging station may be difficult to identify. Solar panels and electrical storage may be able to help solve this, but can increase installation cost.
- ◉ **Demand for public charging:** Even with above-average market penetration rates by PEVs, the smaller and more distributed populations in rural communities can significantly lower the demand for each charging station.
- ◉ **Utility-related concerns:** Some rural communities are served by smaller municipal utilities, which may not offer the same range of PEV-related rates, policies, and incentives offered by larger utilities.

Although there may not be clearly defined solutions to these issues, several best practices can help begin to overcome these barriers.

- ◉ **Prioritize transportation corridors:** Travelers in rural areas must often travel long distances to reach businesses and services, so providing EV chargers in commonly used transportation corridors can help ensure adequate range. For extremely low population areas with no roadside services for long distances, highway emergency call boxes can potentially provide access to digital cellular connectivity.



- ▶ **Leverage available infrastructure grants:** Some federal and state grant programs give additional consideration to rural or underserved communities. See the Funding and Financing for ZEV Efforts section of this Guidebook for more information.
- ▶ **Encourage EVSE operators to make charging stations available to the public:** Ensuring public access to charging can increase utilization rates where demand for charging is low and make effective use of what may be scarce suitable sites.
- ▶ **Partner with local business and tourism organizations:** Advertising the availability of charging in a community may help encourage tourists driving PEVs to visit.
- ▶ **Consider making campgrounds available for charging:** Campgrounds may offer a location for charging, if wired for electrical hookups for recreational vehicles. These should be considered potential supplemental facilities for PEV drivers. Although they are likely unsuitable for primary charging locations, they can nonetheless increase consumer confidence in the availability of charging for long-distance trips or recreational weekends.

Recommended Actions:

- ▶ **Local governments should decide what their priorities will be based on the local availability of land uses that can host charging.** Local governments can only advance those land use portions of the charging pyramid that lie substantially within their jurisdiction. For example, a local government may have only workplace land uses or only multi-unit family dwellings. The municipal planners' focus should be on assisting the most prevalent types of site hosts in developing charging opportunities in the most cost-effective manner.
- ▶ **Regional governments and councils of governments should provide targeted PEV technical assistance to cities and counties by assessing counts of parking by land use in absolute numbers or by the relative dominance of particular land uses within each jurisdiction** (i.e., target technical assistance on workplace charging to local governments that either have the highest employee counts or the highest concentrations of employee parking relative to parking for other purposes).
- ▶ **Local, subregional and regional planners should assess their existing supply of charging equipment and their dominant land uses** to understand where gaps may exist and where obsolete hardware may need to be replaced or removed.
- ▶ **Planners can compare the location of existing publicly accessible charge stations with the locations of employment centers, retail centers and PEV daytime destinations** in order to identify where new charging equipment could be installed.
- ▶ **Planners should seek usage data and trends from existing sites to determine if additional EVSE are needed and/or to identify underutilized sites.** (If underutilized, determine whether it is because of the location, demographics or some other factor, such as pricing.)

Featured Resource:

Statewide Plug-In Electric Vehicle Infrastructure Plan. The California Energy Commission is developing a statewide Plug-In Electric Vehicle Infrastructure Plan that will provide helpful guidance to local governments about public infrastructure planning.

General Plans, Zoning and Building Codes for Plug-In Electric Vehicles

Snapshot: Including zero-emission vehicle readiness in a general plan can set the stage for taking significant actions to help promote ZEV readiness. Once ZEVs are incorporated into a general plan, addressing PEVs in the zoning and building code can help ensure that communities become PEV ready. Zoning policies can be created for PEVs that enable ease of charging throughout a jurisdiction, and building codes allow a community to incorporate PEV readiness into the building process.

Background:

General Plans and Zero-Emission Vehicles: California’s cities and counties typically have exclusive authority over land use decisions within their local jurisdictions. These decisions range from general plans and other policies that guide the long-term growth of a community to specific zoning requirements that regulate streets, buildings and public spaces. Within these planning policies, cities and counties can encourage and prepare for zero-emission vehicles. Actions that local governments can take include integrating ZEVs into long-range plans and adopting standards, guidelines and requirements for ZEV parking, charging and fueling stations.

California state law requires each city and county to adopt a general plan for “the physical development of the county or city and any land outside its boundaries which bears relation to its planning” (§65300). The California Supreme Court has called general plans the “constitution for future development” in local areas, and these plans outline the community’s development goals and future land uses. Including policies and strategies in a general plan is a useful first step in building consensus among policymakers and the public in support of more specific implementation measures. Incorporating ZEVs into general plans can also facilitate allocating different funding streams toward ZEV plans and projects.

Some local governments have determined that incorporating language about ZEV readiness into a general plan can be fairly simple and straightforward. In general, including simple high-level policy objectives, like a one sentence description in the circulation element of a general plan that a community wants to work toward ZEV readiness, can provide a foundation for future initiatives like zoning-friendly ZEV policies. The Governor’s Office of Planning and Research is updating the state’s **General Plan Guidelines**, which will encourage communities to include ZEV readiness in local general plans and provide recommendations on how this can be accomplished.

Zoning for Plug-In Electric Vehicles: Local zoning requirements are one of the primary means of implementing a general plan. In contrast to the long-term outlook of the general plan, zoning classifies the specific allowable uses of land. The successful implementation of a general plan rests in part upon the effectiveness of a consistent zoning ordinance in translating the long-term objectives and policies contained in the plan. Zoning codes regulate what types of land uses and densities are appropriate for different areas of a local jurisdiction. Zoning is one of the most powerful tools that local governments have to incentivize certain types of development, including placement of charging and fueling stations.

Sample Zoning Districts and Allowed PEV Infrastructure Uses

Zoning District	AC Level 1 & 2 Charging Station	DC Fast Charging Station
Low-density residential	Yes	Yes
High-density residential	Yes	Yes
Mixed use	Yes	Yes
Commercial	Yes	Yes
Industrial	Yes	Yes
Institutional	Yes	Yes
Recreational	Yes	Yes



Case Study

In his 2013 State of the County Address, Santa Clara County Supervisor Ken Yeager said “To further reduce greenhouse gas emissions, I want the county to encourage the use of electric vehicles. To accomplish this, electrical wiring should be installed in new homes and commercial buildings so that electric vehicle chargers can be easily added if owners want them. To spur that opportunity, I am calling for the county to update its building codes to include this capability in all new residential and commercial construction.”

[Learn more.](#)

The goal of zoning for PEVs should be to ensure that charging is an allowed land use — such as an accessory or a principal use — in as many types of zoning classifications as possible. Planners also can consider reducing parking requirements in exchange for installation of charging units or allowing PEV charging spaces to count toward minimum parking requirements. Another reason to consider zoning for PEVs is to make zoning ordinances compatible with PEV-ready building codes. Some cities and counties have begun to adopt building codes that require PEV-ready wiring in new construction, but their zoning ordinances may not even list PEV charging as a use.

PEV charging should be widely allowed in different zoning classifications because it is compatible and complementary to many land uses. Generally, PEV charging does not fundamentally alter the purpose or interfere with the use of a land parcel. PEV charging complements existing land uses in that it facilitates transportation modes that were not accommodated previously by those land uses.

If a property is to be used in a way that is not specified as an allowed use in a certain zone, some local governments may require the property owner to apply for a use permit. Uses are generally classified as a principal use or an accessory use. Principal uses describe the basic purpose of a site, for example, a bookstore. Accessory uses, such as a small cafe within a bookstore, are subordinate to the primary use of a site. The designation as an accessory use is intended to circumvent the need for additional parking requirements and review. Many local governments will simply require a planning permit for an accessory use to verify that it is indeed not the dominant use of the site.

Some local governments may not see a need to specify PEV charging as either a principal or an accessory use in any of their zoning classifications. They may view charging as an accessory use by default and only require a plan check and electrical permit. Other local governments may wish to clarify that charging is an accessory or outright permitted use because unless stated otherwise, planners may interpret this to mean that some sort of use permit is required. However, different use permits are subject to different fees and levels of review, which may require the individual planner to make various determinations. Eliminating a requirement for a separate planning permit for PEV charging in addition to a building and/or electrical permit can reduce the time and cost of

installing chargers. Alternatively, listing PEV charging as a principal or accessory use will guide planners in how to process planning permits if they are required.

Building Codes: California's state building codes provide uniform requirements for buildings throughout the state. These requirements are contained in Title 24 of the California Code of Regulations (CCR). Title 24 applies to all building occupancies and related features and equipment throughout the state. Cities and counties in California are required by state law to enforce Title 24 building standards. However, cities and counties may adopt local laws (also called ordinances) to modify these state building standards under limited circumstances because of local climatic, geological or topographical conditions. In addition to following current building codes to ensure safety, local governments could create ordinances to create PEV-ready building codes.

Local governments can advance PEV adoption in a way that ensures safe, cost-effective installation of charging equipment. For example, by adopting more stringent building codes that require PEV-ready wiring in new construction, local governments can help meet future demand for charging and reduce or eliminate the costs associated with future retrofitting. In addition to these benefits, PEV-readiness building codes advance equity by ensuring access to charging for multifamily building residents and the disabled. Requiring developers to run conduit and to plan for and provide space for future electrical panels and/or transformers is a relatively low cost means to ensure low-cost upgrades as the number of PEVs grows. Requiring a dedicated 40-amp circuit in the garage for new homes or significant remodels is another low-cost strategy. When modifying building codes, it is important to expand or upgrade electrical service in tandem with any new prewiring requirements to ensure that load capacity can be met, thus helping to avoid potential future costs of service interruptions and necessary panel upgrades.

Building codes related to PEVs also can provide guidance on the following issues:

- ▶ The number of circuits needed and service panel requirements
- ▶ Placement of electric meters
- ▶ Sourcing of electricity for on-street and lot parking
- ▶ The impact of charging infrastructure on building electrical loads and local electrical distribution
- ▶ Allocation and sizing of parking spaces to accommodate charging infrastructure
- ▶ Compliance with the Americans with Disabilities Act (ADA) (See Access to PEV Charging section for more information)

Building codes provide construction standards according to building uses. These uses can be classified as residential or nonresidential. Residential buildings are often classified into two categories: one- and two-family homes and townhouses, and multifamily dwellings (also called multi-unit dwellings or MUDs). Nonresidential buildings can include business, industrial, institutional and mercantile (retail) uses. The types of building codes a local government will need to prepare for PEV infrastructure will depend in part on the kinds of land uses and occupancies that are most commonly found in that city.

California's state building codes provide uniform requirements for buildings throughout the state, such as the California Electrical Code (Title 24, Part 3). Refer to the Zero-



More Info

The National Electric Code has been adopted as the California Electrical Code (Title 24, Part 3) by the State of California through the California Building Standards Commission. Article 625 of the California Electrical Code contains the specific requirements for the installation of electric vehicle charging systems. Access to the California Electrical Code is provided by the California Building Standards Commission. [Lean more.](#)



Emission Vehicle Codes and Standards section of the Guidebook for more information about the State Building Code. The following are voluntary measures contained in the CALGreen Code that can currently be implemented by local ordinance.

- ▶ For one- and two-family dwellings, the code calls for installation of a raceway to accommodate a dedicated branch circuit. For multifamily residential dwellings of three stories or less, CALGreen also calls for a minimum number of parking spaces to be capable of supporting PEV charging. The following are relevant CALGreen code sections.²
 - *A4.106.6.1* One- and two-family dwellings
 - *A4.106.6.2* Multifamily dwellings
 - *A4.106.6.2.1* Single charging space required
 - *A4.106.6.2.2* Multiple charging spaces required
- ▶ CALGreen also offers municipalities a voluntary standard for PEV charging at commercial, retail and other nonresidential locations.
 - *A5.106.5.3* Electric vehicle charging.
 - *A5.106.5.3.1* Electric vehicle supply wiring.

A building code's applicability generally falls along a continuum of scope and cost effectiveness. The continuum ranges from new construction (the narrowest scope and the most cost effective) to remodels involving a certain percentage of a structure, and finally, to retrofits (the widest in scope and potentially most costly, because it may apply to existing buildings as well as new construction).

Planning for PEVs in a local building code requires flexibility. Changes in the number of PEVs on the road, technological requirements, charging and fueling requirements and the timeframe in which PEVs become ubiquitous may occur more quickly than the average lifespan of a building.

² In the 2013 CALGreen Code, these sections are numbered *A4.106.6.1*, *A4.106.6.2*, *A4.106.6.2.1* and *A4.106.6.2.2*, respectively.

Recommended Actions:

► General plans

- **Local governments should include language about ZEV readiness in their general plans.** In general, including simple high-level policy objectives, like a one sentence description in the circulation element of a general plan that a community wants to work toward ZEV readiness can be sufficient.
- **Local governments should stay up-to-date on the status of OPR's General Plan Guidelines Update,** which will include more information about incorporating ZEVs into general plans.

► Zoning

- **Local governments should examine their land use mix and determine in which zoning classifications, if any, to prioritize** for explicit permission in the zoning ordinance for different types of charging. Local governments may want to do this as part of a general land use or zoning ordinance update.
- **Local governments should allow charging as an accessory use that does not require more than a planning permit** as long as charging is not the primary purpose of the site.
- **Installation of chargers should be allowed as an outright permitted or accessory use** as appropriate in zones that present the most significant local opportunities for PEV charging.
- **Charging spaces designated for PEVs should count toward meeting minimum parking requirements for business owners and developers.** Planners may also consider reducing parking requirements in exchange for the site host providing PEV charging spaces.
 - Local governments often use density bonuses to obtain public benefits such as contributions to parks, open space or affordable housing. Local governments may consider including PEV-ready wiring or charging units as an option for obtaining a density bonus when negotiating with developers who want to build more densely on a site than the zoning code normally allows.
- **Local governments should require that a minimum percentage of parking spaces in new construction be PEV ready based on current and anticipated PEV demand.**
- **Zoning ordinances that allow charging as a permitted or accessory use should tailor any additional conditions of installation to the type of building specified in the ordinance.** For example, it may not be necessary to require signage and protection against damage to the charging unit as a condition of permitting charging in single-family zones.

► Building Codes

The following recommendations are intended to facilitate PEV charging through building codes for commercial, high-rise, industrial and/or multifamily developments. These recommendations should be adapted to reflect local land use opportunities for PEV charging and anticipated PEV demand, which may vary greatly among local governments.

- **Allow charging capability** to satisfy PEV readiness requirements in building codes.
- **Consider present PEV charging demand** in determining whether to require a percentage of spaces with ready-to-use charging equipment in addition to PEV-ready wiring for new single and multi-unit dwellings.
- **Require a certain minimum percentage of parking spaces** in new construction be wired to be PEV-ready



Learn More

The Department of Energy has a [Clean Cities YouTube Channel](#) with several educational videos about permitting for plug-in electric vehicle infrastructure.

- **Consider future PEV charging demand and require the layering of conduit capable of carrying future wires or cables** from the electrical room to the charging units in new construction, where applicable. Require insets for additional or future panels and pads for additional or future transformers.
- **Require a minimum percentage of parking spaces in new construction** be wired to be PEV ready in commercial or industrial buildings, if these opportunities represent significant opportunities locally for PEV charging.
- **Address Accessibility Requirements.** Refer to the Access to Charging section of the Guidebook for more information.
- **Consider updating electrical codes to allow the sizing of electrical service** for charging systems to reflect the load permitted by an automated energy management system. The National Fire Protection Association (NFPA) has issued two Temporary Interim Amendments (TIAs) to the 2011 National Electrical Code, which was adopted into the 2013 California Electrical Code. [TIA 11-2](#) and [TIA 11-3](#) provide specific model code language that can be adopted by local jurisdictions. For more information, refer to the [Building Standards Commission Information Bulletin 13-02](#).

Featured Resources:

- ▶ **California Green Building Standards Code:** The California Green Building Standard Code of Regulations (Title 24, Part 11), also known as the CALGreen Code, provides both mandatory requirements and voluntary measures. Currently, all measures in the code related to ZEVs are voluntary; however, municipalities can make them mandatory by adopting them through ordinance.
- ▶ **California Electrical Code:** Article 625 of the California Electrical Code (Title 24, Part 3) provides minimum mandatory requirements for the installation of electric vehicle charging systems. Jurisdictions may further amend these requirements under limited circumstances because of local climatic, geological or topographical conditions.



Case Study

The City of Berkeley offers a standardized and user-friendly permitting process to approve EV chargers in local homes. Most residential charging systems in Berkeley only require an inexpensive over-the-counter electrical permit. Berkeley also maintains a comprehensive website with easy-to-understand information about PEV ownership and permitting. Learn More: [City of Berkeley Website](#).



Plug-In Electric Vehicle Infrastructure Permitting

Snapshot: Installing electric vehicle charging stations typically requires local government approvals in the form of permits. Residents, businesses and other organizations therefore benefit from permitting processes that are efficient, timely, consistent and affordable, while ensuring safety of the installations.

Background: Many local governments in California have instituted practices that provide a model of efficient permitting for EV charging infrastructure. The city and county of San Francisco, for example, offer same-day permitting for Level 2 electric vehicle chargers in single-family homes. These same-day permits can be applied for through the Internet or over-the-counter at the building department. San Francisco's practice simply requires a standard electrical permit for installation of Level 2 chargers, which is a simple practice that other jurisdictions could adopt.

According to a mid-2012 survey of San Francisco Bay Area local governments to assess PEV readiness, more than half of local governments in the region currently issue same-day permits for electric vehicle supply equipment in single-family residences, and 80% charge applicants under \$250 for these permits. The survey also indicated that 22% of jurisdictions either have adopted or are in the process of adopting additional practices to support expedited and low-cost permits for installations at all property types.

The permitting process for an EV charger installation can vary depending on where the charger is being installed. For example, installing chargers in a large apartment building presents a different set of issues compared to installing a charger in a single-family home with a garage. This subsection of the Guidebook discusses PEV permitting for:

- ▶ Single-family Residential Charging
- ▶ Charging and Permitting in Multi-unit Dwellings
- ▶ Workplace Charging
- ▶ Retail and Public Sector Charging
- ▶ DC Fast Charging

The method by which PEV infrastructure permits are accepted and reviewed directly impacts the cost, schedule and customer experience. The permitting process for a PEV charging installation can vary greatly. Current permitting practices include the following methods.

- ▶ **Permit Required, Online System:** Some jurisdictions have invested in online permitting and inspection portals. The jurisdiction defines what is acceptable to be permitted through the online system. As a result, the up-front paperwork and time to complete the necessary permit application are reduced.
- ▶ **Permit Required, Over-the-Counter (OTC) with Scope-of-Work Only:** This process is similar to the online system except that the contractor deals directly with a city or county official noting the type of job being completed. There is no detailed overview of the installation and the permit is obtained immediately.
- ▶ **Permit Required, OTC with Plan Check:** Plan check is defined as a technical review of the installation and typically requires additional documentation from the electrician. While adding time and cost to the up-front permit application process,



Case Studies

- ▶ The **City of Los Angeles** has committed to a seven-day approval process for installation of EVSE, providing that the customer's electrical system can support the charging requirement.
- ▶ The County of Los Angeles Public Works Department has drafted a **simple checklist** for permitting and inspection to provide consistency throughout the greater Los Angeles area.
- ▶ The Tri-Chapter Uniform Code Council, representing building departments in the greater San Francisco Bay Area, has **adopted uniform guidelines** for both residential and commercial EVSE permits that provide guidance for the 55 jurisdictions in the South Bay region.
- ▶ The City of Riverside has prepared a **guide to EVSE permitting** for local residents.

plan checks are intended to speed up the actual on-site inspection time since an inspector has the documents that can be compared to the actual installation.

- ▶ **Permit Required, Plan Check:** The same technical review occurs, but not immediately. Instead, an official or third-party contractor reviews the documents according to the jurisdiction's process timeline; it is common for the timeframe to be a few days to a few weeks, or longer for complicated installations such as DC fast chargers.

PEV Permitting and CEQA Compliance

The California Environmental Quality Act (CEQA) generally requires state and local government agencies to inform decision-makers and the public about the potential environmental impacts of proposed projects and to reduce those environmental impacts to the extent feasible. The Natural Resources Agency maintains an interactive [flowchart](#) summarizing the CEQA process.

The applicability of CEQA to actions that support ZEVs must be determined on a case-by-case basis and this Guidebook does not advocate for a particular way to comply with CEQA or recommend particular exemptions. Local governments or other lead agencies should consult with their legal counsel about how CEQA may apply to their ZEV initiatives.

If a project subject to CEQA may cause adverse environmental impacts, the lead agency must prepare a detailed study called an environmental impact report (EIR). If a project subject to CEQA will *not* cause any adverse environmental impacts, a public agency may adopt a brief document known as a negative declaration. Many local governments have found that permits associated with ZEVs are not defined as a "project" under CEQA, meaning that no further action is required under CEQA. Others have found that the installation of electric vehicle supply equipment or hydrogen fueling stations may qualify as a project, but that a notice of exemption may be filed. Filing a notice of exemption completes the CEQA compliance process. In either of these particular cases, neither an EIR nor a negative declaration needs to be prepared.

Many local governments have determined that charger installations are not subject to CEQA. However, assessment under CEQA is required when government funding is used for a project—such as Alternative and Renewable Fuel and Vehicle Technology Program funding from the California Energy Commission. In these cases, lead agencies typically comply with CEQA by filing a notice of exemption. Commonly filed exemptions include:

- ▶ 15301 (Class 1) for Existing Facilities
- ▶ 15303 (Class 3) for Small Structures
- ▶ 15304 (Class 4) for Minor Alternations to Land

Some local governments have found that installing PEV charging equipment can be used as a CEQA mitigation measure in large projects when concerns exist about environmental impacts such as transportation-related impacts. In such cases, lead agencies can use PEV charging equipment as a mitigation measure because it reduces overall greenhouse gas emissions generated by a development.

Please refer to the Practical Tools and Templates section of the Guidebook on page 93 for the full text of each CEQA exemption.

Single-Family Residential Charging

Snapshot: Single-family homeowners represent the largest source of demand for plug-in electric vehicles to date. This is partially because charging in single-family homes presents the fewest physical and institutional barriers relative to other charging environments. Attached garages often have household outlets that can be used for overnight charging instead of buying special equipment; and cars can generally be parked a relatively short distance from an electrical panel, eliminating the need for lengthy conduit or trenching. Some local governments have taken measures to require PEV-ready wiring in new residential construction and to improve the permitting and inspection process. Reducing the up-front costs of charging in single-family homes is the low-hanging fruit of PEV planning. It is also the most effective way to increase the overall value of driving electric miles, regardless of the battery capacity of specific PEVs.

Background: The permitting process for single-family residential charging can be one of the most straightforward areas for electric vehicle supply equipment (EVSE) permitting, and the installation is often as simple as adding a 120V or 208/240V branch circuit (for Level 1 or Level 2 charging). The permitting process for this type of installation should utilize the same permitting process for installing a standard electrical appliance.

Any electrical work, including the addition of a 120V or 208/240V outlet, typically requires an electrical permit from the local building department and a subsequent inspection to verify that work is completed in compliance with the approved permit. Obtaining a permit generally requires the completion of an application describing the work to be done and payment of a permit fee. Some jurisdictions allow permits to be requested online, while others require a personal visit to city hall or the local building department.

Variables in the permitting process can significantly affect residential EVSE installation cost, timing and complexity. These variables can include local requirements specific to EVSE installations, the electrician's familiarity with these local requirements, the type of EVSE installation and the individual permitting official's experience with EVSE installations. Older buildings typically have a very limited electrical capacity, which could require upgrades. Confusion may occur for permitting and inspection officials who are not familiar with PEVs and EVSE installations. One way to avoid this confusion is to work with qualified electrical contractors who are experienced with EVSE installations during the permitting process, which can also ensure a safer installation process. Residents can verify contractor credentials to ensure they are working with someone knowledgeable about EVSE installations.

Some common issues that may arise during the permitting process for single-family residences may include:

- ▶ **Required Permitting Documentation:** To obtain a permit, documentation requirements have ranged from none, such as in online systems, to a full set including a site plan, line drawings, load calculations and installation guide. In most cases, a simple, hand-drawn diagram has been sufficient. Other cases, however, have required professional drawings. Documentation requirements are not uniformly applied across jurisdictions and, depending on the jurisdiction, they do not necessarily mirror the complexity of the installation.



Case Study

The City of Riverside allows water heater replacements to have a **virtual inspection** in which the contractor emails photos to the city inspector. Cities and counties may wish to consider photo inspection for simple EV installations.

- ▶ **Plan Check:** While processes for permitting the installation of a basic 120V or 240V circuit are established and generally do not require a formal review, some jurisdictions have added a plan check requirement for a 240V circuit when associated with Level 2 EVSE because of the higher electrical demands associated with this equipment and the potential for the existing electrical service panel to become overloaded. This step, which typically requires a formal review by an official, can take a few hours to a few weeks. If the installation is delayed, an electrician may need to complete additional office visits to provide documentation and answer questions, increasing the cost of the installation. One reason given for a plan check is to ensure a successful inspection during the first visit by the inspector. In this case, the inspection official needs only to review the installation against the submitted plans, which theoretically makes the inspection simpler, straightforward and timely. Online permitting systems often eliminate preinstallation plan check requirements
- ▶ **Dedicated Time-Of-Use (TOU) Meters for PEV Charging:** Installing a separate or special TOU meter dedicated to PEV charging in order to obtain PEV-specific electricity rates is an option some homeowners may desire; however, it adds a layer of complexity to the EVSE installation. The electrician must coordinate with the local electric utility, which can potentially add time and cost to the electrician's work. In addition, in early PEV installations, some permitting officials in the service areas of California's largest utilities expressed concern that a dedicated meter for PEV charging in a garage might enable un-permitted garage apartments.
- ▶ **Limited Electrical Capacity:** Older buildings typically have limited electrical capacity. Parking areas typically have minimal electrical capacity. Most AC Level 2 chargers require a minimum of a 40-amp circuit. However, some Level 2 EVSE is designed for a 20-amp circuit (which limits their output to 3.3 kWh). This is adequate for many PEVs. Upgrading electrical capacity can be very costly and could trigger requirements to bring the properties electrical up to today's building codes.

Additional challenges may include general familiarity with the topic, how to interpret codes and understanding local permitting requirements.

The following diagram shows the basic order for permitting and using a PEV charger.



Recommended Actions:

- ▶ **Implement Online Permitting for Residential Charging:** Cities and counties are encouraged to enable homeowners and licensed contractors to submit PEV charger permit applications online for installations at a predetermined complexity level to reduce the number of time-consuming visits to government offices. When online permitting is not available or feasible, a simple over-the-counter permit process can suffice. A plan check could be avoided for a vast majority of standard EVSE installations.

- ▶ **Provide Outreach and Resources:** Local governments are encouraged to provide information or hyperlinks on their websites as resources for defining residential EVSE permitting requirements. Outreach material may also include PEV benefits and types, available EVSE options and other PEV resources to prepare homeowners and licensed contractors. For more information, see the Public and Business Engagement section of this Guidebook.
- ▶ **Ensure Permitting Officials are Knowledgeable about EVSE Requirements:** A number of organizations exist that can provide helpful training on EVSE to local government. See the ZEV Incentives and Outreach section for more information.
- ▶ **Integrate Residential Charging Permit into Standard Electrical Permitting:** For AC Level 1 and Level 2 EVSE, there is little difference between an EVSE installation and a standard appliance installation. Local governments should work to include permits for single-family residential charging in their standard electrical permitting process.
- ▶ **Establish Reasonable Permitting Fees:** There are two primary cost components of permitting a residential EVSE installation: the permit fee and the electrician's indirect costs to complete the paperwork, including time and material necessary. For a jurisdiction issuing a permit, the cost of the permit should cover the time necessary to issue the permit (including necessary plan checks), as well as the time to inspect the installation. However, the manner in which a permit fee is calculated varies; a flat fee can be based on a published fee schedule, the total project cost or the scale of the project. The permit cost should be kept at a reasonable price.
- ▶ **Ensure an Efficient Inspection Process:** There are several different strategies available for local governments to ensure an efficient inspection process. Options may include giving a specific window of time for a visit, doing spot checks, establishing trusted relationships with specific installers or online inspection using digital photographs. Measures taken should be consistent with safety requirements to ensure that the EVSE is properly installed.
- ▶ **Develop Clear Procedures:** It is important to ensure that local utilities are aware of installations and that utilities work with residents to offer metering options. Working cooperatively, local agencies and utilities are encouraged to develop procedures for acceptable design and metering options.

Featured Resource: Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations: The California Plug-In Electric Vehicle Collaborative created a report providing recommendations and references so that jurisdictions can create improved procedures for permitting and inspection of in their area.

Charging and Permitting in Multi-Unit Dwellings

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

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

- ▶ **Limited parking:** In many multifamily complexes, especially older ones, parking spaces are at a premium, and there may not be room to install charging equipment.
- ▶ **Long distance between electrical panels and parking spaces:** A new 208/240V PEV charging circuit may require connection between the charger location and the tenant's or building owner's electrical panel. In MUDs, the electrical panel may be in the residential unit and located hundreds or even thousands of feet from the parking area.
- ▶ **Inability to take advantage of off-peak charging rates:** A new meter and utility service may be required to take advantage of off-peak PEV charging rates. Since most multifamily units have meters that are clustered together in a central location, there may not be space to add another meter.
- ▶ **Limited electrical capacity:** Older buildings typically have a very limited electrical capacity. Parking areas typically have minimal electrical capacity. Most AC Level



Case Study

CityFront Terrace is a mid-rise condominium community in the Marina District of downtown San Diego. Residents of CityFront Terrace were interested in electrical vehicle charging station options. With assigned underground parking spaces far from the residents' individual living unit, electric meters located on upper floors and common area meters on commercial rates subject to demand and time-of-use impacts, this project proved to be a challenge. The property and facility managers, homeowners' association and residents all worked together to identify a solution that allowed for lower cost electric vehicle charging rates, individual billing and flexibility of charging units for each resident. After reaching a compromise to the design, installation and billing plan, CityFront Terrace agreed they would install 20 individual meters wired directly to the utility side of the building electrical supply via one of the main buses. Wiring hubs on each floor of the parking garage would allow for wiring to individual parking places. Each individual requesting vehicle charging would pay an equal portion of the up-front capital expenditure for the project and purchase/own their own charging unit for installation in their space. Each resident secures the required liability insurance referenced under SB 880 in California for potential liability that may occur from these units being located within a common area. Under this arrangement, each resident receives their monthly bill directly from San Diego Gas & Electric and sees firsthand their individual time-of-use behavior and resulting cost savings from the utility's special, low EV rates.



2 chargers require a minimum of a 40-amp circuit. However, some Level 2 EVSE is designed for a 20-amp circuit (which limits their output to 3.3 kWh). This is adequate for many PEVs. Individual units in older apartments or condominium may only have a 60-amp service or less. Upgrading electrical capacity can be very costly and could trigger requirements to bring the property's electrical up to today's building codes.

- ▶ **Variable costs associated with installation:** Costs for MUD installations largely are determined by existing electrical capacity and distance from the electrical panel to the parking space. Cost mitigation strategies can include placement of charging equipment in guest parking spaces or other common areas. While these high costs can be significantly reduced if EVSE capacity is included in the construction phase, other approaches must be considered for existing buildings.

When installing charging equipment, the California Electrical Code requires electrical capacity for the charging equipment to reflect the full load charging capability of the equipment, plus an additional 25% capacity buffer, in order to prevent circuit overload. If multiple charging stations are installed, planners and utilities have historically had to assume that all might be in use simultaneously when determining electrical needs. However, the need to upgrade electrical panels in existing buildings may be reduced by the use of energy management software, which can monitor and regulate the additional load brought by PEV charging. A tentative interim amendment to the National Electrical Code has been issued, which allows the EVSE load on a service panel or feeder to reflect the maximum load permitted by an automatic load management system. To view this amendment, visit the [NFPA website](#). Local governments have to amend their codes in order to utilize the tentative interim amendment.

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

The rights and responsibilities of HOAs and PEV owners for charging in common-interest developments (condominiums, co-ops and other ownership MUDs) are outlined under California law by [Senate Bill 880](#) (Corbett, Chapter 6, Statutes of 2012). The basic purpose of this law is to ensure that PEV drivers are not unreasonably prohibited from installing charging equipment, either in their deeded or designated parking spaces or in common areas. HOAs must allow charging in common areas only if installation in the PEV owner's deeded or designated space is impossible or unreasonably expensive. If a driver has exclusive use of a charging station in a common area, HOAs must then enter a license agreement with the PEV driver, who must meet the following conditions:

- ▶ The charging station meets all applicable health and safety standards as well as all other applicable zoning, land use or other ordinances or land use permits. The applicable safety standard for AC Level 1 or Level 2 charging is UL 2594, Standard for Safety of Electric Vehicle Supply Equipment. For DC fast charging, the standard is UL 2202, Standard for Safety of Electric Vehicle Charging System Equipment.

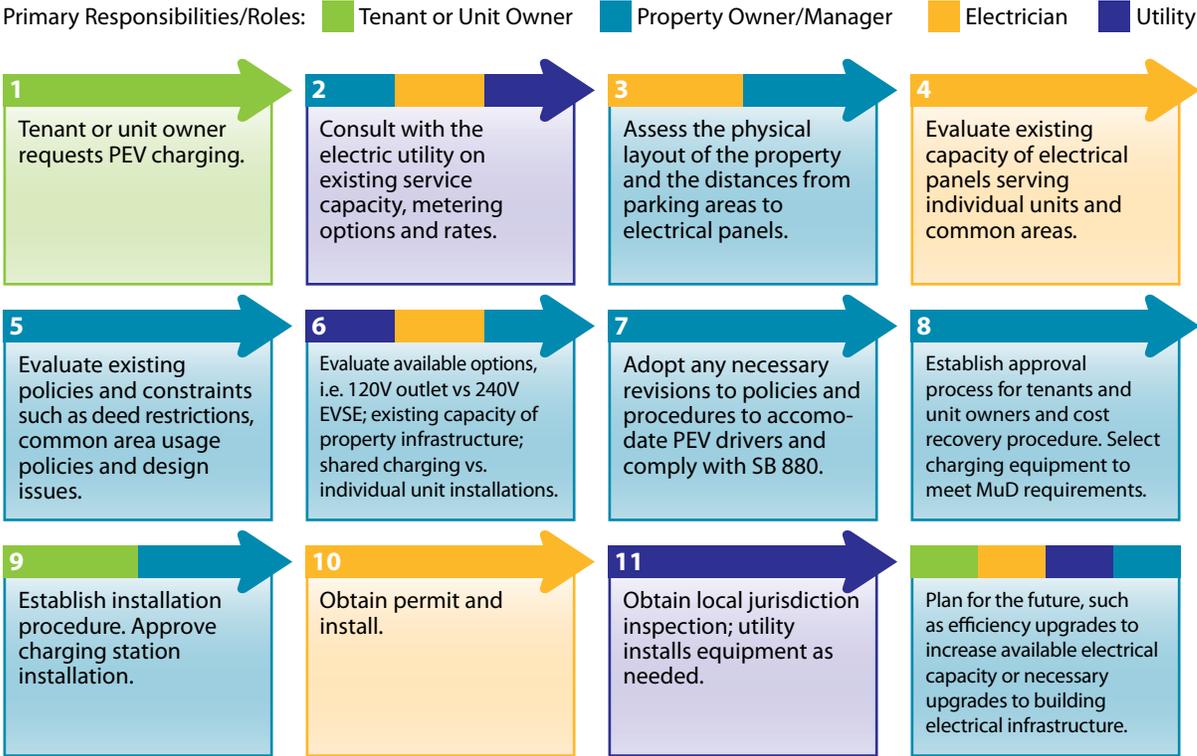
Case Study

San Diego Gas & Electric created an easy-to-understand guidance document for members in their community titled **Prepping for Plug-In Electric Vehicles at Condos, Townhomes, and Apartments.**

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

The HOA can also compel current and future owners of the charging station to pay for maintenance, repair or removal of the charging station and for any resulting damage to the station, common area or exclusive-use common area. Importantly, the law allows, without a full HOA member vote, a portion of the common area to be used for utility lines or meters to support charging in a deeded or designated parking space. The provisions of this law are in Sections **1353.9** and **1363.07** of the Civil Code. Note that Senate Bill 880 does not apply to apartment buildings.

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



Recommended Actions:

► For MUD Landlords or Owners

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

► For Local Governments

- **Ensure landlords and MUD owners are familiar with SB 880 requirements.**
- **Develop and deploy an EVSE permit checklist:** Develop and utilize an EVSE permit checklist that references all required elements for approval of a permit. This allows a permitting agency to determine if certain criteria are being met, such as proof of electrical capacity. It also highlights that MUD charging installation will vary depending on the specific case. A checklist template has been provided in the Template section of the Guidebook.
- **Fast-track approval of MUD EVSE projects:** As discussed in the explanation of the charging pyramid, home charging is essential for PEV readiness. As such, local authorities may give priority to MUD permit applications since these EVSE installations are necessary for home charging. In addition, MUD inspection approvals may be fast-tracked.
- **Develop clear procedures to ensure that local utilities are aware of MUD installations and that utilities work with MUD residents to offer metering options:** Working cooperatively, local agencies and utilities are encouraged to develop procedures acceptable design and metering options.
- **Publish submittal and plan check requirements for EVSE projects:** Local agencies are encouraged to make informational materials available (for over-the-

Case Study

Google's Mountain View, Calif., headquarters has one of the world's largest workplace charging programs. Google's parking lot features AC Level 1 and 2 charging stations that are used by employees and the company's growing car-sharing program for their employees called GFleet. Google has a goal to make 5 percent of its campus parking EV ready. There are no fees for employees or guests to use the charging equipment. [Learn more.](#)

Learn More

Electric Vehicle Everywhere Workplace Charging Challenge: The Department of Energy initiated a program in early 2013 that promotes employers placing electric vehicle chargers in their workplaces. Many businesses, including national and international companies, have already signed on to this program. See [a current list of all companies.](#)



More Info

If you are a business that wants to offer your customers or your employees the benefit of charging, check out the PEV Resource Center's information for **businesses**. For a list of considerations to share with employers, refer to the Practical Tools and Templates section of this Guidebook.

counter and online distribution) containing the requirements for EVSE permitting and installation.

- **Share case studies of successful MUD installations** so that other MUD applicants can review a template and process that worked.

Featured Resource:

- ▶ The California Plug-In Electric Vehicle Collaborative is working on a multi-unit dwelling guideline. The publication will include information about multi-unit dwelling charging installations and case studies. To check on its completion, visit the **PEV Resource Center**.



Workplace Charging

Snapshot: Workplaces present a significant, and largely untapped, opportunity for plug-in electric vehicle charging. After residences, they are the single most important environment for PEV charging. Vehicles are generally parked at workplaces for many hours every weekday, making it possible for them to recharge completely before the commute home. This allows more people to commute with battery electric vehicles, reduce pollutants and greenhouse gas (GHG) emissions and increase electric miles traveled for plug-in hybrid electric vehicles. The ability to charge at work enables those with longer commutes to drive PEVs and may encourage PEV adoption by those for whom residential charging is unavailable, cost-prohibitive or logistically difficult, particularly residents of older multi-unit dwellings.

Background: Private and public employers can demonstrate real environmental leadership, reduce criteria pollutants and achieve GHG reduction goals while attracting and/or retaining top-notch talent and enhancing the company's brand as socially and environmentally responsible by adding PEV charging for employees and customers.

Implementing workplace PEV charging is typically easiest where a business/organization is in complete control of their entire location. With singular control of the key pieces of real estate parking area, building and electrical service, it can be a straightforward process to establish PEV charging opportunities for employees. The situation can involve more steps for employers or employees at companies with a more complex building ownership/parking arrangement at their site. There have been many successful installations under complex ownership structures when there are clearly defined expectations, close coordination and a division of responsibilities.

Given that most employees are at work for 8-10 hours each day, Level 1 (120V) charging from a common, often available outlet can offer a less expensive and less complicated solution. However, the ability to charge several cars at once or in sequence using Level 2 equipment makes faster charging a potentially attractive option as the PEV population grows at a facility.

The permitting process for workplace charging is one of many variables that employers may have to consider when installing workplace charging. Some of the other considerations include:

- ▶ Cost (installation, maintenance, operation, etc.)
- ▶ Developing an internal policy regarding charging vehicles (i.e., determining protocol for plug-sharing among employees)
- ▶ Buy-in from senior management
- ▶ Getting employees interested in using the system
- ▶ Liability issues
- ▶ Choosing the appropriate EVSE network, EVSE vendor and electrical contractor
- ▶ Complying with the Americans with Disabilities Act
- ▶ Obtaining approval from property or parking garage owners



- ▶ Gaining insight into IRS rules regarding employee benefits as it relates to subsidizing workplace charging (For information, view [IRS Publication 15-B](#) regarding tax code/fringe benefits for transportation.)
- ▶ Pricing of electricity provided at the worksite to employees
- ▶ Evaluating future infrastructure needs during the initial installation
- ▶ Understanding the federal and state grant process for the purchase and installation of EV charging equipment — how to apply, what terminology to use
- ▶ Apportioning charging spaces between employees and the public; understanding the conditions when public access is required

Recommended Actions: Successful efforts to establish a workplace charging opportunity for PEV owners depend on the employee, employer and/or building owner being fully informed about the challenges and benefits. Local governments can play a key role in helping share information about workplace charging with interested employers and helping guide them through the permitting process.

- ▶ **Share Information with Interested Employers about Installation Guidelines.**
Local governments can help provide information about the benefits of workplace charging for employers of all sizes in the community.
- ▶ **Local governments should help employers to identify any special local fire, construction, environmental or building requirements that may be required.**
- ▶ **Local governments should provide an easy-to-fill-out application for workplace permitting.**
- ▶ **Local government can set an example by installing chargers for their employees and for public use.**
- ▶ **Local governments can consider if they have opportunities to provide workplace charging for their employees.**

Featured Resource: Workplace Charging Case Studies: The California Plug-In Electric Vehicle Collaborative is creating a workplace charging case studies publication and charging decision-making guides, as well as a best practices document with [CALSTART](#). To check on their completion, visit [PEV Resource Center](#).

Retail and Public Sector Charging

Snapshot: Most plug-in electric vehicle charging occurs at home, followed by charging at the workplace. To extend electric miles and give consumers confidence to travel wherever they choose, or to provide for access for those who might not be able to charge where they live, a robust and well-planned public electric vehicle supply equipment (EVSE) infrastructure is necessary. These chargers can be located at public parking lots, retail chains, tourist destinations, entertainment venues and airports. Research shows that retail stores offering public charging keep customers in their stores significantly longer. Several websites and mobile apps allow drivers to find these stations and plan their routes accordingly.

Background: The cost to install electric vehicle charging infrastructure for retail or public sector charging varies widely, depending on a multitude of factors. These factors include charging level, type of charger, existing electrical infrastructure, facility characteristics, permitting considerations, desired location of charging stalls at the property and installation cost. Charger hardware cost will depend largely on the choice of features and preference for design or brand, similar to the pricing range for automobiles and other consumer technology.

If the charging equipment can be installed close to an adequately sized electrical panel, the cost of installation can be minimized. The installations that require long conduit runs, concrete or asphalt cutting, ground trenching and/or panel upgrades cost significantly more.

All commercial electric vehicle charging equipment installations will require a permit. In general, only a building or electrical permit will be required. However, if extensive landscape, parking lot, electrical or structural alterations are involved, the services of an engineer and/or architect, as well as electrical design consultant, may be necessary. In these cases, additional permits may be required covering the appropriate project elements.

Recommended Actions:

- ▶ **Permitting agencies should be available to answer questions about retail and public sector charging early in the planning process** to help ensure the timely installation of chargers.
- ▶ **Permitting agencies should create a similar or duplicate permitting application for workplace and retail charging installations** because both types of charging impacts have many similarities.
- ▶ **Local Governments can provide general information about retail charging services.** Local governments can use existing resources, such as the featured resource, to share information about current payment options to interested companies.

Featured Resource: [Plug-In Electric Vehicle Handbook for Public Charging Station](#)

Hosts: The Department of Energy provides a handbook about plug-in electric vehicles for public charging station hosts. It is mainly for site hosts who are considering a charging station, but it also has helpful information for local governments to share with site hosts.

Case Study

The City of Thousand Oaks partnered with ECOtality and Ventura County Air Pollution Control District to fund and install the first Blink DC Fast Charger in Ventura County at the Thousand Oaks Transportation Center. The center is a local transit hub for the Ventura–LA county region located along the Ventura Freeway (Route 101) at Rancho Road. [Learn more.](#)





Case Study

The California Public Utilities Commission reached a \$122.5 million dollar settlement with NRG Energy Inc. that will fund the construction of a statewide network of charging stations for PEVs, including at least 200 public fast charging stations and another 10,000 plug-in EVSE “make-ready” units at a minimum of 1,000 locations across the state by end of the 2016.



Case Study

Several California utilities have developed tools and resources for local residents.

PG&E Plug-In Electric Vehicle Savings

Calculator – Provides an illustration of potential costs and savings associated with plug-in electric vehicles.

SCE Plug-In Car Rate

Assistant – Allows Southern California Edison customers to identify a rate plan that will give them savings on their electricity bill when charging a plug-in.

Fast Charging

Snapshot: Fast charging typically is defined as the capability to deliver more than 20 kW in a 30 – 60 minute period. Compared with Level 1 or Level 2 charging, direct current (DC) fast charging entails a much higher cost (currently \$20,000 – \$50,000 plus installation costs). The electrical supply to the site must be commercial-grade, typically 440 – 480-volt 3-phase AC; however, a few fast chargers are available using 208-volt AC. Some commercial enterprises view DC fast charging as a business opportunity, similar to operating a gas station. Unlike gas station customers, however, PEV drivers may visit DC fast chargers infrequently, depending on their need to travel a greater distance on a given day. Fleets may require DC fast charging to meet their higher daily mileage requirements.

Background: DC fast charging (DCFC) installations offer a number of benefits and opportunities:

- ▶ Rapid charging for PEV drivers who need to travel longer distances and do not want to wait or cannot wait for the time it would take using Level 1 or 2 charging.
- ▶ The ability to own or operate a PEV when charging can be a challenge at their home, workplace or destination. Finding a nearby DCFC station can offer a PEV driver an alternate place to charge.
- ▶ DC fast charging installations also raise a number of challenges for property owners and utilities, specifically:
 - The higher power requirements of a DCFC installation may require costly additional electrical service upgrades at the site.
 - Demand-based electricity rates can result in significantly higher electricity costs to the site host through demand charges.

Recommended Actions:

- ▶ **Carefully select the site for the DC fast charging based on available voltage, location, ease of access and use.** Site selection for DCFC may be difficult because of the need for high-voltage electrical service. Industrial sites more commonly have this service, but should be avoided as sites unless they are adjacent to a major roadway or freeway, are well lit and provide safe and convenient locations for charging customers. Other sites with available voltage include supermarkets, some big box stores and hospitals.
- ▶ **When considering a site, conduct a full building site electrical load evaluation with the potential DCFC loads.** This will show if demand charges are likely to be incurred at the facility.
- ▶ **Site selection should carefully consider the travel patterns of PEV drivers in the region.** Examples of some PEV drivers that may use a fast charging include those in high-density areas with limited access to installing chargers (such as apartments or condominiums), and those traveling between cities along interregional corridors. Convenient locations right off major freeways or at easily accessible, high-traffic locations are important to consider.
- ▶ **Understand available options for DC fast chargers and provide chargers that offer CHAdeMO and SAE combo connections.** A few DC fast chargers are 208 – 220-volt AC 20 kW. Charging with a 20-kW DC fast charger will take twice as long

as fast charging with a 50-kW model, but it will still take less than an hour to get an 80% charge for most PEVs. These fast chargers may assist site hosts in avoiding or lessening demand charges. PEVs such as the Nissan LEAF and Mitsubishi i-MiEV use the CHAdeMO connector for DC fast charging. The Society of Automotive Engineers (SAE) Combo DC fast charging connector has been adopted by eight automakers, including GM, Ford, Chrysler, BMW, Daimler, Volkswagen, Audi and Porsche. In 2013, vehicles that use each type of connector will be on the road; therefore, it is generally recommended to install a DC fast charger capable of charging both CHAdeMO and the SAE Combo.

- ▶ **Determine the appropriate fast charging permit.** In most cases, permits for fast charging are within the typical scope of business for authorities having jurisdiction. A conditional use permit may be required, necessitating additional time and resources.
- ▶ **Develop a fast charger parking count procedure.** Those with jurisdiction should include EVSE or DC fast charging spaces as part of the overall required parking ratios to ensure that installing a fast charger does not bring a fast-charging host to fall below minimum municipal parking requirements.
- ▶ **Develop landscape policies for fast charger installation.** Installing DC fast charging equipment in landscaped areas of a parking lot can be the least intrusive installation area so that the charge cord can reach the maximum number of cars. Local governments could consider strategies to allow for equipment installation in a landscaped area without reducing the required landscape ratio.
- ▶ **Allow the installation of vertical infrastructure.** Some DC fast charging installations may require a vertical installation, such as a light, sign or security camera. Local governments should consider how approval for a vertical installation could be incorporated to their current permitting process.
- ▶ **Ensure zoning compatibility.** Installing a DC fast charger should not require specific zoning classifications for the installation. Consider adopting policies that ensure that a DC fast charger installation is compliant with current zoning.
- ▶ **Ensure an efficient inspection process.** There are several different strategies available to local governments to ensure an efficient inspection process. Options include giving a specific window of time for a visit, doing spot checks, establishing trusted relationships with specific installers and/or an online inspection using digital photographs. Measures taken should be consistent with safety requirements. Local governments should determine if the DC fast charging permitting process could be completed without requiring a full plan review.



Case Study

Smart City San Diego, then-Mayor Jerry Sanders and the San Diego Zoo created a solar photovoltaic canopy that charges PEVs in the Zoo parking lot. One of the first of its kind in the country, the project uses solar energy to directly charge PEVs, store solar power for future use and provide renewable energy to the surrounding community. The solar-to-EV project serves as a new energy infrastructure blueprint that can be replicated throughout the region and beyond. [Learn more.](#)



Working with Utilities for Plug-In Electric Vehicle Readiness

Snapshot: Charging a plug-in electric vehicle is typically cheaper than fueling a gasoline car, especially when consumers charge at home overnight using off-peak electricity rates. Paying off-peak rates of \$0.10 per kWh is equivalent to paying around \$1.00 per gallon of gasoline. California utilities are already anticipating and planning for the widespread deployment of PEVs to manage the growing electrical load. Coordination with utilities and local governments can facilitate the preparation for anticipated increase in electrical load.

Background: Studies and modeling by a number of groups, including the Electric Power Research Institute, have shown that California's electrical grid can easily handle large numbers of PEVs. However, isolated problems could occur in neighborhoods that have a concentration of PEVs if the utility is not aware of local EVSE installations and locations in which a large number of vehicles plug in during peak utility load periods.

Utilities in California are divided into two groups: municipal utilities governed by local district boards or city councils and investor-owned utilities that are private corporations governed by their boards of directors and regulated by the California Public Utilities Commission (CPUC). The CPUC has been investigating issues related to the implementation of PEV charging for several years under Rulemaking 09-08-009 and has issued two decisions that are important to industry stakeholders and PEV drivers.

The first major policy decision (Phase 1, issued June 2010) addresses the issue of whether private businesses that sell electricity for the purchase of vehicle charging should be considered utilities and therefore subject to regulation by the CPUC. In its decision, the CPUC set a goal of encouraging competition in this new market and determined that businesses that sell PEV charging services should not be defined as utilities. **AB 631 (Ma, Chapter 480, Statutes of 2011)** codifies this decision and specifies that a facility that supplies electricity to the public only for use to charge a PEV does not make the person or corporation a public utility as defined under California Public Utilities Code Section 216.

The second CPUC decision (Phase 2, issued July 2011) provides additional direction to utilities on PEV-related charging issues, including rate design, provision of submeters to track PEV energy use, involvement of utilities in the promotion of PEVs and other issues. The decision prohibits IOUs from owning/operating equipment outside their own fleets or workplace charging for utility employees. Municipal utilities, while not subject to CPUC regulation, are closely watching the direction that the CPUC is taking, as often they are required by the state legislature to implement policies similar to those required of the investor-owned utilities.

Recommended Actions:

- ▶ **Utility Notification of EVSE Installation:** Utilities have been working closely with automakers, infrastructure suppliers, electricians and local governments to prepare for the deployment of PEVs. They have reached agreements with automakers and EVSE installers on an "automatic option/affirmative opt-out" notification system, in which automakers or infrastructure providers facilitate a customer's ability to notify utilities of PEV purchases. Utilities have also been active in educating consumers and

local governments on the importance of providing notification of EVSE installations so that utilities can plan for necessary infrastructure upgrades. The current system, while helpful, does not capture all PEV purchases.

- **Key Action:** A useful addition to the existing communication between utilities and local governments would be for local jurisdictions that issue EVSE installation permits to notify utilities when permits have been issued. This will help utilities ensure that there is sufficient capacity for increased electrical load.
 - As part of a standardized permitting application and checklist, include a check box that permits the local agency to share EVSE information with the local utility and establish a process for efficiently sharing that information with the local utility.

- ◉ **Electricity Rate Information and Metering:** Several factors will influence the electricity rates for charging a PEV, including frequency that the vehicle is charged at home, all other electric household load tendencies, total electrical load and daytime versus nighttime charging. Many California utilities offer special time-of-use (TOU) rates to encourage PEV owners to charge during nighttime off-peak hours when utilities have surplus capacity. Most PEV users, including fleet and residential customers, already find it convenient and cost effective to charge overnight. Some TOU rates, however, require customers to install additional electrical equipment and utilities to install additional metering equipment. Additional meters can result in higher installation costs and longer installation time. Some utilities have created excellent online rate calculators to help customers evaluate their options.

- **Key Action:** Customers should contact their local utility for more information about the most cost-effective time to charge and for information about special utility PEV TOU rates.

- ◉ **Submetering:** In Phase 2 of Rulemaking 09-08-009, the CPUC directs utilities to explore submetering. Submetering directs a portion the electrical usage of the PEV from the rest of the household and potentially allows a homeowner or a third party to manage the billing considerations associated with the flow of electricity through EVSE to a PEV.

- **Key Action:** Submetering is a major shift in the way electricity is metered and may give customers more options. Many technical and market considerations are being investigated to determine how these new options will be implemented. Check with the local utility for the most up-to-date information about submetering.

- ◉ **Commercial Charging and Demand Response Programs:** Most commercial rates vary by time of day and season. Commercial rates include monthly demand charges based on the maximum amount of electricity or peak load. Some California utilities offer rates for PEV charging: contact the local utility to see if this program may be available. There are currently no special PEV rates for commercial customers.

- **Key Action:** To save money, some customers choose rates that allow the utility to interrupt service when supply circumstances demand it. Additionally, many sophisticated building energy management systems enable managers to balance a variety of loads to ensure that demand charges are minimized even if there are several chargers being accommodated at a single location or property.

- ◉ **Integration of PEVS with Renewable Energy and Efficiency Strategies:** As technologies evolve, some vehicle batteries could eventually serve as distributed energy



storage assets that can help provide a variety of grid services, including frequency regulation (balancing supply and demand), via two-way connections to the grid.

- **Key Action:** Commercial and residential customers can integrate solar photovoltaic power into their home energy mix. To the extent that solar power can substitute for more expensive grid-tied power, utilizing solar power to directly charge vehicles may be a cost-effective option, with the added benefit of further reducing greenhouse gas (GHG) emissions. In addition, through vehicle-to-building (V2B) connections, it may be possible for future PEVs to provide backup power to homes or offices during a power outage. If installing solar panels prior to an EVSE installation, the solar project could still be sized to accommodate future EV charging.

- ▶ **DC Fast Charging:** Unlike 240-volt AC Level 2 chargers that take 3 to 8 hours to fully recharge a depleted battery pack, DC fast chargers can recharge a PEV more quickly. While rapid charge times are beneficial, DC fast charging installations raise a number of challenges for property owners and utilities, specifically:

- The demand on the utility of instantaneous high voltage may require utility upgrades to existing infrastructure
- The current rate structure can result in high electricity demand charges

Featured Resources: All major California utilities have plug-in electric vehicle (PEV) infrastructure programs. The scope may vary by utility provider, but generally, they include working with city officials to develop residential electric vehicle supply equipment (EVSE) procedures, planning for local infrastructure enhancements, providing time-of-use rates and meter options and working in partnerships to demonstrate public infrastructure programs. These programs include:

- ▶ [California Municipal Utilities Association \(CMUA\), Electric Trans. Committee](#)
- ▶ [LA Department of Water and Power \(LADWP\)](#)
- ▶ [Pacific Gas & Electric Company](#)
- ▶ [Sacramento Municipal Utility District](#)
- ▶ [San Diego Gas & Electric](#)
- ▶ [Southern California Edison](#)
- ▶ [PEV Resource Center Information on Charging and Electricity Rates](#)

Plug-In Electric Vehicle Infrastructure and Equipment Accessibility

Snapshot: The zero-emission vehicle community is working toward the introduction of vehicles and infrastructure to enable the widest possible range of ZEV usage by anyone who wishes to use them. To that end, vehicles, locations, infrastructure and equipment must be accessible to all users. Plug-in electric vehicles need charging in a range of locations. The Governor's Office of Planning and Research is developing voluntary guidelines to address physical accessibility at PEV charging stations. Fuel cell electric vehicle fueling generally follows the accessibility requirements for common gasoline fueling. Because FCEV fueling and PEV charging station equipment includes "self-contained, closed systems," it must be purchased in accordance with the Statewide Information Management Manual (SIMM), Section 25. The requirements listed in the SIMM, Section 25 are based upon Section 508 of the U.S. Rehabilitation Act.

Physical Accessibility for Plug-In Electric Vehicle Charging: The Governor's Office of Planning and Research is currently working to develop voluntary guidelines that address physical accessibility standards and design guidelines for the installation of PEV charging stations in California. Once finalized, the guidelines will address accessible PEV charging stations on both public and private sites and within public rights of way. Recommendations will be added into this Guidebook once the guidelines are published.

It is important to recognize that individual organizations, whether public or private, may have their own internal policies regarding how they ensure that these services are accessible and meet federal and state accessibility standards. For example, the State of California has its own internal policy for the state's Department of General Services regarding accessibility of its PEV fleet and charging facilities. Such policies may address aspects of access or related issues that are specific to an individual organization. The recommendations that will be provided in this section are not intended to alter or supplant any standards or policies that an organization already may have in place.

Charging and Fueling Equipment Accessibility Requirements (Section 508 of the U.S. Rehabilitation Act): Any entity that receives federal, state or local government funding to build PEV and FCEV fueling stations must adhere to current electronic accessibility requirements regarding the availability and use of charging equipment or devices.

The requirements of Section 508 and California Government Code 11135 basically ensure that any machinery that contains embedded software needs to be designed and installed in such a fashion so that a person with a visual, auditory, cognitive or physical disability can operate it easily and independently. For example, this means it must provide auditory output and tactile discernible buttons for persons with low-vision or blindness. This is not an exhaustive list, and the [United States Access Board](#) provides a complete list of Section 508 requirements. The State of California Building Code also has specific requirements that address these issues in Chapter 11B of the California Building Code. Similar machines covered by Section 508 are copiers, fax machines, rapid transit ticket dispensers, automated teller machines and card readers.

If there are questions regarding the requirements of Section 508, California Government Code 11135 or Chapter 11B of the California Building Code, contact the [Disability](#)

Access Services unit of the California Department of Rehabilitation. Email questions to DASinfo@dor.ca.gov.

Featured Resource: Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices (DRAFT): The Governor's Office of Planning and Research has developed draft guidelines that recommend accessibility standards and design guidelines for PEV charging stations. When completed, a final version will be included in the Guidebook.







Fuel Cell Electric Vehicle Readiness

Snapshot: There are several actions that local governments can take to become fuel cell electric vehicle ready. These steps include identifying fuel cell electric vehicle infrastructure needs in the community, permitting hydrogen fueling stations and understanding the characteristics of hydrogen.

Background: Hydrogen fueling stations are similar to conventional gasoline stations so they will not be located as ubiquitously as EV charging stations. This is due to the longer driving range of fuel cell electric vehicles compared to the driving range for most battery electric vehicles.

The goal is to increase the number of hydrogen fueling stations and the geographic coverage of the stations to ensure that a sufficient number of early adopters consider purchasing a fuel cell electric vehicle. The number of hydrogen stations in early market communities will need to increase and additional stations will be required expand the market.

A station's location, and its ability to encourage customer adoption of FCEVs, represents one-half of the equation. The other half is whether anticipated vehicle volumes will prove adequate to allow station operators to create a retail hydrogen fuel market.

The approach to station placement during early commercialization provides an important foundation toward balancing the coverage with capacity utilization principles. This focuses the earliest vehicle deployments on a few target areas in key California regions. The underlying strategy for fuel cell electric vehicle readiness is to create a network that meets the needs of the earliest adopters, while making sure that station operators are able to build a business case for selling hydrogen.



Identifying Fuel Cell Electric Vehicle Infrastructure Needs in Communities

Snapshot: A local community's network of fueling infrastructure supports convenient use of fuel cell electric vehicles by local residents. Ensuring adequate fueling opportunities for FCEVs will also help expand the statewide ZEV market. This section of the Guidebook explains how to identify infrastructure needs in local communities. Recognizing the most effective locations for hydrogen fueling will continue to improve as more data on FCEV usage is collected.

Background: In working to bring FCEVs and stations to market, several studies have determined that adequate fueling infrastructure must come before vehicles and that stations must be in customer-friendly locations that are convenient to home and work. Existing gas and compressed natural gas stations are ideal locations. Research from UC Irvine indicates that people will not drive very far out of their way to fuel.

Launching FCEVs and the supporting hydrogen fueling infrastructure is a significant undertaking and requires considerable planning and coordination with local governments, community residents and other stakeholders. Automakers begin engineering development three-to-five years in advance of vehicle deployment, along with vehicle testing, automotive supplier development, manufacturing preparation and marketing plans. To execute these capital investments, which amount to billions of dollars, an infrastructure plan must give automakers a high level of confidence that their customers will have access to hydrogen fuel.

Hydrogen Use Today

The U.S. safely produces and uses over 9 million tons of hydrogen per year for processes including petroleum refining, fertilizer production, pharmaceuticals, food processing and manufacturing.

The number of commercial sites utilizing stationary fuel cells powered by hydrogen for baseload or back-up power generation is rapidly growing.

Stationary fuel cells are installed in a third of California counties. These installations represent almost 35 megawatts of installed capacity. For more information, visit the [California Stationary Fuel Cell Collaborative website](#).

Hydrogen-powered forklifts have been favored by major warehouses as an economical solution to materials handling. These forklifts require similar hydrogen dispensing stations needed for vehicles.

Hydrogen has been recognized as an energy storage solution to curtail excess renewable energy production.

Hydrogen has been demonstrated as a suitable transportation fuel for various vehicles: cars, buses, motorcycles, space shuttles, airplanes, locomotives and marine vessels. Today, fuel cell electric cars and buses are the main drivers bringing hydrogen fueling stations to a retail environment globally. In fact, more than 60 hydrogen stations have been approved for operation in the U.S.

The latest information on installed hydrogen stations in California can be found on the [California Fuel Cell Partnership website](#).

Hydrogen Station Planning: Through a collaborative process, substantiated by data and modeling conducted at UC Irvine and UC Davis, the California Fuel Cell Partnership determined that an initial network of 68 stations operating statewide by 2016 would enable the launch of the early commercial market of 10,000-30,000 FCEVs. Before FCEVs are sold or leased on a larger scale, consumers must have confidence that they can fill up near their homes, jobs and key destinations throughout California. At the same time, hydrogen stations must have an adequate supply on a daily basis and during peak hours to supply the growing number of vehicles. Providing customers with sufficient locations will initially result in a greater available hydrogen supply than needed, but location and station coverage are essential for early adopters to take full advantage of FCEVs' long range.

Through individual and joint meetings over more than a year, automakers and stakeholders identified the areas where they expect to find their first customers. To determine the most likely locations for FCEV customers, participants considered:

- ▶ Demographic information, such as household income, cars per household, population and land use considerations
- ▶ Individual automaker market assessments
- ▶ California Energy Commission/Air Resources Board Vehicle Survey for battery electric vehicles and plug-in hybrid electric vehicles, as noted in the 2011-12 Investment Plan
- ▶ Hybrid vehicle, plug-in hybrid electric vehicle, battery-electric vehicle and natural gas vehicle registrations

Geographic distribution for the hydrogen stations fell into areas defined as clusters, connectors or destinations. These definitions serve as broad geographic descriptions of early market communities in which hydrogen stations are currently and will likely be located in the future. Some of these areas may have more than one existing, forthcoming or recommended station.

- ▶ Cluster: A small geographic area with a high percentage of potential early FCEV adopters
- ▶ Connector: A city or community that links clusters and seeds new communities
- ▶ Destination: A city or community that is a popular destination and seeds new communities
- ▶ Market: An area that can include two or more clusters, e.g., Los Angeles County, San Francisco Bay Area

The five initial cluster communities are:

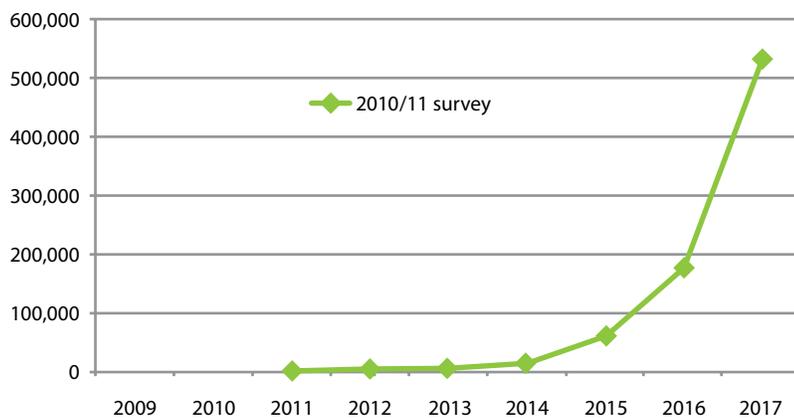
- ▶ Berkeley
- ▶ South San Francisco, Bay Area
- ▶ Santa Monica and West Los Angeles
- ▶ Torrance and nearby coastal communities
- ▶ Irvine and Southern Orange County

The goal is to increase the number of stations and geographic coverage to ensure an adequate number of early adopters have the confidence that the infrastructure is sufficient and growing, which will in turn increase their consideration of purchasing a FCEV. With 45 stations in the cluster communities and 23 additional stations seeding additional markets as well as promoting wider travel, California will have an initial network of 68 hydrogen stations that give customers the freedom to drive almost anywhere in the state.

Current Progress: California is working toward having 68 hydrogen stations throughout the state in planning or with funding committed by 2016 in order to serve the thousands of FCEV drivers expected in the early years of commercialization. About half of the 68 stations are in process—open, in planning or have funding committed. The [DriveClean Website](#) includes links that list currently available hydrogen station locations, and [H2Stations.Org](#) has a website with hydrogen stations worldwide.

Several automakers plan to introduce FCEVs to the California commercial market around 2015. The following figure shows the results of the most recent vehicle survey conducted by the State of California for the volume of anticipated FCEVs that could be on the road during 2011-2017 should the network of hydrogen stations become available.

Estimated FCEV Sales



Future Hydrogen Station Plans: After the initial network is built, hydrogen fuel demand should closely follow vehicle sales, which will lead to increased vehicle sales growth and more station development. Slower growth may require fewer or no additional stations, and faster growth may encourage a quicker and broader rollout of hydrogen stations. In other words, 68 stations are capable of serving thousands of vehicles. If 50,000 vehicles were on the road, upwards of 100 stations would be necessary to ensure the network has enough capacity for additional vehicles. Building additional stations or completing station upgrades to meet market demands will be necessary to serve this expected FCEV population.

Recommended Action:

- ▶ **Contact the [California Fuel Cell Partnership](#) for inquiries about installing a hydrogen refueling stations.** Email: info@cafcp.org.

Featured Resource: [A California Road Map: Bringing Hydrogen Fuel Cell Vehicles to the Golden State](#): The California Fuel Cell Partnership’s report describes the infrastructure needed to successfully launch the commercial FCEV market.

Permitting Hydrogen Fueling Stations

Snapshot: Fuel cell electric vehicles are at the cusp of transitioning into the early commercial market. According to automaker surveys and publicly announced plans, the commercialization of fuel cell electric vehicles is scheduled to begin in the 2015-2017 timeframe. Building the initial network of strategically placed hydrogen dispensing stations for FCEVs is critical to support the early deployment of these advanced vehicles on a commercial scale in California. Codes, standards and regulations have been and continue to be developed to enable a smoother permitting process and the retail sale of hydrogen as a fuel.

Background: Hydrogen has been produced and employed for industrial, power-generation, energy storage and transportation purposes for decades. Hydrogen is developing into one of several major fuel types for advanced clean vehicles.

Safety codes and standards are in place to ensure the safe production, storage, handling and use of hydrogen in the U.S. Some local governments have had experience with codes (e.g., NFPA 1, NFPA 2, NFPA 52, NFPA 55, NFPA 70, ICC codes adopted by the state) and standards (e.g., ASME, CGA, CSA, SAE and UL) as they relate to industrial, commercial and fueling infrastructure projects that incorporate hydrogen. However, most jurisdictions have limited experience with hydrogen so there is a need for authorities having jurisdiction (AHJs) to become more knowledgeable of hydrogen codes, standards and fueling equipment as well as the FCEVs themselves. This is especially important as the number of planned hydrogen dispensing stations substantially increases in conjunction with the market introduction of FCEVs in the 2015-2017 timeframe. Local governments and other key stakeholders will require education and outreach to address the following types of concerns.

▶ **Local Zoning Codes:** Until recently, most hydrogen dispensing stations were built for specific vehicle fleets and to provide experience with designing, installing and operating a station, such as those built through the Department of Energy Technology Validation Programs. The market has evolved over the past few years, and hydrogen stations are now being installed in retail settings alongside gasoline and natural gas dispensers. This trend is anticipated to continue with the majority of hydrogen stations collocating with existing gasoline sites. In California, jurisdictions are responsible for writing or adopting their own zoning codes. As such, the rules that govern the construction of hydrogen stations may differ, sometimes substantially from one jurisdiction to another. Some





jurisdictions may have specific language that covers hydrogen stations in an industrial zone, but not in a commercial zone. Others may simply group hydrogen in with all automotive fuels and, therefore, may allow it in commercial zones. Some jurisdictions may require design reviews or specific discretionary approvals to proceed, while in others hydrogen dispensers may be installed in existing fueling stations by right or entitlement. Sorting out these rules and understanding how they should be applied can present challenges for station builders and permitting officials alike, especially as hydrogen stations move from industrial settings to retail locations.

- ▶ **Technology Certification:** The codes and standards specific to hydrogen distribution, storage and dispensing have been developed by standard development organizations, the National Fire Protection Association, the International Code Council and with support from the Department of Energy and other entities. Nationally Recognized Testing Laboratories are publishing test and design standards for hydrogen station components and continue to move toward greater standardization of hydrogen station components. Local officials may find few listed components and assemblies at hydrogen stations in the early commercialization stage. Key stakeholders are working to establish consistent processes for equipment review.

The Preparing Permitting Authorities box provides useful resources for permitting authorities regarding codes and standards, best practices, safety and available case studies.

Preparing Permitting Authorities

- ▶ The Department of Energy offers an online training course for code officials. The **Introduction to Hydrogen for Code Officials** provides an overview of hydrogen and fuel cell technologies, how they are used in real-world applications and references for related codes and standards.
- ▶ **H₂BestPractices.org** offers an online best practices manual providing suggestions and recommendations pertaining to the safe handling and use of hydrogen. It contains a hydrogen safety checklist, hydrogen facility design considerations, change control form and a wealth of other information and templates.
- ▶ The Department of Energy presents examples of operational hydrogen fueling stations throughout the nation on its **Hydrogen Fueling Station Case Studies** webpage.
- ▶ **Regulations, Codes and Standards (RCS) Template for California Hydrogen Dispensing Stations**, developed by the National Renewable Energy Laboratory, provides information on codes and standards that could help the design and construction and regulatory approval of hydrogen dispensing stations. The report also includes permit templates and an example permit.
- ▶ The California Fuel Cell Partnership offers **educational materials for authorities having jurisdiction and first responders**. CaFCP also conducts workshops for AHJs and first responders in California communities where FCEVs and hydrogen stations currently exist or are planned. To schedule a workshop, contact CaFCP's Safety & Education Specialist (info@cafcp.org).

Recommended Actions:

- ▶ **Presubmittal Review:** Prospective permit applicants are recommended to meet with permitting officials before submitting an application. Permitting officials are encouraged to offer a presubmittal review, which provides an opportunity to avert potential issues that may delay the permitting process or lead to the denial of an application.
- ▶ **Authorities Having Jurisdiction (AHJ)** are encouraged to make the applicant aware of
 - any special concerns relating to the proposed hydrogen station site

- local zoning codes and amendments that may have not been considered in the draft application
- history of issues with similar projects in the jurisdiction and other key insights for a successful project plan during the presubmittal review

- ◉ **Project applicants** are encouraged to provide AHJs with information about
 - hydrogen station technology
 - any codes, standards and regulations related to hydrogen station development used for other projects
 - how certain codes have been interpreted or amended in other jurisdictions

Open communication between local AHJs and hydrogen station developers is especially vital when local codes have not been adopted for certain aspects of the project.

- ◉ **Community Support:** Hydrogen station developers and automakers should prepare high-level presentations and/or educational materials about hydrogen as a fuel, commercialization plans for fuel cell electric vehicles, emergency response and other appropriate topics for the public. Extensive and ongoing outreach to the general public—especially local elected officials, businesses and residents—in the local area has proven to be advantageous for projects in California.

- ◉ **Periodically Communicating Safety Plan:** As with any project that could impact the health and safety of a community, a hydrogen station operator should develop a project safety plan that addresses potential risks and impacts to personnel, equipment and the environment. The plan should describe how project safety is communicated and made available to the operating staff, neighboring occupancies and local emergency response officials. A communication plan that employs regular dissemination of safety procedures and practices is critical to avoiding potential safety incidents and assure proper incident response.

- ◉ **Other Regulatory Requirements**

- **California Environmental Quality Act (CEQA):** Installing a hydrogen station generally fits the definition of a project under CEQA. Local governments have taken a range of actions under CEQA to install hydrogen fueling stations, including filing categorical exemption or preparing a negative declaration. Most of the recently built hydrogen stations have used categorical exemptions. Commonly filed exemptions for hydrogen stations are
 - 15301 (Class 1) for Existing Facilities
 - 15303 (Class 3) for Small Structures

It is recommended that agencies enforcing the CEQA statute refer to exemptions granted by other enforcing agencies.

- ◉ **California Accidental Release Program (Cal-ARP):** Hydrogen dispensing stations are exempt from the California Accidental Release Program (Cal-ARP) if less than 10,000 pounds of hydrogen is stored or processed on site. It is recommended that Cal-ARP enforcement officials contact [California Emergency Management Agency](#) for information on the program.

Featured Resource: The California Air Resources Board, with assistance from the California Fuel Cell Partnership, is developing the Hydrogen Community Readiness Kit (H2CRK) for the public, industry stakeholders and safety officials. When completed, it will be posted to [Drive Clean](#).

Characteristics of Hydrogen as a Fuel

Snapshot: Hydrogen is widely recognized as a suitable fuel for transportation and has been classified as such by the State of California (**Senate Bill 76** – Committee on Budget and Fiscal Review, Chapter 91, Statutes of 2005). As with all automotive fuels, the safety factors associated with hydrogen need to be properly assessed and understood as it is deployed in retail fueling stations. This section provides information about hydrogen as it relates to safety considerations in the design and permitting of constructed facilities and in properly managing incident response.

Background: Industry has used hydrogen in vast quantities in the petroleum refinery process, as an industrial chemical and as fuel for space exploration. This developed an infrastructure to produce, store, transport and utilize hydrogen safely. Hydrogen is no more or less dangerous than other flammable fuels, including gasoline and natural gas. In fact, some of hydrogen's differences actually provide safety benefits compared to gasoline or other fuels. However, all flammable fuels must be handled responsibly. Like gasoline and natural gas, hydrogen is flammable and can behave dangerously under specific conditions. Hydrogen can be handled safely when guidelines are observed and the user has an understanding of its behavior.

The following lists some of the most notable differences between gaseous hydrogen and other common fuels.

- ▶ **Hydrogen is lighter and smaller than other fuels:** Hydrogen is the lightest and smallest element in the universe and diffuses rapidly. The small molecular size increases the likelihood of a leak, but its low weight results in very high buoyancy and diffusivity. Industry takes into account the buoyancy and diffusivity of hydrogen when designing structures to confine hydrogen safely.
- ▶ **Hydrogen is odorless, colorless and tasteless:** Most human senses will not detect a hydrogen leak. For these and other reasons, industry often uses hydrogen sensors to detect hydrogen leaks and has maintained a high safety record using them for decades. By comparison, natural gas is also odorless, colorless and tasteless, but industry adds a sulfur-containing odorant, called mercaptan, to make it detectable by the human sense of smell. Today, researchers are investigating methods that might be used for hydrogen detection, such as odorants benign to fuel cells, gaseous tracers and advanced sensors.
- ▶ **Hydrogen flames have low radiant heat:** When hydrogen does ignite, it burns with an invisible or near-invisible flame. Heat and water are produced when hydrogen combusts in air. Since hydrogen is carbon-free, hydrogen air flames are void of the carbon products common with combustion of a hydrocarbon. A hydrogen fire radiates significantly less heat compared to a hydrocarbon fire as a result of being carbon-free. Since the flame emits low levels of heat near the flame (the flame itself is just as hot), the flame is more easily contained and the risk of secondary fires is usually lower than a hydrocarbon fire. This fact can have a significant impact for the public and rescue workers.
- ▶ **Combustion:** In order for a fire to ignite, an adequate concentration of fuel, the presence of an ignition source and the right amount of oxidizer (like oxygen) must be present at the same time. Hydrogen has a wide flammability range (4 – 74% in air) and the energy required to ignite hydrogen (0.02 megajoule) can be very low compared to gasoline and natural gas. The wider flammability range presents an

increased probability of ignition, but the likelihood that a flammable mixture will form in air is reduced by the dispersion characteristics of hydrogen and higher ignition energies along the upper flammability limit. At low concentrations (below 10%) the energy required to ignite hydrogen is higher—similar to the energy required to ignite natural gas and gasoline in their respective flammability ranges—making hydrogen realistically more difficult to ignite near the lower flammability limit. Furthermore, the lower flammable limit for hydrogen (4%) is higher than gasoline (1%), which means that a greater percentage of hydrogen in the air is required than gasoline to ignite. If conditions exist where the hydrogen concentration increases toward the stoichiometric (most easily ignited) mixture of 29% hydrogen (in air), the ignition energy drops to about one fifteenth of that required to ignite natural gas (or one tenth for gasoline). See the following chart for more comparisons.

Fuel Comparisons

Property*	Hydrogen	Gasoline Vapor	Natural Gas
Flammability Limits** (in air)	4 – 74%	1.4 – 7.6%	5.3 – 15%
Minimum Ignition Energy (mJ)	0.02	0.20	0.29
Flame Temperature (°C)	2045	2197	1875
Stoichiometric Mixture	29%	2%	9%

* The properties vary with pressure, temperature, ignition energy and water vapor content. The values listed are true at standard conditions.

** Lower flammability limit is true for upward flame propagation. The influence of propagation direction on flammability decreases as percent of fuel in the air increases.

- ▶ **Asphyxiation:** Any gas can cause asphyxiation. In most scenarios, hydrogen’s buoyancy and diffusivity make hydrogen unlikely to be confined where asphyxiation might occur.
- ▶ **Toxicity/Poison:** Hydrogen is nontoxic and nonpoisonous. It will not contaminate groundwater, because it is a gas under normal atmospheric conditions, nor will a release of hydrogen contribute to atmospheric pollution. Hydrogen does not create harmful fumes.

Fire safety professionals in California can expect greater likelihood of encountering more transportation-related applications using hydrogen, especially as the number of hydrogen refueling stations grow in the coming years. The following section recommends actions that fire safety officials should consider in order to prepare for permitting applications or emergency response related to hydrogen.

Recommended Actions:

- ▶ **Develop Up-To-Date Emergency Response Guidelines for Hydrogen-Powered Vehicles:** Emergency response training officers should use available training programs and materials related to hydrogen vehicles, such as those available through the Office of the State Fire Marshal, Department of Energy and National Fire Protection Association. Auto manufacturer guidelines are typically available online through their websites. For further information, contact the [California Fuel Cell Partnership](#).

- ◉ **Assess Training Needs for Content Relating to Personnel:** Fire service organizations need to assess hydrogen-related training needs for response, fire inspection, permitting and fire training personnel. Instructional materials and training programs are available for fire professionals. Refer to Preparing Fire Personnel for existing education and training programs.
- ◉ **Periodically Review Fire Codes and Standards:** Codes and standards help dictate safe building and installation practices. NFPA 2 is a single-source document for permitting hydrogen facilities (stations, repair facilities, etc.). The goal is for the International Fire Code to reference NFPA 2 and, therefore, be adopted by the state. NFPA 2 (2011) is currently undergoing revision for publication in 2015. It is recommended to check periodically for updated codes and standards or reports that seek to provide clarification of previously published codes and standards. For instance, the Fire Protection Research Foundation publishes hydrogen-related reports periodically that may provide clarity and guidance to jurisdictions.

Featured Resource: Hydrogen Safety Fact Sheet: The Fuel Cell and Hydrogen Energy Association's fact sheet describes the safety of hydrogen and compares its properties to other gases and fuels.

Preparing Fire Personnel

- ◉ The Department of Energy offers online training courses for emergency responders and permitting officials. **Introduction to Hydrogen Safety for First Responders** acquaints first responders with hydrogen, its basic properties and how it compares to other familiar fuels; hydrogen use in fuel cells for transportation and stationary power; potential hazards; initial protective actions should a responder witness an incident; and supplemental resources including videos, supporting documents and links relevant to hydrogen safety.
- ◉ The **Hydrogen Safety Bibliographic Database** provides references to reports, articles, books and other resources for information on hydrogen safety as it relates to production, storage, distribution and use. In addition to bibliographic references, the database provides select full text documents or links to other websites that offer these documents.
- ◉ **H₂Incidents.org** is a database-driven website intended to facilitate the sharing of lessons learned and other relevant information gained from actual experiences using and working with hydrogen. The focus of the database is on characterization of hydrogen-related incidents and near misses, and ensuing lessons learned from those events.
- ◉ Pipeline and Hazardous Materials Safety Administration provides first responders with **2012 Emergency Response Guidebook**, a free go-to manual to help deal with hazmat accidents during the critical first 30 minutes. The guidebook covers many hydrogen-related topics pertinent to first responders.
- ◉ The California Fuel Cell Partnership offers **educational materials** for first responders and authorities having jurisdiction. Visit www.er.cafcp.org for links to other useful resources. CaFCP also conducts workshops for first responders and AHJs in California communities where FCEVs and hydrogen stations currently exist or are planned. To schedule a workshop, contact CaFCP's safety & education specialist (info@cafcp.org).
- ◉ **Hydrogen Highway Listserve** is a forum for asking questions, discussing or sharing information related to hydrogen, fuel cell vehicles, fueling stations, codes and standards, permitting, etc.
- ◉ The Fuel Cell & Hydrogen Energy Association publishes the **Hydrogen and Fuel Cell Safety Report**, a monthly electronic publication that provides information about developing hydrogen and fuel cell codes and standards and related safety information.





Case Study

The Bay Area Air Quality Management District provides an example of some of the actions that air districts may be working on in your region. Learn more about the district's efforts to help the **Bay Area get PEV ready.**

Growing the Zero-Emission Vehicle Market in Local Communities

Snapshot: Local governments should inform residents and businesses about zero-emission vehicles, charging and fueling infrastructure and actions under way in the community to become ZEV ready. Key, high-level messages can highlight ZEV availability and benefits such as lower total cost of ownership, issues related to the environment and health, and can leverage state and national outreach campaigns. The primary focus, however, should emphasize community-specific ZEV activities and information such as local ZEV policies.

Background: This section of the Guidebook contains chapters on partnering with community stakeholders, engaging with the public and businesses, installing ZEV signage, greening public and private vehicle fleets and ZEV support opportunities. Incentives already exist at the national and state level to encourage ZEV adoption, and additional local incentives can be created with little cost.

Each chapter in this section provides guidance and tools that will help ensure ZEV readiness goals are understood and supported by all stakeholders in the community and that those in a position to make the change to ZEV technology are fully aware of local ZEV-related benefits and opportunities.



Partnering with Community Stakeholders

Snapshot: Creating partnerships with local associations and community stakeholders, such as business or environmental groups, provides an opportunity to leverage existing private and nonprofit expertise and experience in government planning and outreach for zero-emission vehicle readiness.

Background: Local associations and community stakeholders are key allies in ZEV adoption because of the information and expertise they can provide. For example, they can educate businesses and consumers about ZEV benefits, act as a common voice for the ZEV industry in the community or facilitate dialogue and plans among the various community stakeholders.

A number of regional PEV readiness plans have been developed that assess efforts in six areas of the state and are an excellent resource for more specific regional information (see Featured Resources). Local planning for ZEV readiness should tie in to these ongoing and future efforts.

One example of an effective partnership available to all California regions is the DOE-supported Electric Vehicle Infrastructure Training Program (EVITP), which has developed a training and certification curriculum. The program can conduct local community workshops for public officials for a nominal instructor fee; local governments can pool together support for a full-day regional workshop. For more information, contact Robert Meyer at the [California Employment Training Panel](#).



Case Study

- ▶ **The Business Council on Climate Change** is a partnership of 100+ San Francisco Bay Area businesses committed to reducing greenhouse gas emissions and has developed an [EV Guide for Business](#). Although aimed at Bay Area businesses, it contains useful information applicable statewide.
- ▶ **The Los Angeles Economic Development Corporation** created the E-Mobility Task Force with the mission of developing a comprehensive Los Angeles County EV deployment plan. They are working to increase plug-in EV adoption rates, collect vital data, maximize infrastructure design and effectiveness and foster and support the county's EV industry cluster.
- ▶ San Francisco-based public-private collaboration **Charge Across Town**, supported by a declaration from Mayor Ed Lee, successfully held its first annual EV Week in 2012. Electric vehicle manufacturers, EV charging equipment businesses, solar companies and community nonprofits participated in an expo that had more than 10,000 visitors each day, hosted over 400 ride-and-drives and garnered extensive media coverage.
- ▶ **Plug In Santa Barbara** is bringing electric vehicle charging stations to the Central Coast and making it easier to use EVs in Santa Barbara County. Supported by a group of cities, businesses and utilities, Plug In Santa Barbara is a one-stop resource for local plug-in electric car buyers, with information on all the new models, home charging, charging rates, government incentives, permitting requirements and the benefits of connecting solar electric systems into charging facilities.

Several organizations throughout the state may be helpful during the ZEV planning process. Following is a partial list of local, regional and statewide organizations to consider involving in community planning or training.

- ▶ **Plug in America** (nationwide)
- ▶ **EV Project** (nationwide)
- ▶ **Electric Vehicle Infrastructure Training Program** (nationwide)
- ▶ **California Fuel Cell Partnership** (statewide)
- ▶ **California Plug-in Electric Vehicle Collaborative** (statewide)
- ▶ **CALSTART** (statewide)
- ▶ **The Business Council on Climate Change** (Bay Area)
- ▶ **Los Angeles Economic Development Corporation “e-Mobility task force”** (Los Angeles)
- ▶ **SoCal EV** (Southern California)
- ▶ **California Center for Sustainable Energy** (Statewide emphasis)
- ▶ **Department of Energy’s Clean Cities Program**
 - **San Diego Region**
 - **Coachella Valley**
 - **Western Riverside**
 - **Long Beach**
 - **Southern California Association of Governments**
 - **Los Angeles**
 - **Antelope Valley**
 - **Central Coast**
 - **San Joaquin Valley**
 - **Silicon Valley**
 - **San Francisco**
 - **East Bay**
 - **Sacramento**

Recommended Actions:

- ▶ **Create partnerships with local associations and stakeholders** to further ZEV readiness in local communities.
 - If an appropriate organization does not currently exist, consider creating one.
- ▶ **Establish training programs for local officials and EVSE installers.** The training program can include utilities, automakers and other relevant stakeholders.
- ▶ **Work with the regional readiness plans** that have been or are being developed with funding from the Department of Energy or California Energy Commission (see Featured Resources).
- ▶ **Contact the local Metropolitan Planning Organization and Air Quality Management District to learn more** about the ZEV work happening in local regions and any potential resources that may be available.
 - Air districts are county or regional governing authorities that have primary responsibility for controlling air pollution from stationary sources. Get **regional contact info and a statewide overview**.
 - Metropolitan planning organizations are responsible for regional transportation planning. Find the appropriate **regional contact**.

Featured Resources: Regional Readiness Plans. The California Plug-In Electric Vehicle Collaborative has published regional PEV readiness plans that are part of the Plug-In Electric Vehicle Readiness Project supporting regional planning and infrastructure development. For more information, view the [Regional Readiness Plans](#).

- ▶ San Francisco Bay Area and Monterey Area
- ▶ Central Coast
- ▶ Southern California
- ▶ Sacramento
- ▶ San Diego
- ▶ San Joaquin Valley

The California Energy Commission has provided grants to continue regional planning for these six regions plus three others:

- ▶ North Coast
- ▶ Coachella Valley
- ▶ Northern Inland Region (upstate)

Free PEV Charging

State and local governments, employers and businesses may choose to offer free PEV charging as one of the ways to incentivize PEV driving. Here are some considerations to address if offering free charging.

- ▶ **Private Businesses:** Providing free charging to employees has raised questions about whether it is a reportable benefit. The IRS has not included any express language concerning the consequences of providing free charging for employees in the tax code. For more information, view [IRS Publication 15-B](#) regarding tax code/fringe benefits for transportation. Private businesses should check in with the IRS about offering free charging.
- ▶ **Private Organizations:** For private organizations that give free electricity to customers, this is simply a perk of shopping at their store and no further action is needed.
- ▶ **State Agencies:** There are state rules and labor contracts restricting some agencies to offer free charging. However, other departments can offer free charging.
- ▶ **Local Government:** The California Constitution prohibits local government from gifting public funds or gratuitously providing anything of value to any individual, municipality or corporation. However, local governments may appropriate public funds for any public purpose without violating the provision against gifts. There is no additional, outright restriction on local governments offering free charging; they must simply determine that it benefits a public purpose.

Free charging is one of many options to encourage the use of PEVs, but the choice to offer free charging should be determined by local policy decisions and budgets.



More Info

The California Air Resources Board has a **“Drive Clean” Buying Guide**. This site contains a full listing of existing federal, state and local incentives available to ZEV purchasers, sortable by region, technology and incentive type. Note that tax credits associated with EVSE are also listed. This research can be shared with community residents who are interested in purchasing a ZEV.

Zero-Emission Vehicle Incentives and Outreach

Snapshot: While local governments can offer incentives, policies and support for zero-emission vehicle adoption, these will ultimately have little effect if consumers and ZEV infrastructure operators are unaware of the benefits. The creation of ZEV incentives, such as free parking, and direct engagement with residents and local businesses about ZEVs and ZEV incentives are equally important for ZEV readiness.

Background:

► Incentives

- **Federal and State Incentives:** Both California and the federal government offer significant financial incentives to ZEV owners and infrastructure operators, such as grants and tax credits, as well as nonmonetary incentives such as HOV lane access. Ensuring the public is aware of these benefits should be the first level of outreach.
- **Local Incentives:** In addition to state and federal incentives, there are several local government incentives offering residents and businesses help with outreach and encouraging ZEV adoption. While some include financial benefits, such as providing free charging at public charging stations, most do not involve significant costs.

► Communication

- **Local Residents:** Residents will need information on what types of charging equipment are available. For PEVs, residents will need to know how to have charging equipment installed in their homes, how to find local contractors trained and certified to install charging infrastructure and how to contact their local electric utility to address service and rate program upgrades. Residents also will want to know where to find regional public charging infrastructure and whether there are local incentives for vehicles or charging equipment. For FCEVs, residents will need to know where fueling stations are available.
- **Local Businesses and Dealers:** Employers and retail outlets in the community will need information on what to consider when deciding whether to install charging or hydrogen fueling infrastructure. Guides such as the Bay Area Business Council’s **Electrify Your Business** provide information about statewide policies and information. It is also helpful to have specific local information available, such as employers or employer associations that have implemented ZEV readiness measures or a list of local dealer contacts, infrastructure vendors and installers.

Recommended Actions:

- **Provide Charging and Parking Incentives for ZEVs:** Local agencies should consider adopting policies and ordinances that promote installation of charging and fueling infrastructure and parking incentives for ZEVs. Some options include:
 - Offering free parking for ZEVs in metered spaces or paid parking lots
 - Designating reserved parking for ZEVs in preferential locations
 - Reducing parking requirements for developers or businesses when significant EVSE are installed and/or ZEV car-sharing agreements are implemented for PEVs
 - Offering free public charging for PEVs when appropriate

- ◉ **Recognition for Businesses Offering ZEV Benefits:** Programs that recognize businesses in the form of a public award or by allowing them to advertise a “ZEV-friendly” label can be a good, low-cost incentive for local businesses and organizations to install infrastructure or implement policies.
- ◉ **Articulate Incentives and Outreach:**
 - Create a “one-stop shop” online tool, possibly through a city or county website, with links to state and national campaigns as well as unique local content.
 - Send DriveClean staff information about local incentives so that they can be included in their comprehensive incentives database. Email Ichilada@arb.ca.gov with details.
 - Distribute information through other formats such as local print and electronic media, social networks, over-the-counter handouts at city hall and at local restaurants, retail establishments and auto dealers, public signage and other local distribution.
 - Coordinate ride-and-drive events with local ZEV dealers or manufacturers at public events or large employers’ workplaces to familiarize consumers with ZEV technology, and use these forums to present information about incentives.
 - Coordinate with local utilities to provide information about any preferential rates or pricing they may offer to PEV owners, such as time-of-use rates, and about expected electricity costs for transportation as they may compare to gasoline.
- ◉ **Encourage Development of Community Plans and Collaboration between Neighboring Communities:** Ensure that charging and hydrogen stations are installed in maximally useful locations, that all electrical load requirements are met for PEVs and that overall ZEV readiness planning happens with a coordinated approach.

Featured Resources:

- ◉ **Plug-in Electric Vehicle Communication Guides:** The Plug-In Electric Vehicle Collaborative developed eight guides with information on California-specific topics, such as the benefits of driving PEVs, fuel costs and currently available vehicles.
- ◉ **Fuel Cell Electric Vehicle Benefits:** The California Fuel Cell Partnership’s website explains the benefits of FCEVs and the issues of air pollution, global warming and petroleum dependence.



Zero-Emission Vehicle Signs and Pavement Markings

Snapshot: Signs and pavement markings are important elements of zero-emission vehicle infrastructure, serving to inform ZEV drivers of available charging and fueling services and to help enforce ZEV-related rules and laws. Signs also help increase ZEV market visibility, which can help to grow adoption in local communities. Throughout the state, ZEV signs and markings must be uniform and consistent in their appearance and placement, allowing them to be clearly recognizable to motorists. This section summarizes current standards, guidance and options for signage and street markings under state regulations. It also outlines the steps required to install ZEV-related signage and pavement markings.

Background: Although many ZEV drivers use smartphones or computers to locate charging and fueling stations, finding them can often be challenging. It will continue to be important to have adequate and consistent signage. Moreover, drivers are accustomed to having street signage that indicates where gas stations are located, so the same information should be provided for ZEV charging and fueling. Well-placed, visible signs can safely direct a driver to a station better than a mobile device, keeping the driver's eyes on the road, reducing distractions and potentially collisions, while increasing the visibility of the ZEV industry. Proper signage also raises awareness and confidence in the availability of PEV charging and hydrogen refueling stations.

The California Department of Transportation (Caltrans) has issued comprehensive standards for ZEV signage in its **Traffic Operations Policy Directive 13-01**, released in March 2013. The directive incorporates new ZEV-related signs and pavement markings into the California Manual on Uniform Traffic Control Devices (MUTCD), which ensures uniformity and consistency in signs, markings and signals. The California MUTCD provides standards (mandatory or specifically prohibited practices), guidance (recommended practices) and options (permissive practices) that may modify standards or guidance. State law and federal regulations require signs, markings and signals placed on California's public roadways to comply with the requirements of the MUTCD. Devices or signs installed on private roadways and parking also should be consistent with the MUTCD to be enforceable.³ While the California MUTCD exists to ensure signage consistency throughout the state, it allows for some local flexibility in the placement and usage of signs.

³ 23 CFR 655.603, and California Vehicle Code, Section 21401

General Service Signs and Plaques



G66-22G
G66-22H



G66-21C (CA)
G66-21B (CA)



G66-21C (CA)
G66-21 (CA)

Information about these signs can be found in Figure 2I-1(CA), Table 2I-1(CA) and Section 2I.01 of the CA MUTCD.

General Service Supplemental Plaques



G66-21A(CA)



M5-1



M5-2



M6-1



M6-2



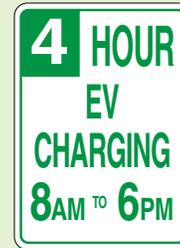
M6-3

Information about these signs can be found in Figure 2I-1 and 2I-1(CA), Tables 2D-1(CA) and 2I-1(CA); and Section 2I.02 of the CA MUTCD.

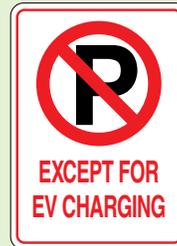
Parking Signs



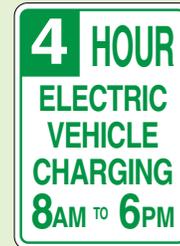
R113A(CA)



R114(CA)



R113(CA)



R114A(CA)



R112(CA)

Guidance on these signs can be found in Figure 2B-24(CA), Table 2B-1(CA) and section 2B.46 of the CA MUTCD.

"HOV" Highway Signs



R86-4(CA)
R93A(CA)



These signs can be found in Figure 2G-1(CA) of the CA MUTCD.

Optional Off-street Pavement Markings



Information about these pavement markings can be found in Figure 3B-108(CA) and Section 3B.20 of the CA MUTCD.



Case Study

The City of Santa Monica has adopted a local ordinance allowing for the designation of PEV-only parking: “The Director of Planning and Community Development, or his or her designee, is authorized to designate parking spaces or stalls in an off-street parking facility owned and operated by the City of Santa Monica or the Parking Authority of the City of Santa Monica for the exclusive purpose of charging and parking a vehicle that is connected for electric charging purposes.” (Santa Monica Municipal Code, Ordinance 2403, Section 29 2012)

Guidance Signs for ZEV Fueling and Charging: Roadway signs that guide ZEV drivers to refueling and charging stations are known as “general service” signs under state regulations. General service ZEV signs consist of:

- ▶ Highway signs to indicate that ZEV charging or fueling service is available at a given highway exit or turnoff
- ▶ Where necessary, follow-up signage to direct the driver to a charging or fueling station

Placement of these guidance signs on highways and local streets improves safety and convenience for ZEV drivers. For a general service sign to be added onto a state highway, the charging and fueling station must be available for use at least 16 hours per day. General service signs for ZEVs set forth in California MUTCD can be used on both highways and surface streets. These signs help increase awareness of ZEVs as a transportation option in California.

Plug-In Electric Vehicles No Parking and Charging Signs: On-site PEV charging signage has two purposes. The first is informational, to indicate clearly and quickly where the station is located. The second purpose is regulatory in nature and helps to keep non-PEVs from using the location. Even though on-street and off-street public parking can be controlled by local jurisdictions, signage that indicates rules that govern a charging space must be supported by appropriate local ordinances, per California Vehicle Code (CVC) 22511. In order for a tow-away sign to be enforceable, the tow-away warning sign (R112[CA]) must either be placed immediately adjacent to and visible from a PEV charging equipment space or at the entrance to the off-street parking lot containing the stations. If placed at the entrance to the lot, the tow-away sign should be collocated with a way-finding sign such as G66-21B(CA) in order to alert drivers that the lot contains electric vehicle supply equipment.

High Occupancy Vehicles (HOV) Signs: Federal and state laws allow drivers of qualified ZEVs to use HOV-designated lanes that are typically limited to vehicles with multiple passengers.⁴ This benefit is provided, in part, because like carpooling, driving a ZEV reduces transportation-related criteria pollutants and greenhouse gas emissions. California’s Department of Motor Vehicles (DMV) issues **vehicle decals** to **qualified vehicles** to administer this benefit. Vehicles displaying this “clean air decal” may travel in any HOV lane, regardless of vehicle occupancy. Although a regulatory sign exists to inform ZEV drivers of this permission, the presence of the sign is not required in order for a decal vehicle to drive in the HOV lane. Caltrans is the responsible agency for the designation, signage and maintenance of HOV lanes on state highways. However, local authorities have responsibility with regard to county highways and should ensure that HOV lanes display signs indicating ZEVs are authorized to use these lanes.

⁴ CVC 21655.9, 23 U.S.C. 166(b)(5)

Recommended Actions: The recommended actions in this section refer to signs by the titles as listed in the ZEV Signage Policy Directive. In order to understand which sign is referred to, also view the images of the signs included in this chapter.

► **Installing ZEV Fueling and Charging Highway and Local Guidance Signs**

- Identify publicly available charging and refueling stations within three miles of a state highway. Note that only stations available at least 16 hours per day can be featured on signage placed on state highways. Local guide signs not on state highways can be placed for charging and fueling stations regardless of this specific requirement. Further guidance on placing signage is contained in Section 2I.03 of the California MUTCD.
 - Contact the **regional Caltrans district** to request highway sign(s).
 - Prior to the actual placement of a highway guide sign on a state or county highway by Caltrans, local follow-up (also known as “trailblazer”) guide signs must be in place off the highway to direct traffic to the refueling or charging station. This requirement ensures that drivers can find the station indicated on the highway sign.⁵
 - California counties follow Section 21.03 of the CA MUTCD when installing guide signs. If interested in having a guide sign installed on a county roadway, contact the county planning agency. Contact information for all county planning agencies is provided in OPR’s **Directory of California Planning Agencies**.
 - If PEV charging equipment is capable of charging at least 20 kWh in a 30-minute period, the “FAST” header plaque may be placed above the sign.⁶
- Install follow-up off-highway signs (if necessary) as follows.
 - Follow-up signs are necessary if the fueling or charging equipment is not easily visible from the state highway or if additional turns on local roadways are required to reach the station after turning off the state highway.
 - To indicate the direction to a refueling station from an intersection, use a G66-(CA) series sign in combination with one of the M5 or M6 series signs below it, following the guidance of sections 2D.26, 2D.28 and 2I.02 of the CA MUTCD.
 - Procure signs from preferred vendor and install, using existing signposts where possible (see CA MUTCD Tables 2I-1 and 2I-1[CA] and Policy Directive 13-01 for sign sizes and specifications).

► **Installing Plug-In Electric Vehicles No Parking and Charging Signs**

- Adopt or modify local parking ordinances to designate rules for EV charging spaces. Use of a broad ordinance that permits latitude by public officials in the designation of EV-only parking is recommended. Model ordinances are available in the Practical Tools and Templates section of this Guidebook beginning on page 93.

⁵ CA MUTCD 2I.03, para. 31, 44

⁶ CA MUTCD 2I.03, para. 45b, “A Fast Electric Vehicle Charging equipment is where the rate of battery electric charging is at least 20 kWh in a 30-minute period. Fast charging stations include direct current (DC) fast charging”

- Identify required signage for designated EV charging spaces, including the number of needed signs and their locations.
- Procure signs from a preferred vendor and install. For a recommended list of sign vendors, contact the [regional Caltrans district](#).

▶ **Installing High Occupancy Vehicles (HOV) Signs**

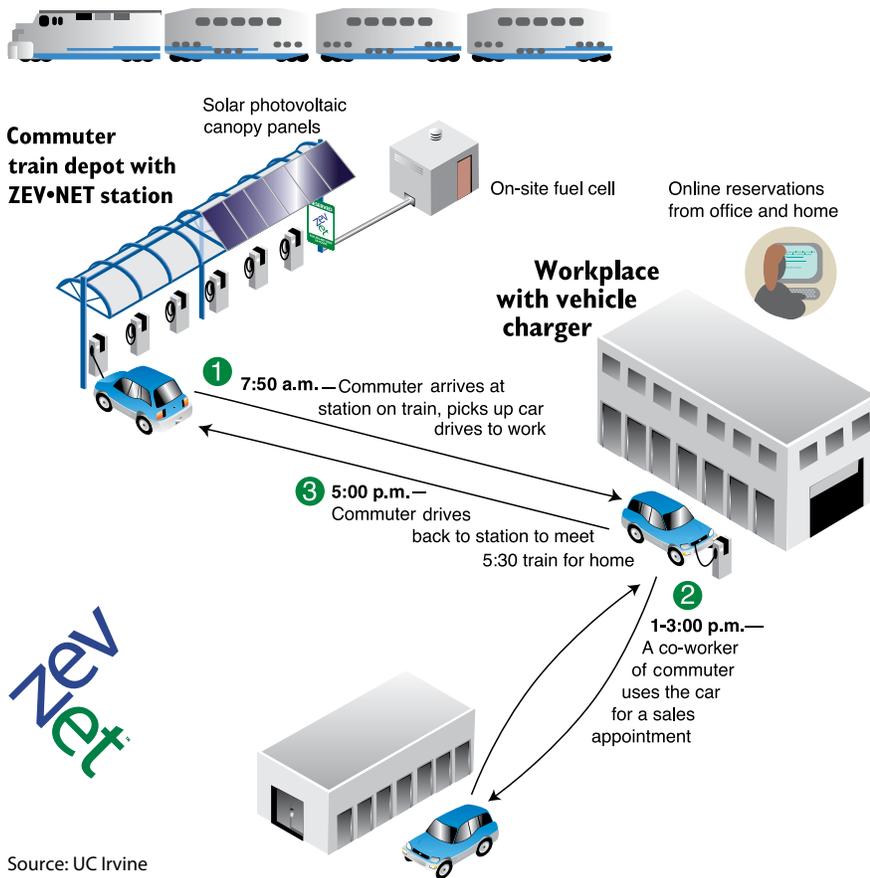
- If a local area includes an HOV lane, verify if adequate signage exists that indicates that qualified ZEVs can use the HOV lane. If it appears that signage is needed and the HOV lane is on a state highway, contact the [regional Caltrans district](#) and request that signage be installed.
- If the HOV lane is on a county roadway and signage is needed to indicate use of HOV lanes by qualified ZEVs, identify all occurrences of sign R86-4(CA), then procure and place sign R93A(CA) directly below each occurrence.

Featured Resources:

- ▶ **Zero-Emission Vehicle Signs and Pavement Markings Policy Directive:** Caltrans issued Policy Directive 13-01, which lists all approved ZEV signs and pavement markings in the state.
- ▶ **California Manual on Uniform Traffic Control Devices (MUTCD):** The MUTCD provides requirements and guidance for the design, use and placement of all signs and road markings on California’s roadways.



Diagram of ZEV-NET Program



Source: UC Irvine



ZEV fleet at UC Irvine

Case Study

UC Irvine's Advanced Power and Energy Program operates two innovative fleet initiatives: a fleet of 17 hydrogen fuel cell vehicles that it leases to companies and a fleet of PEVs called **ZEV-NET** that enables more commuters to take the train to work by providing convenient transportation between the train station, home and office. ZEV-NET also allows multiple users to share a single car with an intelligent web-based reservation system.

Greening Fleets with Zero-Emission Vehicles

Snapshot: While zero-emission vehicle infrastructure is essential, the most critical aspect of the ZEV transition is vehicle adoption itself. Local governments and businesses that operate their own vehicle fleets have an opportunity to help lead this adoption. Greening public and private fleets with PEVs and FCEVs can be a key part of getting residents interested in ZEVs, becoming ZEV ready and providing employees invaluable hands-on experience with the benefits and challenges of making the ZEV transition.

Background: Public and commercial fleets that include medium- and heavy-duty trucks are responsible for a disproportionate share of greenhouse gas emissions and fossil fuel use. Accordingly, greening a fleet is a high-priority for fleet operators in response to California state regulatory mandates and steeply rising gasoline and diesel fuel costs. At the regulatory level, fleet operators are being pressed to reduce both “Category 1” pollutants directly harmful to human health and “Category 2” pollutants — greenhouse gases — that are causing disruptive changes in the climate system. Historically, “clean fleet” or “green fleet” efforts have focused on fuel economy improvements and partial emissions reductions, using technologies such as conventional hybrid vehicles and natural gas vehicles.



While ZEVs are one logical focus for green fleet programs, the structure of green fleet initiatives can best be stated in terms of overarching goals, rather than the specific technology choices deployed to achieve those goals. Thus, green fleet programs are typically focused on:

- ▶ Enhancing fleet impact on human health and the environment
- ▶ Reducing costs
- ▶ Preparing for future conditions (including potential fuel price spikes or supply disruptions) and regulatory requirements

What distinguishes green fleet initiatives in the era of electrified transportation, however, is that new ZEV models are available with significantly improved environmental and operating cost advantages over conventional hybrids and other alternative fuel vehicles. Given the increased diversity of available ZEVs and their steadily improving price/performance profile relative to conventional vehicles, green fleet programs are focused increasingly on accelerated integration of ZEVs into the fleet mix.

Furthermore, it is important to emphasize that battery-electric vehicles, plug-in hybrid electric vehicles and fuel cell electric vehicles are available in most classes of vehicles, including many specialty vehicles, such as bucket trucks, shuttle buses, airport equipment, off-road “Class 8” port operations (drayage vehicles) and others.

While the initial purchase price of ZEV fleet vehicles may be higher than comparably equipped conventional vehicles, significant tax credits and rebates exist that can offset the increase. In addition, ZEV buyers typically enjoy lower fuel costs, insulation from fossil fuel price shocks and significantly lower maintenance costs. These advantages are leading many fleet managers to embrace ZEVs as a core element in their green fleet plans.

One barrier to the purchase of ZEVs by public agencies is that local governments, having no tax liability, do not benefit from the state and federal tax credits associated with ZEV purchases. However, most lenders such as the Nissan Motor Acceptance Corporation and Ford Financing offer capital-leasing options, also referred to as municipal lease financing. Such arrangements are mutually beneficial and allow the leaser to take advantage of available tax credits that they may then pass on to public agencies as a reduction in cost.



Case Study

The Bay Area Climate Collaborative worked with four San Francisco Bay Area governments to deploy 50 PEVs for local government fleets — representing one of the largest single municipal fleet deployments of light-duty, all-electric vehicles in the nation. The vehicles were secured under highly favorable lease terms, removing the up-front cost barrier and risk of traditional vehicle procurement. These unique lease options are allowing participating municipalities to expand on their already progressive sustainability efforts, while delivering significant operations, maintenance and fuel cost savings. The City of San Jose, which received 38 vehicles, is aiming to power 100 percent of its fleet with alternative fuel vehicles by 2022 as a part of its Green Vision. This deployment also is enabling smaller municipalities to demonstrate the benefits of EVs in fleets and emerge as sustainability leaders. “The Town of Los Gatos is pleased to participate in this initiative to add electric vehicles to the fleet, which lowers our carbon footprint in keeping with our Sustainability Plan,” said Los Gatos Mayor Barbara Spector. [Learn more.](#)

Local governments are also eligible to purchase vehicles using the California Department of General Services' (DGS) state procurement contracts. These include contracts for a variety of alternative fuel vehicles, including some ZEVs, at negotiated prices. While the state makes this contract available to local governmental agencies, each of these agencies should determine whether this contract is consistent with its procurement policies and regulations. More information, including specific instructions on how to take advantage of this and contact information for the appropriate DGS contract manager, is on the [DGS website](#).

Recommended Actions:

- ▶ **Develop a ZEV Fleet Planning Initiative:** To work through the specifics of ZEV fleet greening efforts, a typical planning effort involves these elements:
 - Developing a greenhouse gas emissions inventory (baseline)
 - Establishing greenhouse gas emission and fuel efficiency targets
 - Analyzing fleet duty cycles and comparing to available ZEVs with regard to range, refueling requirements and operating costs
 - Developing a comprehensive green fleet plan that includes goals, milestones, staff responsibilities, commitments from top management, and monitoring and implementation strategies
- ▶ **Consider all Available Financing and Purchase Tools:** Ensure that all available pricing incentives, purchase contracts and financing options are considered when assessing ZEV fleet purchases.
- ▶ **Resource Allocation:** Developing a green fleet may require a reconsideration of how capital and operating expenditures are allocated. With fueling costs that are much lower than internal combustion engines and initial ZEV purchase prices that may be higher, many fleet managers have pointed out that much or all of the battery expense may need to be reconfigured as an operating expense and taken out of the fuel budget.
- ▶ **Consider Total Cost of Ownership when Evaluating ZEV Purchases:** This incorporates the resale value of the vehicle into the cost comparisons and can make a ZEV purchase much more cost effective, as these vehicles are expected to retain greater residual value upon resale than their petroleum-fueled counterparts. While the recent ZEV surge is too new to have established long-term residual value studies based upon actual resales, ZEV's are expected to retain greater value. This is well documented in hybrid vehicles.
- ▶ **Integrate Several "Value Streams" across the Organization:** When considering changes to fleet composition and operations, include an assessment of the value of related benefits such as environmental health and marketing/communications.
- ▶ **ZEV Expertise:** As with any commercial charging arrangements, fleet managers need to be cognizant of hydrogen fueling availability for FCEVs and demand charges and demand response programs, as well as utility time-of-use rates to select an optimum configuration for their PEV needs.
- ▶ **Fleet Charging and Management:** Fleet operators have the ability to manage charging status and charging information centrally using available management software. Several manufacturers currently have or plan to offer PEV fleet charging software with varying levels of sophistication.

- ◉ **Establish Incentives to Encourage Businesses to Green Their Fleets:** One example is local taxi companies: agencies responsible for taxi oversight are encouraged to develop a suite of incentives for companies that choose to buy and operate ZEVs. Taxi incentives can range from lowered permitting costs, inspection changes and preferred route and zone selections to airport and destination center access and staging area advantages such as “front-of-the-line passes.”

Featured Resource: Plug-In Electric Vehicle Handbook for Fleet Managers: The Department of Energy has a handbook about PEVs for fleet managers. It answers basic questions about different vehicle options and charging infrastructure.





Case Study

The **Rio Hondo College Alternative Fuel Program** is aimed at preparing the workforce for ZEV technology: “Alternative fuels and vehicles are here to stay and we better prepare to work on them. . . . The economic outlook for technicians in this area is excellent. All major fleets and vehicle manufacturers are looking for technicians with knowledge in the legal and safe operation and maintenance.” Similarly, Saddleback College in Mission Viejo offers an **alternative fuel technologies program** aimed at preparing technicians for a variety of reduced- and zero-emission vehicle technologies.

Economic Benefits of Zero-Emission Vehicle Readiness

Snapshot: The transition to zero-emission vehicles brings not only environmental benefits, but economic benefits as well. Workers with various educational and employment backgrounds are needed in the EV industry, from the scientists who conduct research in electric drive technology to automotive maintenance technicians who repair vehicles. In addition to creating new jobs and businesses, ZEV adoption in communities can also be leveraged to support existing businesses.

Background: Employment growth is expected in most occupations in the electric vehicle industry in the next few years, according to a study by the Center for Entrepreneurship and Technology at the University of California, Berkeley. Automotive and electrical training programs at community colleges or support for new businesses such as auto dealers or infrastructure retailers can be an effective way to grow these economic benefits in local communities.

Providing public retail PEV charging at businesses can be another way to capture additional economic benefits of local ZEV adoption. Using data collected through its **EV Project**, ECotality has found that on average, customers spend an additional 30 minutes shopping while charging their PEV. Businesses can use free or reduced-cost charging to attract additional customers and can help lead the way for community ZEV readiness.

Recommended Actions:

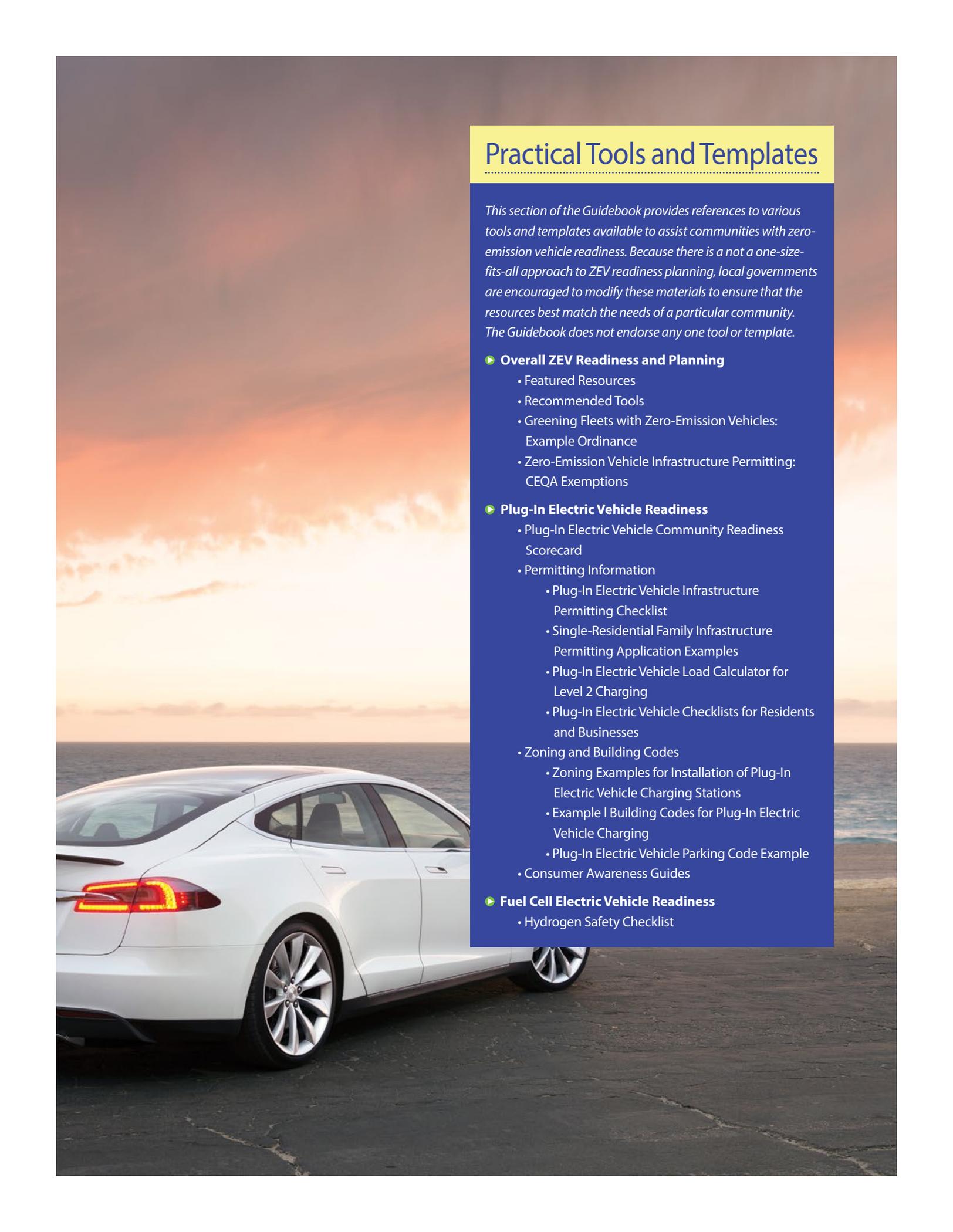
- ▶ **Identify local ZEV-related technical training programs** and ensure they are supported and publicized. If one does not exist, consider creating one.
- ▶ **Encourage retail businesses and restaurants to provide retail charging for PEVs.**
- ▶ **Ensure that new ZEV-related businesses in the community are effectively “plugged in”** to existing ZEV organizations and are supported by policies and processes.

Featured Resource: Careers in Electric Vehicles: The Bureau of Labor Statistics has prepared a report that provides information on the relevant career fields in the production and maintenance of electric vehicles, including hybrids, plug-in hybrids and battery electric vehicles, as well as the economic outlook for these fields.



More Info

The **Electric Vehicle Infrastructure Training Program** (EVITP) provides training and certification for electricians installing EV supply equipment. A voluntary nonprofit collaboration of electrical industry organizations, EVITP supports developing electric vehicle (EV) charging infrastructure for residential and commercial markets. The EVITP offers training around the country at community colleges and electrical training centers. Training is open to licensed electricians in compliance with requirements of state or municipal jurisdictions.

A white sedan is parked on a beach at sunset. The car is viewed from the rear passenger side, showing its taillight and rear wheel. The background features a calm ocean and a sky with soft, orange and yellow clouds from the setting sun.

Practical Tools and Templates

This section of the Guidebook provides references to various tools and templates available to assist communities with zero-emission vehicle readiness. Because there is not a one-size-fits-all approach to ZEV readiness planning, local governments are encouraged to modify these materials to ensure that the resources best match the needs of a particular community. The Guidebook does not endorse any one tool or template.

► Overall ZEV Readiness and Planning

- Featured Resources
- Recommended Tools
- Greening Fleets with Zero-Emission Vehicles: Example Ordinance
- Zero-Emission Vehicle Infrastructure Permitting: CEQA Exemptions

► Plug-In Electric Vehicle Readiness

- Plug-In Electric Vehicle Community Readiness Scorecard
- Permitting Information
 - Plug-In Electric Vehicle Infrastructure Permitting Checklist
 - Single-Residential Family Infrastructure Permitting Application Examples
 - Plug-In Electric Vehicle Load Calculator for Level 2 Charging
 - Plug-In Electric Vehicle Checklists for Residents and Businesses
- Zoning and Building Codes
 - Zoning Examples for Installation of Plug-In Electric Vehicle Charging Stations
 - Example I Building Codes for Plug-In Electric Vehicle Charging
 - Plug-In Electric Vehicle Parking Code Example
- Consumer Awareness Guides

► Fuel Cell Electric Vehicle Readiness

- Hydrogen Safety Checklist

Featured Resources

Snapshot: Each of the featured resources listed throughout the Guidebook are summarized.

▶ **Identifying PEV Infrastructure Needs in Community**

- **Statewide Plug-In Electric Vehicle Infrastructure Plan:** The California Energy Commission is developing a statewide Plug-In Electric Vehicle Infrastructure Plan that will provide helpful guidance to local governments about public infrastructure planning.

▶ **General Plans, Zoning and Building Codes for Plug-In Electric Vehicles**

- **California Green Building Standards Code:** The California Green Building Standard Code of Regulations (Title 24, Part 11), also known as the CALGreen Code, provides both mandatory requirements and voluntary measures. Currently, all measures in the code related to ZEVs are voluntary; however, municipalities can make them mandatory by adopting them through ordinance.
- **California Electrical Code:** Article 625 of the California Electrical Code (Title 24, Part 3) provides minimum mandatory requirements for the installation of electric vehicle charging systems. Jurisdictions may further amend these requirements under limited circumstances because of local climatic, geological or topographical conditions.

▶ **Plug-In Electric Vehicle Infrastructure Permitting**

• **Single-Family Residential Charging**

- **Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations:** The California Plug-In Electric Vehicle Collaborative created a report providing recommendations and references so that jurisdictions can create improved procedures for permitting and inspection of in their area.

• **Charging and Permitting in Multi-Unit Dwellings**

- **Multi-Unit Dwelling EV Guidelines:** The California Plug-In Electric Vehicle Collaborative is working on a multi-unit dwelling guideline. The publication will include information about multi-unit dwelling charging installations and case studies. To check on its completion, visit [PEV Resource Center](#).

• **Workplace Charging**

- **Workplace Charging Case Studies:** The California Plug-In Electric Vehicle Collaborative is creating a workplace charging case studies publication and charging decision-making guides, as well as a best practices document with [CALSTART](#). To check on their completion, visit [PEV Resource Center](#).

• **Retail and Public Sector Charging**

- **Plug-In Electric Vehicle Handbook for Public Charging Station Hosts:** The Department of Energy provides a handbook about plug-in electric vehicles for public charging station hosts. It is mainly for site hosts who are considering a charging station, but it also has helpful information for local governments to share with site hosts.

▶ **Working with Utilities for Plug-In Electric Vehicle Readiness**

- All major California utilities have plug-in electric vehicle (PEV) infrastructure programs. The scope may vary by utility provider, but generally, they include working with city officials to develop residential electric vehicle supply equipment (EVSE) procedures, planning for local infrastructure enhancements,

providing time-of-use rates and meter options and working in partnerships to demonstrate public infrastructure programs. These programs include:

- [California Municipal Utilities Association \(CMUA\)](#)
- [Los Angeles' Department of Water and Power \(LADWP\)](#)
- [Pacific Gas & Electric Company](#)
- [Sacramento Municipal Utility District \(SMUD\)](#)
- [San Diego Gas & Electric](#)
- [Southern California Edison](#)
- [Plug-In Electric Vehicle \(PEV\) Resource Center](#)

▶ **Plug-In Electric Vehicle Infrastructure and Equipment Accessibility**

- [Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices](#) (DRAFT): The Governor's Office of Planning and Research has developed draft guidelines that recommend accessibility standards and design guidelines for PEV charging stations. When completed, a final version will be included in the Guidebook.

▶ **Identifying Fuel Cell Electric Vehicle Infrastructure Needs in Communities**

- [A California Road Map: Bringing Hydrogen Fuel Cell Vehicles to the Golden State](#): The California Fuel Cell Partnership's report describes the infrastructure needed to successfully launch the commercial FCEV market.

▶ **Characteristics of Hydrogen as a Fuel**

- [Hydrogen Safety Fact Sheet](#): The Fuel Cell and Hydrogen Energy Association's fact sheet describes the safety of hydrogen and compares its properties to other gases and fuels.

▶ **Partnering with Community Stakeholders**

- The California Plug-In Electric Vehicle Collaborative has published regional PEV readiness plans that are part of the Plug-In Electric Vehicle Readiness Project supporting regional planning and infrastructure development. For more information, view the six regional plans listed or visit [Regional Readiness Plans](#).
 - [Bay Area and Monterey Bay Area](#)
 - [Central Coast](#)
 - [Los Angeles \(South Coast\)](#)
 - [Sacramento](#)
 - [San Diego](#)
 - [San Joaquin Valley](#)
- The California Energy Commission has provided grants to continue regional planning for these six regions plus three others:
 - North Coast
 - Coachella Valley
 - Northern Inland Region

▶ **Zero-Emission Vehicle Incentives and Outreach**

- [Plug-in Electric Vehicle Communication Guides](#): The Plug-In Electric Vehicle Collaborative developed eight guides with information on California-specific topics, such as the benefits of driving PEVs, fuel costs and currently available vehicles.
- [Fuel Cell Electric Vehicle Benefits](#): The California Fuel Cell Partnership's website

explains the benefits of FCEVs and the issues of air pollution, global warming and petroleum dependence.

◉ **Zero-Emission Vehicle Signs and Pavement Markings**

• **Zero-Emission Vehicle Signs and Pavement Markings Policy Directive:**

Caltrans issued Policy Directive 13-01, which lists all approved ZEV signs and pavement markings in the state.

• **California Manual on Uniform Traffic Control Devices:** The MUTCD provides requirements and guidance for the design, use and placement of all signs and road markings on California's roadways.

◉ **Greening Fleets with Zero-Emission Vehicles**

• **Plug-In Electric Vehicle Handbook for Fleet Managers:** The Department of Energy has a handbook about PEVs for fleet managers. It answers basic questions about different vehicle options and charging infrastructure.

◉ **Economic Benefits of Zero-Emission Vehicle Readiness**

• **Careers in Electric Vehicles:** The Bureau of Labor Statistics has prepared a report that provides information on the relevant career fields in the production and maintenance of electric vehicles, including hybrids, plug-in hybrids and battery electric vehicles, as well as the economic outlook for these fields.





Recommended Tools

Snapshot: There are various useful tools to help local governments with zero-emission vehicle readiness. Because many of these tools operate best when used online, a listing is provided in this section rather than the materials themselves. Additional tools and resources are listed in the Resources section of the Appendix.

Tools

California Plug-In Electric Vehicle Collaborative Resources: Provides an overview of ongoing PEV work in California.

California Fuel Cell Partnership Resources: Provides FCEV toolkits for community members, station operators, municipalities and legislators.

DriveClean.ca.gov: Community residents can use this buying guide to learn about the cleanest, most efficient cars on the market.

Zero-Emission Vehicle Incentives: Find rebates, discounts, tax breaks and other incentives available for ZEV purchases, searchable by ZIP code.

GoElectric Drive Resources: Includes helpful resources for first responders, electricians and others.

Alternative Fueling Station Locator: Use this tool on smartphones to locate alternative fueling stations and get maps and driving directions.

eGallon Calculator: Allows consumers to compare the cost of fueling an electrical vehicle compared to a gasoline vehicle based on average electricity and gasoline costs.

Vehicle Cost Calculator: This tool uses basic information about driving habits to calculate total cost of ownership and total emissions for makes and models of most alternative fuel and advanced technology vehicles and allows you to compare them to gasoline vehicles.

Petroleum Reduction Planning Tool: Helps fleet managers determine how to reduce petroleum consumption and greenhouse gas emissions by creating a comprehensive plan for their fleet using several savings methods.

Electric Vehicle Safety Training: A nationwide program to help firefighters and other first responders prepare for the growing number of electric and hybrid vehicles on the road.

Permitting Hydrogen Facilities: This Department of Energy hydrogen permitting website helps local permitting officials deal with proposed hydrogen fueling stations and other hydrogen projects.

Greening Fleets with Zero-Emission Vehicles: Example Ordinance

Snapshot: Local governments that operate their own vehicle fleets can help lead the adoption of zero-emission vehicles in their communities. One initial step to greening government fleets may include adopting a resolution expressing support of incorporating ZEVs into fleets. The following example is adopted from the Metropolitan Energy Center and Kansas City Regional Clean Cities Coalition **Electrify Heartland Plan**.

Model Resolution to Convert Fleet Vehicles to Zero-Emission Vehicles

Whereas, the _____ (community) has established a strategic goal of enhancing and promoting environmental sustainability;

Whereas, zero-emission vehicles are considered clean fuel alternatives compared to clean diesel technologies;

Whereas, current projections are that _____ (electricity/hydrogen) will be a less costly fuel than diesel well into the future;

Whereas, conversion to zero-emission vehicles will require renovations to the fueling and maintenance areas of the vehicle maintenance complex, but even considering the cost of these renovations, the conversion is projected to result in cost savings to _____ (community);

Whereas, the _____ (community governing body) has carefully considered the implications of converting the community fleet to _____ (electricity/hydrogen) from diesel; now therefore be it

Resolved, that the _____ (community governing body) hereby directs _____ (community) management:

1. To begin the design and construction projects necessary to convert the vehicle maintenance complex to support charging or fueling of zero-emission vehicles;
2. To begin the procurement process for securing _____ (electricity/hydrogen) services, including but not limited to, long-range contracts;
3. To encourage management to determine the feasibility and cost effectiveness of using (plug-in electric/fuel cell electric) technologies in all _____ (community) vehicles;
4. Unless otherwise instructed or approved by the _____ (governing body), all future vehicle purchases shall be alternative fuel and should leverage the new _____ (charging/hydrogen) infrastructure as much as feasible;
5. Pursue federal grants and innovative funding options to expedite the conversion and maximize benefits to _____ (community); and
6. Promote partnership opportunities with other community fleet operators in the region and explore the possibility of a regional alternative fuels policy.

In witness whereof,

I have set my hand and the seal of the authority this _____ (date).

Authorized signature

Authorized signature



Zero-Emission Vehicle Infrastructure Permitting: CEQA Exemptions

Snapshot: The California Environmental Quality Act (CEQA) generally requires state and local governments to inform decision-makers and the public about the potential environmental impacts of proposed projects and to reduce those impacts to the extent feasible. Commonly used CEQA exemptions for ZEV infrastructure planning are excerpted below from the **CEQA Statute and Guidelines**. If a notice of exemption is being filed with the California State Clearinghouse, the **Notice of Exemption Form** can be used. For more information, refer to the Plug-In Electric Vehicle Infrastructure Permitting section of the Guidebook on page 42.

CEQA Exemptions

15301. Existing Facilities

Class 1 consists of the operation, repair, maintenance, permitting, leasing, licensing or minor alteration of existing public or private structures, facilities, mechanical equipment or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination. The types of "existing facilities" itemized below are not intended to be all-inclusive of the types of projects which might fall within Class 1. The key consideration is whether the project involves negligible or no expansion of an existing use. Examples include but are not limited to:

- a. Interior or exterior alterations involving such things as interior partitions, plumbing and electrical conveyances
- b. Existing facilities of both investor and publicly owned utilities used to provide electric power, natural gas, sewerage or other public utility services
- c. Existing highways and streets, sidewalks, gutters, bicycle and pedestrian trails and similar facilities (this includes road grading for the purpose of public safety)
- d. Restoration or rehabilitation of deteriorated or damaged structures, facilities or mechanical equipment to meet current standards of public health and safety, unless it is determined that the damage was substantial and resulted from an environmental hazard such as earthquake, landslide or flood
- e. Additions to existing structures provided that the addition will not result in an increase of more than:
 1. 50 percent of the floor area of the structures before the addition, or 2,500 square feet, whichever is less or
 2. 10,000 square feet if
 - A. The project is in an area where all public services and facilities are available to allow for maximum development permissible in the General Plan
 - B. The area in which the project is located is not environmentally sensitive.
- f. Addition of safety or health protection devices for use during construction of or in conjunction with existing structures, facilities or mechanical equipment, or topographical features including navigational devices
- g. New copy on existing on and off-premise signs
- h. Maintenance of existing landscaping, native growth and water supply reservoirs (excluding the use of pesticides, as defined in Section 12753, Division 7, Chapter 2, Food and Agricultural Code)

- i. Maintenance of fish screens, fish ladders, wildlife habitat areas, artificial wildlife waterway devices, streamflows, springs and waterholes and stream channels (clearing of debris) to protect fish and wildlife resources
- j. Fish stocking by the California Department of Fish and Game
- k. Division of existing multiple-family or single-family residences into common-interest ownership and subdivision of existing commercial or industrial buildings, where no physical changes occur which are not otherwise exempt
- l. Demolition and removal of individual small structures listed in this subdivision:
 - 1. One single-family residence – In urbanized areas, up to three single-family residences may be demolished under this exemption
 - 2. A duplex or similar multifamily residential structure – In urbanized areas, this exemption applies to duplexes and similar structures where not more than six dwelling units will be demolished
 - 3. A store, motel, office, restaurant or similar small commercial structure if designed for an occupant load of 30 persons or less – In urbanized areas, the exemption also applies to the demolition of up to three such commercial buildings on sites zoned for such use
 - 4. Accessory (appurtenant) structures including garages, carports, patios, swimming pools and fences
- m. Minor repairs and alterations to existing dams and appurtenant structures under the supervision of the Department of Water Resources
- n. Conversion of a single-family residence to office use
- o. Installation, in an existing facility occupied by a medical waste generator, of a steam sterilization unit for the treatment of medical waste generated by that facility provided that the unit is installed and operated in accordance with the Medical Waste Management Act (Section 117600, et seq., of the Health and Safety Code) and accepts no offsite waste
- p. Use of a single-family residence as a small family day care home, as defined in Section 1596.78 of the Health and Safety Code

15303. New Construction or Conversion of Small Structures

Class 3 consists of construction and location of limited numbers of new, small facilities or structures; installation of small new equipment and facilities in small structures; and the conversion of existing small structures from one use to another where only minor modifications are made in the exterior of the structure. The numbers of structures described in this section are the maximum allowable on any legal parcel. Examples of this exemption include, but are not limited to:

- a. One single-family residence or a second dwelling unit in a residential zone – In urbanized areas, up to three single-family residences may be constructed or converted under this exemption
- b. A duplex or similar multifamily residential structure, totaling no more than four dwelling units – In urbanized areas, this exemption applies to apartments, duplexes and similar structures designed for not more than six dwelling units
- c. A store, motel, office, restaurant or similar structure not involving the use of significant amounts of hazardous substances and not exceeding 2500 square feet in floor area – In urbanized areas, the exemption also applies to up to four such commercial buildings not exceeding 10,000 square feet in floor area on sites zoned

for such use if not involving the use of significant amounts of hazardous substances where all necessary public services and facilities are available and the surrounding area is not environmentally sensitive

- d. Water main, sewage, electrical, gas and other utility extensions, including street improvements, of reasonable length to serve such construction
- e. Accessory (appurtenant) structures including garages, carports, patios, swimming pools and fences.
- f. An accessory steam sterilization unit for the treatment of medical waste at a facility occupied by a medical waste generator, provided that the unit is installed and operated in accordance with the Medical Waste Management Act (Section 117600, et seq., of the Health and Safety Code) and accepts no offsite waste

15304. Minor Alterations to Land

Class 4 consists of minor public or private alterations in the condition of land, water and/or vegetation that do not involve removal of healthy, mature, scenic trees except for forestry or agricultural purposes. Examples include, but are not limited to:

- a. Grading on land with a slope of less than 10 percent, except that grading shall not be exempt in a waterway, in any wetland, in an officially designated (by federal, state or local government action) scenic area or in officially mapped areas of severe geologic hazard such as an Alquist-Priolo Earthquake Fault Zone or within an official Seismic Hazard Zone, as delineated by the State Geologist
- b. New gardening or landscaping, including the replacement of existing conventional landscaping with water efficient or fire resistant landscaping
- c. Filling of earth into previously excavated land with material compatible with the natural features of the site
- d. Minor alterations in land, water and vegetation on existing officially designated wildlife management areas or fish production facilities which result in improvement of habitat for fish and wildlife resources or greater fish production
- e. Minor temporary use of land having negligible or no permanent effects on the environment, including carnivals, sales of Christmas trees, etc.
- f. Minor trenching and backfilling where the surface is restored
- g. Maintenance dredging where the spoil is deposited in a spoil area authorized by all applicable state and federal regulatory agencies
- h. The creation of bicycle lanes on existing rights-of-way
- i. Fuel management activities within 30 feet of structures to reduce the volume of flammable vegetation, provided that the activities will not result in the taking of endangered, rare or threatened plant or animal species or significant erosion and sedimentation of surface waters – This exemption shall apply to fuel management activities within 100 feet of a structure if the public agency having fire protection responsibility for the area has determined that 100 feet of fuel clearance is required due to extra hazardous fire conditions



Plug-In Electric Vehicle Community Readiness Scorecard

Snapshot: The Plug-In Electric Vehicle Community Readiness Scorecard, developed by the National Renewable Energy Laboratory, is an interactive online assessment tool that evaluates a community's PEV readiness, provides feedback about strengths and suggestions for ways to improve and records community readiness progress. Local governments can fill out the scorecard online to calculate the score and save results; however, creating a free online account is required to access the site. The scorecard questions are provided below to highlight the questions asked.

Electric Vehicle Supply Equipment (EVSE) Permitting and Inspection Process

1. In your area, what is the average time it takes for an electric vehicle supply equipment (EVSE) owner or site manager to complete the permitting, installation and if applicable, inspection process?

- a) Less than 1 day
- b) 1 to 2 days
- c) 2 days to 1 week
- d) > 1 week
- e) I don't know

2. What are the options for submitting an EVSE permitting application? Check all that apply.

- Online
- In person
- By telephone
- Snail mail
- I don't know

3. Indicate all the types of EVSE installation permit applications you have that are separate from general electrical work permit applications. Check all that apply.

- Residential
- Commercial/workplace
- Public
- Fast charger
- None
- I don't know

4. How is information describing the permitting process made available? Check all that apply.

- Online
- Telephone hotline
- Print publications
- Training sessions
- Other/not available
- I don't know

5. Is there an accessible, designated point of contact for questions about the electrical vehicle supply equipment (EVSE) permitting process?

- a) No
- b) Yes
- c) I don't know

6. What is the average fee for a *residential* electric vehicle supply equipment (EVSE) permit and inspection in your area? If your area charges a separate fee for these two services, add the two together.

- a) \$0-50
- b) \$51-100
- c) \$101-300
- d) \$301-500
- e) More than \$500
- f) I don't know

7. What is the average fee for a *commercial* electric vehicle supply equipment (EVSE) permit and inspection in your area? If your area charges a separate fee for these two services, add the two together.

- a) \$0-50
- b) \$51-100
- c) \$101-300
- d) \$301-500
- e) More than \$500
- f) I don't know

8. Are there electric vehicle supply equipment (EVSE) installer training or certification programs available for electricians in your area? If so, please enter the program name(s) in the notes section below.

- a) No
- b) Yes
- c) I don't know

9. Have permitting inspectors in your area been trained on the specifics of EVSE installations?

- a) No
- b) Yes
- c) I don't know

Laws, Initiatives and Financing

1. Does your area offer a tax incentive, grant or rebate to purchase highway-certified, plug-in electric vehicles? If yes, indicate the maximum amount allowable per vehicle.

- a) No
- b) Less than \$1000
- c) \$1001 to \$2000
- d) \$2001 to \$3000
- e) More than \$3000
- f) I don't know

2. Does your area have a tax incentive, grant or rebate for residential of public charging equipment? If yes, indicate the maximum allowable per installation.

- a) No
- b) Less than \$250
- c) \$251 to \$500
- d) \$501 to \$750
- e) More than \$750
- f) I don't know

3. What low-cost or nonmonetary incentives for plug-in electric vehicles does your area offer? Check all that apply.

- Free parking
- HOV lane access or bypassing taxi queues
- Free charging
- Reduced licensing or registration fees
- Exemption from vehicle testing (e.g., emissions)
- I don't know

4. Does your area have any existing policies that benefit plug-in electric vehicles (PEVs) and infrastructure use (for example, local fleet mandates to use electric vehicles, low carbon fuel standards, greenhouse gas emission regulations, planning/zoning requirements for new construction to include EVSE provisions, etc.)?

- a) Yes
- b) No
- c) No, we actually have laws that restrict PEVs
- d) I don't know

5. Are there any future laws, policies or incentives pending or planned that would affect the deployment or plug-in electric vehicles (PEVs)?

- a) Laws or incentives that encourage PEVs
- b) No, there are proposed policies that actually restrict PEVs
- c) Neither
- d) I don't know

6. Does your area have any attractive financing or special purchase options for plug-in electric vehicles or electric vehicle supply equipment (EVSE)?

- a) No
- b) Yes
- c) I don't know

Education and Outreach

1. Does your area host a website for the general public that provides local information about plug-in electric vehicles and charging infrastructure?

- a) No
- b) Yes
- c) I don't know

2. Does your area make use of Clean Cities educational resources for plug-in electric vehicles, such as the Alternative Fuels Data Center website, FuelEconomy.gov, or local coalition websites?

- a) No
- b) Yes
- c) I don't know

3. Is your area connected with a national outreach program to encourage the use of plug-in electric vehicles (such as Clean Cities, Project Get Ready or National League of Cities)?

- a) No
- b) Yes
- c) I don't know

4. Are educational efforts in your area coordinated at the regional or state level?

- a) No
- b) Yes
- c) I don't know

Utility Involvement

1. Do utilities in your area have a program in place to address grid infrastructure requirements and operational impacts of charging for plug-in electric vehicles?

- a) No
- b) Yes
- c) I don't know

2. Do utilities in your area offer a separate rate for plug-in electric vehicles?

- a) No
- b) Yes
- c) I don't know

3. Do utilities in your area offer any tools to help the consumer understand the costs and benefits of plug-in electric vehicles under different rate structures?

- a) No
- b) Yes
- c) I don't know

4. How engaged are the utilities in local efforts to deploy plug-in electric vehicles and charging infrastructure (for example, participation in planning efforts, working with local jurisdictions to understand building permitting and codes or working with public utility commissions on how to help with plug-in electric vehicle rollouts)?

- a) Not engaged
- b) Somewhat engaged
- c) Moderately engaged
- d) Highly engaged
- e) I don't know

5. Have the utilities in your area analyzed the impacts of plug-in electric vehicles on the local grid or forecasted the location of potential plug-in electric vehicle concentrations?

- a) No
- b) Yes
- c) I don't know

6. Have the utilities in your area developed a procedure for customers (directly or indirectly) to notify the utility before installing EVSE, so the utility can plan for additional demand?

- a) No
- b) Yes, via automated reporting
- c) Yes, via voluntary reporting
- d) I don't know

7. Have the utilities in your area deployed "smart grid" technologies (such as smart meters) to assist with development of future plug-in electric vehicle markets and capabilities?

- a) No
- b) Yes, planned in next 2-5 years
- c) Yes, as a pilot with limited coverage
- d) Yes, with full implementation for PEV owners
- e) I don't know

Plug-In Vehicle Market Conditions

1. How many models of plug-in electric vehicles do you expect to be available for purchase or lease in your area during the next one to two years?

- a) Less than 3
- b) 3 to 5
- c) 6 to 10
- d) More than 10
- e) I don't know

2. How many dealerships in your area are currently selling plug-in electric vehicles?

- a) None
- b) 1
- c) 2 to 10
- d) More than 10
- e) I don't know

3. Approximately how many public electric vehicle supply equipment (EVSE) charging points ("ports" or "outlets," not just "stations") are currently in service in your area?

- a) None
- b) Less than 10
- c) 10 to 25
- d) More than 25
- e) I don't know

4. Approximately what percentage of plug-in electric vehicle buyers are installing residential Level 2 (240 V) EVSE in your local jurisdiction?

- a) Less than 25%
- b) 25% to 49%
- c) 50% to 75%
- d) Greater than 75%
- e) I don't know

5. How many public EVSE charging points ("ports" or "outlets," not just "stations") do you anticipate will be constructed in your area during the next one to two years?

- a) None
- b) Less than 10
- c) 10 to 25
- d) More than 25
- e) I don't know

6. How many workplace EVSE charging points ("ports" or "outlets," not just "stations") do you anticipate will be constructed in your area during the next one to two years?

- a) None
- b) Less than 10
- c) 10 to 25
- d) More than 25
- e) I don't know

7. Approximately how many plug-in electric vehicles do government fleets (federal, state and local) in your area use?

- a) None
- b) Less than 5
- c) 5 to 10
- d) More than 10
- e) I don't know

8. Approximately how many plug-in electric vehicles do private fleets (including utility fleets) in your area use?

- a) None
- b) Less than 10
- c) 10 to 25
- d) More than 25
- e) I don't know

9. Approximately how many plug-in electric vehicles do government fleets (federal, state and local) in your area plan to add in the next one to two years?

- a) None
- b) Less than 10
- c) 10 to 25
- d) More than 25
- e) I don't know

10. Approximately how many plug-in electric vehicles do private fleets (including utility fleets) in your area plan to add in the next one to two years?

- a) None
- b) Less than 25
- c) 25 to 50
- d) More than 50
- e) I don't know

Long-Term Vehicle and Infrastructure Planning

1. Does your area have (or is in the process of creating) a comprehensive plan for plug-in electric vehicle infrastructure deployment?

- a) No
- b) Yes, it's in process
- c) I don't know

2. Has your area created a collaborative group of local stakeholders to help align diverse plug-in electric vehicle interests and plan for deployment?

- a) No
- b) Yes
- c) I don't know

3. Has an elected leader in your area (mayor, governor, etc.) appointed a single agency or person to oversee the development and implementation of a plug-in electric vehicle infrastructure deployment plan?

- a) No
- b) Yes
- c) I don't know

4. Has someone in your area performed an analysis to select the best locations for initial public electric vehicle supply equipment (EVSE)?

- a) No
- b) Yes
- c) I don't know

5. Has your area selected a cohesive set of signage to designate and direct drivers to electric vehicle supply equipment?

- a) No
- b) Yes
- c) I don't know



Plug-In Electric Vehicle Infrastructure Permitting Checklist

Snapshot: Once a local government decides what information to require in an electric vehicle supply equipment (EVSE) permit application, it is a best practice to combine requirements and guidance into a single document that can guide plug-in electric vehicle owners through the process. This document should contain information on the conditions under which an EVSE permit is required, EVSE permit application requirements, the number and type (e.g., preinstallation, postinstallation) of inspections required and applicable codes and guidance regarding EVSE installation. The **California Plug-In Electric Vehicle Collaborative** created the following checklist.

Permitting Checklist

	Residential	Non-Residential
Phase 1 Pre-Work Contractor	<ul style="list-style-type: none"> ✓ Understands intended use of the EVSE (i.e. personal) 	<ul style="list-style-type: none"> ✓ Obtain an address for the location ✓ Determine the ownership of the site and/or authorization to install equipment at site ✓ Understands intended use of the EVSE (i.e., fleet, employee, customer, visitor, etc.) ✓ Determine number of vehicles charging and connectors per charging station ✓ Determine source of power and authorization to use source
	<ul style="list-style-type: none"> ✓ Determine type of vehicle(s) to be charged at EVSE ✓ Evaluate mounting type options (i.e., bollard, pole-mount, wall-mount, ceiling-mount) ✓ Clarify communication requirements (i.e., Ethernet, cellular, Wi-Fi, none or other) ✓ Determine the NEMA Enclosure type ✓ Determine the physical dimensions of the space(s) ✓ Inspect the type of circuit breaker panel board intended for the installation 	
Phase 2 Pre-Work Customer	<ul style="list-style-type: none"> ✓ Identify incentives or rate structures through the utility ✓ Determine size of electrical service at the site ✓ Identify and contact applicable local permit office(s) to identify specific requirements, including local fire, environmental, construction, building, concealment and engineering requirements ✓ Identify incentives available through local, state or federal programs ✓ Contact insurance company to acquire additional insurance or separate coverage as needed ✓ Hire the contractor and verify credentials with all subcontractors; ensure electrical contractor's license for electrical work is current 	
Phase 3 On-Site Evaluation	<ul style="list-style-type: none"> ✓ Verify EVSE meets UL requirements and is listed by UL or another nationally recognized testing laboratory ✓ Verify EVSE has an appropriate NEMA rated enclosure (NEC 110.28) based on environment and customer needs, such as weatherization or greater levels of resistance to water and corrosive agents ✓ Determine the level or charger meets customer's PEV requirements (most vehicles require the maximum of a 240V/32A (40A breaker) ✓ Based on proposed EVSE location, determine if cord length will reach a vehicle's charging inlet without excessive slack and does not need to be more than 25' in length (NEC 625.17) ✓ Cord management methodologies have been considered to reduce the risk of tripping hazards and accidental damage to the connector ✓ Mounting type selection based on requirements to meet site guidelines ✓ Determine whether EVSE communication options are beneficial to customer and/or local utility 	

Phase 4
On-Site
Survey

- ✓ Ensure overhead doors and vehicle parking spot do not conflict with EVSE location
- ✓ Place EVSE in a location convenient to charging port on vehicle and typical orientation of the vehicle in garage (i.e., backed in or head-first)
- ✓ Ensure functionality of lighting in the garage to meet NEC code 210-70

- ✓ Space(s) should be visible to drivers and pedestrians
- ✓ Determine proximity to building entrance (could be considered an incentive for PEV use)
- ✓ Select spaces proximate to existing transformer or panel with sufficient electrical capacity
- ✓ EVSE installation should maintain a minimum parking space length to comply with local zoning requirements
- ✓ If available, use wider spaces to reduce the risk of cord damage and minimize the intersection of cords with walking paths
- ✓ Ensure sufficient lighting at proposed space(s) to reduce the risk of tripping and damage to charging station from vehicle impact or vandalism; light levels above two foot candles are recommended
- ✓ Address accessibility requirements (refer to the Plug-In Electric Vehicle Infrastructure and Equipment Accessibility section of the Guidebook for more information)
- ✓ Determine availability of space for informative signing
- ✓ EVSE with multiple cords should be placed to avoid crossing other parking spaces
- ✓ All available charging station mounting options should be considered and optimized for the space
- ✓ Determine if hazardous materials were located at the site

PARKING DECKS

- ✓ Place EVSE towards the interior of a parking deck to avoid weather-related impacts on equipment

PARKING LOTS

- ✓ Avoid existing infrastructure and landscaping to mitigate costs, potential hazards and other negative impacts

ON-STREET

- ✓ Install on streets with high foot and vehicle traffic to mitigate vandalism
- ✓ Avoid existing infrastructure to mitigate costs, potential hazards and other negative impacts
- ✓ Address accessibility requirements (refer to the Plug-In Electric Vehicle Infrastructure and Equipment Accessibility section of the Guidebook for more information)

		<ul style="list-style-type: none"> ✓ For pull-in spaces, EVSE should be placed in front of the space and either centered on the space if placed between two spaces (if two connectors are available); EVSE with more than two connectors should not be used in on-street applications ✓ For parallel parking locations, the charging station should be installed at the front third of the parked vehicle and based on the direction of traffic flow; EVSE with a single connector is recommended to reduce potential trip hazards
<p>Phase 4 Contractor Installation Preparation</p>	<ul style="list-style-type: none"> ✓ Mount the connector at a height between 36" and 48" from the ground (NEC 625.29) unless otherwise indicated by the manufacturer ✓ Install wall or pole-mount stations and enclosures at a height between 36" and 48" ✓ Ensure sufficient space exists around electrical equipment for safe operation and maintenance (NEC 110.26); recommended space is 30" wide, 3' deep and 6'6" high ✓ Minimize tripping hazards and utilize cord management technologies when possible ✓ Equipment operating above 50 volts must be protected against physical damage (NEC 110.27); ensure the vehicle is out of the line of vehicle travel and use wheel stops or other protective measures ✓ EVSE must be located such that ADA routes maintain a pathway of 36" at all times 	
<p>Phase 5 Installation</p>	<ul style="list-style-type: none"> ✓ Residential garages may permit the use of nonmetallic-sheathed cable in lieu of conduit 	<ul style="list-style-type: none"> ✓ Run conduit from power source to station location ✓ For EVSE greater than 60 amperes, a separate disconnect is required (NEC 625.23) and should be installed concurrently with conduit and visible from the EVSE
<ul style="list-style-type: none"> ✓ Post permit at site in visible location ✓ Remove material to run conduit and/or wiring (i.e., drywall, insulation, pavers, concrete, pavement, earth, etc. ✓ Contractors are encouraged to examine requirement for installation sites and types of wiring in Chapter 3 of the NEC ✓ Pull wiring; charging stations require a neutral line and a ground line and equipment is considered to be a continuous load 		

	<ul style="list-style-type: none"> ✓ Conductors should be sized to support 125% of the rated equipment load (NEC 625.21) ✓ Preparing mounting surface and install per equipment manufacturer instructions ✓ Floor-mount: typically requires a concrete foundation with J-bolts on station base; place with space to allow conductors to enter through the base ✓ Wall/pole/ceiling-mount: install brackets for mounting of the equipment ✓ Install bollard(s) and/or wheel stop(s) as needed ✓ Install informative signage to identify the EVSE and potential trip hazards ✓ Install additional electrical panels or subpanels as needed ✓ Install service upgrades, new service and/or new meter as needed; utility may also pull a meter to allow for charging station wires to be connected to a panel ✓ Make electrical connection ✓ Perform finish work to repair existing infrastructure, surfaces and landscaping
<p>Phase 6 Inspection</p>	<ul style="list-style-type: none"> ✓ An initial electrical inspection by applicable building, fire, environmental and electrical authorities should occur after conduit has been run and prior to connecting equipment and running wires; if necessary, contractor should correct any issues and schedule a second rough inspection ✓ If required, the inspector will perform a final inspection to ensure compliance with NEC and other codes adopted within the jurisdiction by inspecting wiring, connections, mounting and finish work ✓ Contractor should verify EVSE functionality
<p>Additional Resources</p>	<ul style="list-style-type: none"> ✓ National Codes and Standards ✓ American National Standards Institute (ANSI) ✓ National Fire Protection Association (NFPA) ✓ Underwriters Laboratories, Inc. (UL) ✓ International Association of Electrical Inspectors (IAEI) ✓ International Code Council (ICC) ✓ NECA-NEIS Standards ✓ NECA and NFPA Webinars ✓ Electrical Vehicle Infrastructure Training Program (EVITP) Installer Training Course/Certification



Single-Family Residential Permitting Application Example

Snapshot: As discussed in the Permitting section of the Guidebook, the process for single-family residential charging is often as simple as adding a 120V or 208/240V branch circuit (for Level 1 or Level 2 charging). Many local governments permit this type of electrical vehicle supply equipment with the same process used for a standard electrical appliance. Some examples of permit applications include: The City of Davis' **Application for Residential Building Permit**, the City of San Diego's online **E-Permit**, the Department of Energy's **Permit for Charging Equipment Installation** and the city and county of San Francisco's **Worksheet for Electric Permit**. San Francisco's permit is provided to showcase one example of a standard electrical appliance application that local governments could work from and modify for their needs and requirements.

(Insert logo here)	<p align="center">DEPARTMENT OF BUILDING INSPECTION WORKSHEET FOR ELECTRICAL PERMIT</p> <p>Please complete BOTH SIDES of this worksheet prior to application for permit issuance. Required information is shown in bold.</p>
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<p>Job Address: Click here to enter text.</p>	<p>Permit#: Click here to enter text.</p>
	<p>Floor (Job Location): Click here to enter text.</p>

<input type="checkbox"/> Contractor	<input type="checkbox"/> Homeowner	<input type="checkbox"/> Other
Contractor License #: Click here to enter text.	License Class: Click here to enter text.	Business Tax License #: Click here to enter text.

<p>Contractor Company Name: (if applicable) Click here to enter text.</p>	<p>Applicant Signature:</p>
<p>Applicant Name: Click here to enter text.</p>	<p>Applicant Phone: Click here to enter text.</p>
<p>Applicant Address: Click here to enter text.</p>	<p>Applicant Cell Phone: Click here to enter text.</p>
<p>Property Owner Name: Click here to enter text.</p>	<p>Owner Phone: Click here to enter text.</p>
<p>Owner Address: Click here to enter text.</p>	<p>Owner Cell Phone: Click here to enter text.</p>

<p>Describe Scope of Work: Include area(s) of work, electrical distribution equipment, devices, and utilization equipment if applicable and locations (describe area, tenant name, suite #, etc.).</p>	Office Use Only
<p>Click here to enter text.</p>	

Services No. & Sizes: Click here to enter text.				
Feeders No. & Sizes: Click here to enter text.			Circuits: Click here to enter text.	
Panelboards/Switchboards No. & Sizes: Click here to enter text.				
Transformers No. & Sizes: Click here to enter text.				
No. of Lights: Click here to enter text.	Switches: Click here to enter text.	Receptacles: Click here to enter text.	Fans: Click here to enter text.	Dishwashers: Click here to enter text.
Garbage Disposals: Click here to enter text.	Microwaves: Click here to enter text.	Ranges: Click here to enter text.	Hydro-massage Tubs: Click here to enter text.	Smoke Detectors: Click here to enter text.
Other Equipment: Click here to enter text.				

<input type="checkbox"/> Residential	<input type="checkbox"/> Non-Residential	An outlet is defined as a point on the wiring system at which current is taken to supply utilization equipment.
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Building Permit Application # (if applicable): PA# Click here to enter text.	Plumbing Permit # (if applicable): P Click here to enter text.	Valuation of Electrical Work: \$ Click here to enter text.
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Category 1: General Wiring: Residential building of 10,000 sq. ft. or less		
<input type="checkbox"/> 10 outlets or less	<input type="checkbox"/> 21 – 40 outlets	<input type="checkbox"/> Buildings of 5,000 – 10,000 sq. ft.
<input type="checkbox"/> 11 – 20 outlets	<input type="checkbox"/> 41 outlets or more	

Category 2: General Wiring: Non-residential buildings and Residential Buildings over 10,000 sq. ft. in area		
<input type="checkbox"/> Up to 5 outlets	<input type="checkbox"/> 2,501 – 5,000 sq. ft.	<input type="checkbox"/> 50,001 – 100,000 sq. ft.
<input type="checkbox"/> 6 – 20 outlets	<input type="checkbox"/> 5,001 – 10,000 sq. ft.	<input type="checkbox"/> 100,001 – 500,000 sq. ft.
<input type="checkbox"/> 21 or more outlets	<input type="checkbox"/> 10,001 – 30,000 sq. ft.	<input type="checkbox"/> 500,001 – 1,000,000 sq. ft.
<input type="checkbox"/> Up to 2,500 sq. ft.	<input type="checkbox"/> 30,001 – 50,000 sq. ft.	<input type="checkbox"/> More than 1,000,000 sq. ft.

Category 3: Retrofit Service and Distribution Equipment that is not part of Categories 1 and 2		
<input type="checkbox"/> Up to 225 amps	<input type="checkbox"/> 1,200 – 2,000 amps	<input type="checkbox"/> Up to 150 kVa
<input type="checkbox"/> 226 – 500 amps	<input type="checkbox"/> More than 2,000 amps	<input type="checkbox"/> Over 151 kVa
<input type="checkbox"/> 600 – 1,000 amps	<input type="checkbox"/> Over 600 volts	<input type="checkbox"/> Fire pumps

Category 4a: Installation of Fire Warning and Controlled Devices		
<input type="checkbox"/> Up to 2,500 sq. ft.	<input type="checkbox"/> 10,001 – 30,000 sq. ft.	<input type="checkbox"/> 100,001 – 500,000 sq. ft.
<input type="checkbox"/> 2,501 – 5,000 sq. ft.	<input type="checkbox"/> 30,001 – 50,000 sq. ft.	<input type="checkbox"/> 500,001 – 1,000,000 sq. ft.
<input type="checkbox"/> 5,001 – 10,000 sq. ft.	<input type="checkbox"/> 50,001 – 100,000 sq. ft.	<input type="checkbox"/> More than 1,000,000 sq. ft.

Category 4b: Retrofit Systems of Fire Warning and Controlled Devices		
<input type="checkbox"/> Buildings of 6 dwelling units or less	<input type="checkbox"/> Up to 3 floors	<input type="checkbox"/> 21 – 30 floors
<input type="checkbox"/> Buildings of 7 – 12 dwelling units	<input type="checkbox"/> 4 – 9 floors	<input type="checkbox"/> More than 30 floors
	<input type="checkbox"/> 10 – 20 floors	

Category 5: Miscellaneous Installations			
Remodel/Upgrade of Existing Hotel Guest/SRO Rooms: Number of Rooms:			Click here to enter text.
Data, Communications, and Wireless Systems: Number of Cables:			Click here to enter text.
Number of Office Workstations:	Click here to enter text.	Temporary Exhibition Wiring No. of Booths/Outlets:	Click here to enter text.
Number of Exterior Signs:	Click here to enter text.	Number of Interior Signs:	Click here to enter text.
Garage Door Operator (Requiring receptacle installation): Number of Door(s):			Click here to enter text.
Quarterly Permits (Includes 1 inspection) (max 5 outlets in any one location):			<input type="checkbox"/> Quarterly
Survey	<input type="checkbox"/>	Survey Only	Additional Hours: Click here to enter text.
	<input type="checkbox"/>	Research/Survey & Report	Additional Hours: Click here to enter text.
Witness Testing Hours (1 hr. min):	<input type="checkbox"/>	Yes	<input type="checkbox"/> No
			Additional Hours: Click here to enter text.
No. of Off-Hours (2 hrs. min):	Click here to enter text.		No. of Additional Inspections/Hours Required: Click here to enter text.
Security Systems. Number of Components:	Click here to enter text.		Energy Management, HVAC, & Low Voltage. Number of floors: Click here to enter text.
Plan Review: Number of Hours:	Click here to enter text.		Solar PV Systems: Click here to enter text.
			Total kW Rating: Click here to enter text.

PLEASE REVIEW YOUR PERMIT INFORMATION FOR ACCURACY. A NEW PERMIT IS REQUIRED TO CORRECT INACCURACIES OR OMISSIONS ON ISSUED PERMITS.

Plug-In Electric Vehicle Load Calculator for Level 2 Charging

Snapshot: A Level 2 electric vehicle charging system requires a 240-volt electrical circuit and charges the vehicle battery much faster than a Level 1 charger. Local governments can provide an electric vehicle load calculator to residents to help determine if their home is equipped to handle the additional electrical load. The following example is from the City of Riverside's [Residential Electric Vehicle Charger Guidelines](#).

Level 2 Electric Vehicle Charger Service Load Calculator

INSTRUCTIONS: Review the list of electrical loads in the table below and check all that exist in your home (don't forget to include the proposed Level 2 charger). For each item checked, fill in the corresponding "Watts Used" (refer to the "Typical Usage" column for wattage information). Add up all of the numbers that are written in the "Watts Used" column and write that number in the "TOTAL WATTS USED" box at the bottom of the table. Then go to the next page to determine if your existing electric service will accommodate the new loads.

(Loads shown are rough estimates; actual loads may vary. For a more precise analysis, use the nameplate ratings for appliances and other loads and consult with a trained electrical professional.)

Check all Applicable Loads (✓)	Description of Load	Typical Usage	Watts Used
GENERAL LIGHTING AND RECEPTACLE OUTLET CIRCUITS			
	Multiply the square footage of house x 3	3 watts/sq. ft.	
KITCHEN CIRCUITS			
	Kitchen circuits	3,000 watts	
	Electric oven	2,000 watts	
	Electric stove top	5,000 watts	
	Microwave	1,500 watts	
	Garbage disposal under kitchen sink	1,000 watts	
	Automatic dish washer	3,500 watts	
	Garbage compactor	1,000 watts	
	Instantaneous hot water at sink	1,500 watts	
LAUNDRY CIRCUITS			
	Laundry circuit	1,500 watts	
	Electric clothes dryer	4,500 watts	
HEATING AND AIR CONDITIONING CIRCUITS			
	Central heating and air conditioning	6,000 watts	
	Window mounted air conditioning	1,000 watts	
	Whole-house or attic fan	500 watts	
	Central electric furnace	8,000 watts	
	Evaporative cooler	500 watts	
OTHER ELECTRICAL LOADS			
	Electric water heater (storage type)	4,000 watts	
	Electric tankless water heater	15,000 watts	
	Swimming pool or spa	3,500 watts	
	Other (describe)		
	Other (describe)		
	Other (describe)		
ELECTRIC VEHICLE CHARGER CIRCUIT			
	Level 2 electric vehicle charger wattage rating		
			TOTAL WATTS USED

INSTRUCTIONS: Using the "TOTAL WATTS USED" number from the previous page, check the appropriate line in column 1 and follow that line across to determine the minimum required size of the electrical service panel shown in column 3. In column 4, write in the size of your existing service panel (main breaker size). If your existing service panel (column 4) is smaller than the minimum required size of the existing service (column 3), then you will need to install a new upgraded electrical service panel to handle the added electrical load from the proposed Level 2 charger.

The table below is based on CEC 220.83(A), 230.42 and Annex D.

1	2	3	4
Check the appropriate line (✓)	Total Watts Used (from previous page)	Minimum Required Size of Existing 240-Volt Electrical Service Panel (Main Service Breaker Size)	Identify the Size of Your Existing Main Service Breaker (Amps)*
	up to 48,000	100 amps	
	48,001 to 63,000	125 amps	
	63,001 to 78,000	150 amps	
	78,001 to 108,000	200 amps	
	108,001 to 123,000	225 amps	

*Note that the size of your existing service (column 4) MUST be equal to or larger than the Minimum Required Size (column 3) or a new larger electrical service panel will need to be installed in order to satisfy the electrical load demand of the EV charger.

STATEMENT OF COMPLIANCE

By my signature, I attest that the information provided is true and accurate.

Job Address: _____
(Print job address)

Signature: _____
(Signature of applicant) _____ (Date)

In addition to this document, you will also need to provide a copy of the manufacturer's installation literature and specifications for the Level 2 charger you are installing.

Note: This is a voluntary compliance alternative and you may wish to hire a qualified individual or company to perform a thorough evaluation of your electrical service capacity in lieu of this alternative methodology. Use of this electrical load calculation estimate methodology is at the user's risk and carries no implied guarantee of accuracy. Users of this methodology and these forms are advised to seek professional assistance in determining the electrical capacity of a service panel.



Plug-In Electric Vehicle Checklists for Residents and Businesses

Snapshot: Local governments can provide checklists to individuals and organizations interested in plug-in electrical vehicles readiness. Checklists can include information for PEV owners about incentives and can include information about installing electrical vehicle service equipment for local residents to gauge if they meet permitting requirements and to ensure that they have PEV-friendly policies. Sample checklists for PEV owners, multi-unit dwelling permitting and workplace charging are provided. The checklists provided are adopted from the California Air Resources Board's DriveClean.ca.gov website and from **CALSTART**.

Plug-In Electric Vehicle Owner Checklist *(Adopted from DriveClean.ca.gov)*

Residents who have recently purchased a plug-in electric vehicle can complete the following checklist to make sure they are taking full advantage of their new vehicle.

- ▶ Apply for Vehicle Rebates & Tax Credits
 - Federal Tax Credit up to \$7,500: If you purchased a PEV, at tax time you can fill out tax form 8936: Qualified Plug-in Electric Drive Motor Vehicle Credit. (If you leased a PEV, this tax credit was rolled into your lease price.) www.irs.gov/pub/irs-pdf/f8936.pdf and www.irs.gov/businesses/article/0,,id=219867,00.html
 - Clean Vehicle Rebate Project up to \$2,500: Fill out the application by clicking on the "apply now" link below the eligible vehicle you purchased at the website www.energycenter.org/cvrp.
 - Local Incentives: Apply for any local incentives that your area may offer. www.driveclean.ca.gov/pev/Incentives.php
- ▶ Get Set up with Charging
 - Home Charging: By this time you've consulted with your auto dealer and determined if they will coordinate installation of your home charging or not and have likely selected a specific charger model to be installed. If you choose Level 2, it is time to contact your local utility to coordinate installation and to get the best electricity rate for charging your car. www.driveclean.ca.gov/pev/Charging.php
 - Charging Infrastructure Rebates: Sign up for any charging rebates that apply to you. www.driveclean.ca.gov/pev/Incentives.php
 - Public and Workplace Charging: If there is not already PEV charging at your workplace, you may want to request it. More businesses are finding value in installing workplace charging. See www.driveclean.ca.gov/pev/Charging.php and www.driveclean.ca.gov/pev/Resources_For_Businesses.php
- ▶ Apply for Special Decals
 - Clean Air Vehicle Decal: If your vehicle qualifies, apply for the Clean Air Vehicle Decal. www.arb.ca.gov/msprog/carpool/carpool.htm
- ▶ Apply for Discounts & Perks
 - Utility Discounts: If you haven't already, contact your electric utility for their assistance and to determine the best electricity rate plan.
 - Insurance Discounts: Contact your insurance company to receive any discounts they may offer.

- Free or Preferential Parking: If your city or those surrounding you offer special parking programs, make sure you know what the rules and restrictions are, and fill out any necessary forms. www.driveclean.ca.gov/pev/Incentives.php
- ▶ Say Something about PEV Driving
 - PEV Blogs & Forums: You may decide to join the PEV discussion through a blog or discussion forum, and help make the path to PEV ownership easier for someone else. www.driveclean.ca.gov/pev/Related_Sites.php#blogs

Plug-In Electric Vehicle Readiness Policy Checklist for HOAs, Owners and Management *(Adopted from DriveClean.ca.gov)*

Homeowner associations (HOAs), building owners and property management need to establish policies governing MUD PEV charging installations. The following checklist can be used as a guide for developing these policies.

- ▶ How many tenants/owners have PEVs or are likely to buy PEVs in the future?
- ▶ Does the HOA/property owner/management want the charging equipment to serve multiple residents?
- ▶ Are there parking restrictions that limit or govern the installation of charging equipment?
- ▶ Are there equity issues such as reassigning parking spaces or using limited guest parking for charging?
- ▶ Are there handicapped parking issues (under the Americans with Disability Act, California Building Code or other state/federal standards) to resolve?
- ▶ Can individual units accommodate charging equipment?
- ▶ Can the common area electrical wiring/meter be used (perimeter lights, garage gates, laundry room, etc.) to accommodate one or more chargers?
- ▶ Can PEV drivers use Level 1 (120 volt) or is Level 2 (240 volt) charging needed?
- ▶ Can charging equipment technology features help solve payment, billing and access issues?
- ▶ Check regulations to see if the PEV driver (or owners of charging equipment) will need to provide extra insurance to the property owner.
- ▶ Who owns the equipment if the resident moves?

Plug-In Electric Vehicle Workplace Charging Checklist *(Adopted from CALSTART)*

The following list can be shared with employers about logistics for workplace charging.

- ▶ Determine recharging site(s) at your business
 - Closer to existing electric utility equipment is cheaper; adding new circuits and conduit can increase capital costs significantly
 - Review traffic, pedestrian flow, parking requirements and applicable ADA compliance issues
 - Determine additional retrofit needs, including landscaping
 - It is strongly advised to install extra conduit to allow for future expansion during your initial installation — this will save future trenching costs

- ▶ Estimate the electrical load at site(s)
 - Determine whether to use Level 1 or 2 charging
 - Obtain charger requirements from vehicle and charger suppliers
 - Determine the appropriate number of EVSE units
 - Consider purchasing a load management system that automatically sequences multiple EVSE or chargers without human intervention (It is estimated that costs for a complete system could range from \$5,000 to \$13,000 depending on the number and charge.)
 - Estimates should include the number of employee vehicles to be added over the next three to five years, with special attention to the availability of federal and state incentives and changing technologies
 - Contact EVSE suppliers
 - Confirm charging needs, types and costs
 - Level 2 EVSE is most common — average install cost \$2,000 to \$3,000 without trenching or service upgrades
 - Identify any other special considerations for the specific equipment
- ▶ Contact Utility
 - Assess existing electricity supply — is it adequate?
 - If not, determine necessary electrical service upgrades
 - Consider installing extra circuits and additional electrical capacity during initial upgrade to minimize future costs
 - Subpanel upgrade (200A, 120/240 VAC single phase): ~\$1,900.00
 - Review metering requirements and elective options
 - Time-of-Use meter, demand response meter (can add costs)
 - Determine the impacts of rates on choosing charging times and frequencies
- ▶ Contact pertinent permitting agencies and obtain all pertinent building and use permits
 - Identify special local fire, construction, environmental or building requirements
 - Obtain all applications
 - Determine additional permitting costs
 - Determine site plan requirements
 - Hire the prime contractor and verify contractor subcontractor credentials



Zoning Example for Installation of Plug-In Electric Vehicle Charging Stations

Snapshot: The goal of zoning for plug-in electric vehicles charging stations should be to ensure that charging is an allowed land use in as many types of zoning districts as possible, as either an accessory or a principal use. A template for zoning electric vehicle charging stations is provided. This template is adopted from City of Lancaster’s **Municipal Code**.

Zoning Template

- ▶ An electric vehicle charging station (EVCS) shall be allowed within any legal single-family or multiple-family residential garage or carport subject to all applicable city code requirements in addition to the following.
 - The EVCS shall be protected as necessary to prevent damage by automobiles
 - The EVCS shall be designed to:
 - Be safe for use during inclement weather
 - Be tamper-resistant to prevent injury particularly to children
 - Be resistant to potential damage by vandalism
 - Be equipped with a mechanism to prevent the theft of electricity by an unauthorized user
 - The EVCS shall have complete instructions and appropriate warnings posted in an unobstructed location next to each EVCS

- ▶ An EVCS shall be permitted as an accessory use within any existing legal single-family or multiple-family residential garage or carport, or within any existing legal commercial parking space in a parking lot or in a parking garage, subject to all applicable city code requirements and the following.
 - EVCS for public use shall be subject to the following requirements:
 - The EVCSs shall be located in a manner that will be easily seen by the public for informational and security purposes and shall be illuminated during evening business hours
 - Be located in desirable and convenient parking locations that will serve as an incentive for the use of electric vehicles
 - The EVCS pedestals shall be protected as necessary to prevent damage by automobiles
 - The EVCS pedestals shall be designed to minimize potential damage by vandalism and to be safe for use in inclement weather
 - Complete instructions and appropriate warnings concerning the use of the EVCS shall be posted on a sign in a prominent location on each station for use by the operator
 - One standard nonilluminated sign, not to exceed 4 square feet in area and 10 feet in height, may be posted for the purpose of identifying the location of each cluster of EVCSs
 - The EVCS may be on a timer that limits the use of the station to the normal business hours of the use(s) that it serves to preclude unauthorized use after business hours
 - Electric vehicle charging stations for private use shall:
 - Be located in a manner that will not allow public access to the charging station
 - Comply with subsections G.1.c. and G.1.d. of this section
 - Electric vehicle charging stations for private use not located in a single-family residential garage or carport must also comply with subsection G.1.e. of this section.



Example Building Codes for Plug-In Electric Vehicle Charging

Snapshot: Local governments can use building codes to advance plug-in electric vehicle adoption in a way that ensures safe, cost-effective installation of charging equipment. For example, by adopting more stringent building codes that require PEV-ready wiring in new construction, local governments can help meet future demand for charging and reduce or eliminate the costs associated with future retrofitting. Building code template language, excerpts from CALGreen and local government examples are provided. The model building code is adapted from City of Lancaster's [Municipal Code](#).

Model Building Code for Plug-In Electric Vehicle Charging:

New residential development shall provide for electric vehicle charging stations (EVCSs) in the following prescribed manner.

1. Garages serving each new single-family residence and each unit of a duplex shall be constructed with a listed cabinet, box or enclosure connected to a raceway linking the garage to the electrical service, in a manner approved by the building and safety official, to allow for the future installation of electric vehicle supply equipment to provide an EVCS for use by the resident.
2. In new multiple-family projects of 10 dwelling units or less, 20% of the total parking spaces required (all of the 20% shall be located within the required covered parking) shall be provided with a listed cabinet, box or enclosure connected to a conduit linking the covered parking spaces or garages with the electrical service, in a manner approved by the building and safety official, to allow for the future installation of electric vehicle supply equipment to provide EVCSs at such time as it is needed for use by residents. EVCSs shall be provided in disabled parking spaces in accordance with state and federal requirements.
3. In new multiple-family projects of more than 10 dwelling units, 10% of the total parking spaces required (all of the 10% shall be located within the required covered parking) shall be provided with a listed cabinet, box or enclosure connected to a conduit linking the covered parking spaces or garages with the electrical service, in a manner approved by the building and safety official. Of the total listed cabinets, boxes or enclosures provided, 50% shall have the necessary electric vehicle supply equipment installed to provide active EVCSs ready for use by residents. The remainder shall be installed at such time as they are needed for use by residents. EVCSs shall be provided in disabled parking spaces in accordance with state requirements.

New commercial development shall provide for electric vehicle charging stations in the following prescribed manner.

1. New residential uses shall provide EVCSs in accordance with the New Residential Development section.
2. New commercial, industrial and other uses with the building or land area, capacity or numbers of employees listed herein shall provide the electrical service capacity necessary and all conduits and related equipment necessary to ultimately serve

2% of the total parking spaces with EVCSs in a manner approved by the building and safety official. Of these parking spaces, 1/2 shall initially be provided with the equipment necessary to function as online EVCSs upon completion of the project. The remainder shall be installed at such time as they are needed for use by customers, employees or other users. EVCSs shall be provided in disabled person parking spaces in accordance with state and federal requirements.

- a. Construction of a hospital of 500 or more beds, or expansion of a hospital of that size by 20% or more.
- b. Construction of a postsecondary school (college), public or private, for 3,000 or more students, or expansion of an existing facility having a capacity of 3,000 or more students by an addition of at least 20%.
- c. Hotels or motels with 500 or more rooms.
- d. Industrial, manufacturing or processing plants or industrial parks that employ more than 1,000 persons, occupy more than 40 acres of land or contain more than 650,000 square feet of gross floor area.
- e. Office buildings or office parks that employ more than 1,000 persons or contain more than 250,000 square feet of gross floor area.
- f. Shopping centers or trade centers that employ 1,000 or more persons or contain 500,000 square feet of gross floor area.
- g. Sports, entertainment or recreation facilities that accommodate at least 4,000 persons per performance or that contain 1,500 or more fixed seats.
- h. Transit projects (including but not limited to transit stations and park and ride lots).

CALGreen

For one- and two-family dwellings, the code offers a voluntary standard that, if adopted, calls for installation of a raceway to accommodate a dedicated branch circuit. For multifamily residential dwellings of three stories or less, CALGreen also provides an option to establish a minimum number of parking spaces to be capable of supporting PEV charging. The CALGreen code language is excerpted (California Building Standards Commission July 1, 2012 Supplement):

- ▶ **A4.106.6.1** One- and two-family dwellings. Install a listed raceway to accommodate a dedicated branch circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure. Raceways are required to be continuous at enclosed or concealed areas and spaces. A raceway may terminate in an attic or other approved location when it can be demonstrated that the area is accessible and no removal of materials is necessary to complete the final installation.
- ▶ **A4.106.6.2** Multifamily dwellings. At least 3 percent of the total parking spaces, but not less than one, shall be capable of supporting future EVSE.
- ▶ **A4.106.6.2.1** Single charging space required. When only a single charging space is required, install a listed raceway capable of accommodating a dedicated branch

circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure.

- ◉ A4.106.6.2.2 Multiple charging spaces required. When multiple charging spaces are required, plans shall include the location(s) and type of the EVSE, raceway method(s), wiring schematics and electrical calculations to verify that the electrical system has sufficient capacity to charge simultaneously all the electrical vehicles at all designated EV charging spaces at their full rated amperage. Plan design shall be based upon Level 2 EVSE at its maximum operating ampacity. Only underground raceways and related underground equipment are required to be installed at the time of construction.

CALGreen also offers municipalities a voluntary standard for PEV charging at commercial, retail and other nonresidential locations, as excerpted (California Building Standards Commission 2012 Supplement):

- ◉ A5.106.5.3 Electric vehicle charging. Provide facilities meeting Section 406.7 (Electric Vehicle) of the California Building Code and as follows:
- ◉ A5.106.5.3.1 Electric vehicle supply wiring. For each space required by Table A5.106.5.3.1, provide panel capacity and dedicated conduit for one 208/240V 40-amp circuit terminating within 5 feet of the midline of each parking space.

Table A5.106.5.3.1

TOTAL NUMBER OF PARKING SPACES	NUMBER OF REQUIRED ELECTRIC VEHICLE CHARGING STATION SPACES
1 -50	1
51 - 200	2
201 and over	4

Local Government Examples

Beverly Hills

Provide facilities meeting section 406.7 (Electric Vehicle) of the California building code and as follows:

One 120 VAC 20 amp and one 208/240V 40 amp, grounded AC outlets or panel capacity for one 120 VAC 20 amp and one 208/240V 40 amp, grounded AC outlet and conduit installed for future outlets for each dwelling unit. Electric vehicle supply equipment shall be provided and may be installed in a stall provided to comply with the code minimum parking requirements. Dwelling unit shall be defined by the California building code. Exception: Apartment buildings and apartment units (Beverly Hills Municipal Code 2011).

City of Los Angeles

1. For one- or two-family dwellings and townhouses, provide a minimum of:
 - a. One 208/240 V 40-amp, grounded AC outlet, for each dwelling unit or

- b. Panel capacity and conduit for the future installation of a 208/240 V 40-amp, grounded AC outlet, for each dwelling unit

The electrical outlet or conduit termination shall be located adjacent to the parking area.

- 2. For other residential occupancies where there is a common parking area, provide one of the following:
 - a. A minimum number of 208/240 V 40-amp, grounded AC outlets equal to 5 percent of the total number of parking spaces. The outlets shall be located within the parking area or
 - b. Panel capacity and conduit for future installation of electrical outlets. The panel capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40-amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area; or
 - c. Additional service capacity, space for future meters, and conduit for future installation of electrical outlets. The service capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, of a minimum number of 208/240 V 40-amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area.

When the application of the 5 percent results in a fractional space, round up to the next whole number. (Los Angeles Municipal Code 2010)

Rolling Hills Estates

Any new residential construction, including an addition to a residential structure of greater than 50 percent of the existing floor area, including the primary garage, and/or any demolition of greater than 50 percent of the lineal walls of a residential structure within a twelve-month period, shall require the installation of a 220-volt dedicated electrical outlet in the garage for the purposes of charging an electric vehicle. (Rolling Hills Estates Municipal Code)

Temecula

Circuits for electric vehicle charging stations shall meet all the requirements of California Electrical Code Article 62540. Residential garages shall have a minimum three-quarter (3/4) inch metal flex conduit ran from meter box to the garage firewall and terminated in a metal box at forty-two (42) inches above finished floor for future electric vehicle charging station. (Temecula Municipal Code)



240V 32A

Plug-In Electric Vehicle Parking Code Example

Snapshot: The California Vehicle Code (CVC) provides local governments the authority to place traffic control devices in their jurisdictions (including county highways) to guide, warn and regulate traffic as necessary to carry out the provisions of the CVC and local traffic ordinances. **Traffic Operations Policy Directive 13-01** includes several plug-in electrical vehicle signs and pavement markings for communities. Signs that restrict parking to PEVs, or limit the amount of time a vehicle can be parked, need to be added into local codes to become legally enforceable. The following example is adapted from the City of Santa Monica's **Municipal Code**.

Parking Code Templates

The local government of _____, or designee, is authorized to designate parking spaces or stalls in an off-street parking facility owned and operated by _____ or the Parking Authority of the _____ for the exclusive purpose of charging and parking a vehicle that is connected for electric charging purposes.

When a sign provides notice that a parking space is a publicly designated electric vehicle charging station, no person shall park or stand any nonelectric vehicle in a designated electric vehicle charging station space. Further, no person shall park or stand an electric vehicle in a publicly designated electric vehicle charging station space when not electrically charging or parked beyond the days and hours designated on the regulatory signs posted. For purposes of this subsection, charging means an electric vehicle is parked at an electric vehicle charging station and is connected to the charging station equipment.



Consumer Awareness Guides

Snapshot: A number of useful consumer awareness guides are available for download online. These guides provide helpful information on issues such as permitting for electric vehicle supply equipment, the benefits of electric vehicles and models of vehicles that are currently available. Local governments can prepare similar consumer awareness guides for their community readiness.

Consumer Awareness Guides

- ▶ [Plug-in Electric Vehicle Handbook for Consumers](#) (Department of Energy)
- ▶ [Residential Plug-In Electric Vehicle Charging System Permit Guide](#) (City of Berkeley)
- ▶ [Guide to Electrical Vehicle Supply Equipment Permits for Residential](#) (City of Sacramento)
- ▶ [The ABCs of Plug-In EVs](#) (San Diego Gas & Electric)
- ▶ [Prepping for Plug-in Vehicles at Condos, Townhomes and Apartments](#) (San Diego Gas & Electric)

Hydrogen Safety Checklist

Snapshot: Hydrogen has been produced and employed for industrial, power-generation, energy storage and transportation purposes for decades. Hydrogen is developing into one of several major fuel types for advanced clean vehicles. The following checklist provides a concise table of critical safety measures to consider when working with hydrogen. The checklist is adopted from the Hydrogen Safety Panel's **Hydrogen Safety Checklist**.

Hydrogen Safety Checklist

The checklist is intended to assist people developing designs for hydrogen systems as well as those involved with the risk assessment of hydrogen systems. While these considerations are fairly inclusive, it is not possible to include all variables that need to be considered. The hazard analysis process should therefore include personnel who are familiar with applicable codes and standards in addition to team members with expertise in the technical aspects of the specific project.

Plan the Work

Approach	Examples of Actions
Recognize hazards and define mitigation measures	<input type="checkbox"/> Identify risks such as flammability, toxicity, asphyxiates, reactive materials, etc.
	<input type="checkbox"/> Identify potential hazards from adjacent facilities and nearby activities
	<input type="checkbox"/> Address common failures of components such as fitting leaks, valve failure positions (open, closed or last), valves leakage (through seat or external), instrumentation drifts or failures, control hardware and software failures and power outages
	<input type="checkbox"/> Consider uncommon failures such as a check valve that does not check, relief valve stuck open, block valve stuck open or closed and piping or equipment rupture
	<input type="checkbox"/> Consider excess flow valves/chokes to size of hydrogen leaks
	<input type="checkbox"/> Define countermeasures to protect people and property
	<input type="checkbox"/> Follow applicable codes and standards
Isolate hazards	<input type="checkbox"/> Store hydrogen outdoors as the preferred approach; store only small quantities indoors in well-ventilated areas
	<input type="checkbox"/> Provide horizontal separation to prevent spreading hazards to/from other systems (especially safety systems that may be disabled), structures and combustible materials
	<input type="checkbox"/> Avoid hazards caused by overhead trees, piping, power and control wiring, etc.
Provide adequate access and lighting	Provide adequate access for activities including:
	<input type="checkbox"/> Operation, including deliveries
	<input type="checkbox"/> Maintenance
	<input type="checkbox"/> Emergency exit and response

Keep the Hydrogen in the System

Approach	Examples of Actions
Design systems to withstand worst-case conditions	<input type="checkbox"/> Determine maximum credible pressure considering abnormal operation, mistakes made by operators, etc., then design the system to contain or relieve the pressure
	<input type="checkbox"/> Contain: Design or select equipment, piping and instrumentation that are capable of maximum credible pressure using materials compatible with hydrogen service
	<input type="checkbox"/> Relieve: Provide relief devices that safely vent the hydrogen to prevent damaging overpressure conditions
	<input type="checkbox"/> Perform system pressure tests to verify integrity after initial construction, after maintenance, after bottle replacements and before deliveries through transfer connections
Protect systems	<input type="checkbox"/> Design systems to safely contain maximum expected pressure or provide pressure relief devices to protect against burst
	<input type="checkbox"/> Mount vessels and bottled gas cylinders securely
	<input type="checkbox"/> Consider that systems must operate and be maintained in severe weather and may experience earthquakes and floodwater exposures
	<input type="checkbox"/> Demobilize vehicles and carts before delivery transfers or operation
	<input type="checkbox"/> Protect against vehicle or accidental impact and vandalism
	<input type="checkbox"/> Post warning signs
Size the storage appropriately for the service	<input type="checkbox"/> Avoid excess number of deliveries/change-outs if too small
	<input type="checkbox"/> Avoid unnecessary risk of a large release from an oversized system
Provide hydrogen shutoff(s) for isolation	<input type="checkbox"/> Locate automatic fail-closed shutoff valves at critical points in the system (such as storage exit, entry to buildings, inlets to test cells, etc.) to put the system in a safe state when a failure occurs
	<input type="checkbox"/> Consider redundant or backup controls
	<input type="checkbox"/> Install manual valves for maintenance and emergencies
Prevent cross-contamination	<input type="checkbox"/> Prevent backflow to other gas systems with check valves, pressure differential, etc.

Manage Discharges

Approach	Examples of Actions
Safely discharge all process exhausts, relief valves, purges, and vents	<input type="checkbox"/> Discharge hydrogen outdoors or into a laboratory ventilation system that assures proper dilution
	<input type="checkbox"/> Direct discharges away from personnel and other hazards
	<input type="checkbox"/> Secure/restrain discharge piping
Prevent build-up of combustible mixtures in enclosed spaces	<input type="checkbox"/> Do not locate equipment or piping joints/fittings in poorly ventilated rooms or enclosed spaces; use only solid or welded tubing or piping in such areas
	<input type="checkbox"/> Provide sufficient ventilation and/or space for dilution
	<input type="checkbox"/> Avoid buildup of hydrogen under ceilings/roofs and other partly enclosed spaces

Remove potential ignition sources from flammable spaces/zones	<input type="checkbox"/>	Proper bonding and grounding of equipment
	<input type="checkbox"/>	No open flames
	<input type="checkbox"/>	No arcing/sparking devices, e.g., properly classified electrical equipment

Detect and Mitigate

Approach	Examples of Actions	
Leak detection and mitigation	<input type="checkbox"/>	Provide detection and automatic shutdown/isolation if flammable mixtures present, particularly in enclosed spaces
	<input type="checkbox"/>	Consider methods for manual or automatic in-process leak detection such as ability for isolated systems to hold pressure
	<input type="checkbox"/>	Periodically check for leaks in the operating system
Loss of forced ventilation indoors	<input type="checkbox"/>	Automatically shut off supply of hydrogen when ventilation is not working
Monitor the process and protect against faults	<input type="checkbox"/>	Provide alarms for actions required by people, e.g., evacuation
	<input type="checkbox"/>	Provide capability to automatically detect and mitigate safety-critical situations
	<input type="checkbox"/>	Consider redundancy to detect and mitigate sensor or process control faults
	<input type="checkbox"/>	Provide ability for the system to advance to a “safe state” if power failures or controller faults are experienced
Fire detection and mitigation	<input type="checkbox"/>	Appropriate fire protection (extinguishers, sprinklers, etc.)
	<input type="checkbox"/>	Automatic shutdown and isolation if fire detected

Manage Operations

Approach	Examples of Actions	
Establish and document procedures	<input type="checkbox"/>	Responsibilities for each of the parties involved
	<input type="checkbox"/>	Operating procedures
	<input type="checkbox"/>	Emergency procedures
	<input type="checkbox"/>	Preventive maintenance schedules for equipment services, sensor calibrations, leak checks, etc.
	<input type="checkbox"/>	Safe work practices such as lock-out/tag-out, hot work permits and hydrogen line purging
	<input type="checkbox"/>	Review and approval of design and procedural changes
Train personnel	<input type="checkbox"/>	MSDS awareness for hydrogen and other hazardous materials
	<input type="checkbox"/>	Applicable procedures and work instructions for bottle change-out, deliveries, operation, maintenance, emergencies and safety work practices
Monitor	<input type="checkbox"/>	Track incidents and near misses and establish corrective actions
	<input type="checkbox"/>	Monitor compliance to all procedures and work instructions

Hydrogen Letter from the State Fire Marshall

Snapshot: The State Fire Marshall provided the following letter about hydrogen and hydrogen fueling stations. This letter can be shared with local building and fire departments. Local governments can contact the State Fire Marshall for more information about hydrogen codes and standards.

**DEPARTMENT OF FORESTRY AND FIRE PROTECTION
OFFICE OF THE STATE FIRE MARSHAL**

P.O. Box 944246
SACRAMENTO, CA 94244-2460
(916) 445-8200
Website: www.fire.ca.gov



July 2, 2013

Dear Stakeholder:

CAL FIRE - Office of the State Fire Marshal (OSFM) acknowledges and supports the development of codes and standards for hydrogen and hydrogen fueling installations. The OSFM involvement in the development of hydrogen codes and standards is also a strategy in the Governor's Zero-Emission Vehicle Action Plan. OSFM is working to educate and train Authorities Having Jurisdiction and to adopt the most recently approved International Fire and Building Code proposals into the 2013 California Fire Code supplement, and ultimately into the next edition of the California Fire Code.

Establishing a single comprehensive hydrogen code will help project developers and code officials achieve a consistency of safety requirements that can make permit development and approval process more smooth and efficient. The decision by the International Fire Code (IFC) Committee to reference the National Fire Protection Association (NFPA) 2 Hydrogen Technologies Standard in the 2015 edition of the IFC is one example of a significant code advancement to provide consistent code application in the deployment of hydrogen technologies. NFPA 2 is a comprehensive hydrogen standard that addresses hydrogen safety including the installation and operation of hydrogen fueling stations and the associated hydrogen storage and repair facilities.

The following document, *The California Zero-Emission Vehicles: Community Readiness Guidebook* provides valuable resources to aid those involved in bringing a hydrogen installation to their community. OSFM looks forward to working with local governments to help achieve the 1.5 million zero-emission vehicle goal established by the Governor's ZEV Executive Order. If your agency or department has questions concerning the use of this guidebook or the 2013 California Building Standards Supplement, please contact the OSFM Codes Development and Analysis Division.

Sincerely,

TONYA L.HOOVER
State Fire Marshal

Enclosure

CONSERVATION IS WISE-KEEP CALIFORNIA GREEN AND GOLDEN

PLEASE REMEMBER TO CONSERVE ENERGY. FOR TIPS AND INFORMATION, VISIT "FLEX YOUR POWER" AT WWW.CA.GOV.

Appendices

This section provides a listing of some of the information referred to throughout the Guidebook.

- ▶ [Governor's Zero-Emission Vehicle Executive Order](#)
- ▶ [Resources for Zero-Emission Vehicle Readiness](#)
- ▶ [Glossary of Zero-Emission Vehicle Terms](#)
- ▶ [Compilation of Guidebook Hyperlinks](#)
- ▶ [Works Cited](#)



Governor's Zero-Emission Vehicle Executive Order

WHEREAS California is the nation's largest market for cars and light-duty trucks; and

WHEREAS the transportation sector is the biggest contributor to California's greenhouse gas emissions and accounts for approximately 40 percent of these emissions; and

WHEREAS California should encourage the development and success of zero-emission vehicles to protect the environment, stimulate economic growth and improve the quality of life in the state; and

WHEREAS California is a leader of technological innovation, including the innovation necessary to produce commercially successful zero-emission vehicles; and

WHEREAS California attracts over half of the nation's venture capital for clean technology and ranks high among the states in the number of workers and facilities supporting the clean-car industry; and

WHEREAS California is leading the nation in enacting laws and establishing policies and programs that are reducing greenhouse gases, protecting air and water quality, promoting energy diversity and supporting low-carbon alternative fuel technologies; and

WHEREAS zero-emission vehicles provide multiple benefits in addition to reducing greenhouse gas emissions, such as reducing conventional pollutants, operating quietly and cleanly, allowing home refueling and lowering operating and fuel costs; and

WHEREAS California should support and encourage car manufacturers' plans to build and sell tens of thousands of zero-emission vehicles in California in the coming years.

NOW, THEREFORE, I, Edmund G. Brown Jr., Governor of the State of California, do hereby issue the following orders to become effective immediately:

IT IS HEREBY ORDERED that all state entities under my direction and control support and facilitate the rapid commercialization of zero-emission vehicles.

IT IS FURTHER ORDERED that the California Air Resources Board, the California Energy Commission, the Public Utilities Commission and other relevant agencies work with the Plug-in Electric Vehicle Collaborative and the California Fuel Cell Partnership to establish benchmarks to help achieve by 2015:

- The state's major metropolitan areas will be able to accommodate zero-emission vehicles, each with infrastructure plans and streamlined permitting; and
- The state's manufacturing sector will be expanding zero-emission vehicle and component manufacturing; and
- The private sector's investment in zero-emission vehicle infrastructure will be growing; and
- The state's academic and research institutions will be contributing to zero-emission vehicle research, innovation and education.

IT IS FURTHER ORDERED that these entities establish benchmarks to help achieve by 2020:

- The state's zero-emission vehicle infrastructure will be able to support up to one million vehicles; and
- The costs of zero-emission vehicles will be competitive with conventional combustion vehicles; and
- Zero-emission vehicles will be accessible to mainstream consumers; and
- There will be widespread use of zero-emission vehicles for public transportation and freight transport; and
- Transportation sector greenhouse gas emissions will be falling as a result of the switch to zero-emission vehicles; and
- Electric vehicle charging will be integrated into the electrical grid; and
- The private sector's role in the supply chain for zero-emission vehicle component development and manufacturing state will be expanding.

IT IS FURTHER ORDERED that these entities establish benchmarks to help achieve by 2025:

- Over 1.5 million zero-emission vehicles will be on California roads and their market share will be expanding; and
- Californians will have easy access to zero-emission vehicle infrastructure; and
- The zero-emission vehicle industry will be a strong and sustainable part of California's economy; and
- California's clean, efficient vehicles will annually displace at least 1.5 billion gallons of petroleum fuels.

IT IS FURTHER ORDERED that California target for 2050 a reduction of greenhouse gas emissions from the transportation sector equaling 80 percent less than 1990 levels.

IT IS FURTHER ORDERED that California's state vehicle fleet increase the number of its zero-emission vehicles through the normal course of fleet replacement so that at least 10 percent of fleet purchases of light-duty vehicles be zero-emission by 2015 and at least 25 percent of fleet purchases of light-duty vehicles be zero-emission by 2020. This directive shall not apply to vehicles that have special performance requirements necessary for the protection of the public safety and welfare.

This Order is not intended to, and does not, create any rights or benefits, substantive or procedural, enforceable at law or in equity, against the State of California, its agencies, departments, entities, officers, employees, or any other person.

I FURTHER DIRECT that as soon as hereafter possible, this Order be filed in the Office of the Secretary of State and that widespread publicity and notice be given to this Order.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 23rd day of March 2012.

EDMUND G. BROWN JR.
Governor of California

Resources for Zero-Emission Vehicle Readiness

► State of California Resources

- **Governor's Executive Order:** To bring 1.5 million ZEVs to California by 2025
- **ZEV Action Plan:** Plan to follow the governor's executive order by identifying specific strategies and actions the state will take
- **California Air Resources Board Advanced Clean Cars Program:** CARB website providing information on standards for new advanced vehicles
- **California Department of General Services, Office of Fleet and Asset Management:** DGS website providing information on existing vehicles and infrastructure
- **California Energy Commission Drive website:** CEC program to improve and invest in advanced vehicles and related infrastructure
- **California Energy Commission Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program:** CEC's plan for investment in alternative fuels and advanced vehicles
- **Plug-in Electric Vehicle Resource Center:** A buying guide for consumers interested in plug-in electric vehicles from CARB
- **The Emergency Response Guide to Alternative Fuel Vehicles:** Training manual designed to prepare emergency medical, law enforcement and fire service personnel for an emergency response involving a wide range of alternative fuel vehicles

► State of California Departments

- **California Air Resources Board (CARB):** Promotes and protects public health, welfare and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the state
- **California Building Standards Commission:** BSC produces sensible and usable state building standards and administrative regulations that implement or enforce those standards
- **California Department of Food and Agriculture, Division of Measurement Standards:** CDFA website providing information on measurement standards for new and advanced fuels
- **California Department of General Services, Division of the State Architect:** Provides design and construction oversight for schools, community colleges and various other state-owned and -leased facilities and develops accessibility, structural safety and historical building codes and standards utilized in various public and private buildings
- **California Department of Housing and Community Development:** Provides leadership, policies and programs to preserve and expand safe and affordable housing opportunities and promote strong communities for all Californians
- **California Department of Rehabilitation:** Works in partnership with consumers and other stakeholders to provide services and advocacy resulting in employment, independent living and equality for individuals with disabilities

- **California Department of Transportation (Caltrans):** Improving mobility across California through its strategic goals of safety, mobility, delivery, stewardship and service
- **California Energy Commission:** State's primary energy policy and planning agency that sets state energy policy
- **Governor's Office of Planning and Research (OPR):** Serves the governor and the cabinet as staff for long-range planning and research and is the comprehensive state planning agency

► Federal Resources

- **Department of Energy Alternative Fuels Data Center:** Provides information, data and tools about alternative fuels and advanced vehicles
- **Department of Energy Clean Cities:** Coalitions whose goal is to support local actions to reduce petroleum consumption in transportation
- **Electric Vehicle and Infrastructure Codes and Standards Citations:** National Renewable Energy Laboratory (NREL) document listing codes and standards typically used for U.S. electric vehicle and infrastructure projects
- **GPAT: Government Product/Service Accessibility Template (GPAT):** Simple tool to assist federal contracting and procurement officials in fulfilling the market research requirements associated with Section 508 regulations
- **Hydrogen Vehicle and Infrastructure Codes and Standards Citations:** NREL document listing codes and standards typically used for U.S. hydrogen vehicle and infrastructure projects
- **Safety Planning Guidance for Hydrogen and Fuel Cell Projects:** Guidance document providing applicants and recipients with information on safety requirements for hydrogen and fuel cell projects funded by the Department of Energy Fuel Cell Technologies Program
- **Reaching the U.S. Fire Service with Hydrogen Safety Information:** Provides an overview of the U.S. Fire Service to help improve the transfer of hydrogen safety information to and from the emergency response community

► Resources from Other States

- **Washington Electric Vehicle Infrastructure Deployment Guidelines for Local Government:** Includes local governments' model ordinances, model development regulations and guidance for siting and installing electric vehicle infrastructure
- **Oregon Electric Vehicle Infrastructure Deployment Guidelines:** Provides background information for understanding EV requirements and the related codes, laws and standards in order to provide the optimum infrastructure for electric vehicles
- **West Coast Electric Highway:** The West Coast Electric Highway is an extensive network of electric vehicle DC fast charging stations located every 25 to 50 miles along Interstate 5 and other major roadways
- **Hawaii's ZEV Guidebook:** Hawaii-specific installations are featured throughout the guidebook, however, the recommended order of topics and best practices are applicable anywhere in the world
- **New Jersey Information about Permitting Charging Stations:** The New Jersey Department of Community Affairs Division of Codes and Standards has an innovative permitting program that some California jurisdictions may be interested in adopting

📍 Nonprofit Resources

- **California Fuel Cell Partnership (CaFCP):** A collaboration of auto manufacturers, energy providers, government agencies and fuel cell technology companies that promote the commercialization of hydrogen fuel cell electric vehicles
- **California Plug-in Electric Vehicle Collaborative:** A multistakeholder, public-private partnership that facilitates the deployment of PEVs in California to meet economic, energy and environmental goals
- **The EV Project:** The largest deployment of electric vehicles and charge infrastructure in history
- **California and Regional PEV Data Resource:** Updated dynamically, the online CVRP database allows users to filter PEV ownership data by utility, county and air district, as well as by vehicle and applicant type; download program data; and create GIS maps of vehicle deployment by county
- **Center for Climate and Energy Solutions PEV Initiatives:** A group convened by C2ES brings together automakers, electric utilities, policymakers, environmental groups and others to accelerate PEV deployment nationwide
- **California Plug-in Electric Vehicle Owner Survey:** A report and analysis of survey results from electric vehicle owners from across California
- **Plug-in America:** A coalition of electric vehicle owners who promote clean energy and support PEVs as one solution to energy independence
- **Hybrid and EV First and Second Responder Recommended Practice:** Describes the potential consequences associated with hazards from EVs and suggests common procedures to help protect emergency responders, tow and/or recovery, storage, repair and salvage personnel after an incident has occurred with an EV
- **Hydrogen Fuel Cell Safety Meetings and Events:** A comprehensive calendar for key hydrogen and fuel cell codes and standards development cycles, including due dates
- **Hydrogen / Fuel Cell Codes and Standards:** This website tracks the world-wide development of over 300 hydrogen and fuel cell standards, and its matrix can be searched by geographic areas

► Publications

- **A California Road Map – Bringing Hydrogen Fuel Cell Electric Vehicles to the Golden State:** Describes the infrastructure necessary to successfully launch the commercial FCEV market
- **A Road Map for Fuel Cell Electric Buses in California: A zero-emission solution for public transit:** Looks at the progress of FCEBs in California and across the globe and offers recommendations to state and federal policymakers about actions they can take to put FCEBs on the path to full commercial readiness
- **Accessibility and Signage for Plug-In Electric Vehicle Charging Infrastructure:** Gives a clear delineation of the service provided by charging infrastructure and is intended to ensure that charging is accessible and complies with federal and state requirements
- **Evaluating Land Use Opportunities and Existing Charge Stations:** Defines both the opportunities and the limits on where, how much and when PEV charging can occur locally
- **Luskin Center for Innovation: Financial Viability of Non-Residential EV Charging Stations:** Details the financial viability of installing charging stations outside the home for those with sites available
- **Luskin Center for Innovation: Increasing Electric Vehicle Charging Access in Multi-Unit Dwellings:** Highlights the importance of in-home charging for electric vehicles and the barriers faced by those living in multi-unit dwelling buildings
- **Luskin Center for Innovation: Southern California Plug-in Electric Vehicle Readiness Plan:** Shows residential charging, particularly in single-family homes, as critical to PEV adoption in the near term
- **Powering Innovation: California is Leading the Shift to Electric Vehicles from R&D to Early Adoption:** Tracks key indicators to assess opportunities and obstacles for California in the EV sector
- **Ready, Set, Charge, California!** Provides public agencies throughout California with guidance on how to advance community EV readiness
- **Streamlining the Permitting and Inspection Process for Plug-in Electric Vehicle Home Charger Installations:** Characterizes key aspects of the installation process as they relate to permitting and inspection considerations and highlights common challenges and questions that arise
- **Title 24, California Code of Regulations:** Link to all parts of Title 24, California Code of Regulations
- **UC Los Angeles and UC Berkeley Law School: Electric Drive by '25:** Documents challenges to jump-starting the electric vehicle marketplace and possible solutions for policymakers around California

🟢 Codes and Standards Developers

- **Institute of Electrical and Electronic Engineers (IEEE):** The world's largest professional association dedicated to advancing technological innovation
- **International Code Council (ICC):** Develops model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures
- **National Electrical Manufacturers Association (NEMA):** Association of electrical equipment manufacturers that provides a forum for the development of technical standards that are in the best interest of the industry and users, advocacy of industry policies on legislative and regulatory matters and collection, analysis and dissemination of industry data
- **National Fire Protection Association (NFPA):** International nonprofit focused on reducing the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training and education
- **Society of Automotive Engineers (SAE):** Global association of engineers and related technical experts in the aerospace, automotive and commercial vehicle industries
- **Underwriters Laboratories (UL):** Global independent safety science company dedicated to promoting safe living and working environments



Glossary of Zero-Emission Vehicle Terms

- **Battery Charging Station:** an electrical component assembly or cluster of component assemblies designed specifically to charge batteries within plug-in electric vehicles
- **Charging Levels:** standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged
- **Clean Air Vehicle Parking Space:** 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
- **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
- **Clean Vehicle:** Any clean fuel vehicle identified by the State of California as qualifying for the California Clean Vehicle Rebate Project. Effective January 2011 there are two types of vehicles that qualify: zero emission vehicles (ZEVs) and plug-in hybrid electric vehicles (PHEVs) that qualify as enhanced advanced technology partial zero emission vehicles (EAT PZEV) or transitional ZEV (TZEV).
- **Compressed Hydrogen Gas (CHG):** Hydrogen compressed to a high-pressure and stored at ambient temperature
- **Electric Vehicle Charging Station (EVCS):** a public or private parking space that is served by battery charging station equipment
- **Electric Vehicle Charging Station — Public:** An EV charging station that is publicly owned and publicly available (e.g., park & ride lot, public library parking lot, on-street parking) or that is privately owned but publicly available (e.g., shopping center parking lot, commercial office parking garage)
- **Electric Vehicle Charging Station — Restricted:** 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 residence, designated employee parking)
- **Electric Vehicle Infrastructure (EVI):** Structures, machinery and equipment necessary and integral to support an electric vehicle
- **Electric Vehicle Parking Space:** Any posted parking space that identifies the use to be exclusively for the parking of an electric vehicle
- **Electric Vehicle Supply Equipment (EVSE):** 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, NEC, Article 625)
- **Electrolysis:** The process where an electric current is passed through an electrolytic solution or other appropriate medium, causing a chemical reaction

- **Electronic and Information Technology (EIT):** Includes information technology and any equipment or interconnected system or subsystem of equipment that is used in the creation, conversion or duplication of data or information and includes but is not limited to telecommunications products (such as telephones), information kiosks and transaction machines, websites, multimedia and office equipment such as copiers and fax machines
- **Fuel Cell:** A device that uses hydrogen and oxygen to create electricity through an electrochemical process
- **Fuel Cell Stack:** Individual fuel cells connected in series (or stacked) to increase electrical current
- **Fuel Cell Electric Vehicle (FCEV):** A vehicle that uses electricity produced by an onboard fuel cell (typically powered by hydrogen) to run motors located near the vehicle's wheels
- **Fuel Processor:** Device used to extract the hydrogen from fuels, such as natural gas, propane, gasoline, methanol and ethanol, for use in fuel cells
- **Hybrid Electric Vehicle (HEV):** A type of hybrid vehicle that combines a conventional internal combustion (ICE) propulsion system with an electric propulsion system
- **Inlet:** The device on the PEV into which the electric vehicle connector is inserted for charging and information exchange (part of the electric vehicle coupler)
- **Liquefied Hydrogen (LH2):** Hydrogen can exist in a liquid state, but only at extremely cold temperatures, and typically has to be stored at -253°C (-423°F)
- **Non-Electric Vehicle:** Any motor vehicle that does not meet the definition of electric vehicle or plug-in electric vehicle
- **Phosphoric Acid Fuel Cell (PAFC):** A type of fuel cell in which the electrolyte consists of concentrated phosphoric acid (H_3PO_4) and protons (H^+) are transported from the anode to the cathode
- **Plug-in Electric Vehicle (PEV):** 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, including battery electric vehicle (BEV), plug-in hybrid electric vehicle (PHEV), neighborhood electric vehicle (NEV) and an electric motorcycle
- **Point of Service:** The battery charging station from which the charging service is provided
- **Proton Exchange Membrane (PEM) Fuel Cell:** A fuel cell that uses a solid catalyst-coated membrane, similar in consistency to thick plastic wrap, to allow positively charged ions to pass through it, but block electrons
- **Reformer:** Device used to extract the hydrogen from fuels, such as natural gas, propane, gasoline, methanol and ethanol, for use in fuel cells
- **Reforming:** A chemical process that reacts hydrogen-containing fuels in the presence of steam, oxygen or both into a hydrogen-rich gas stream

- **Self-Contained, Closed Products:** Products that generally have imbedded software but are often designed in such a way that a user cannot easily attach or install assistive technology. Examples include information kiosks, information transaction machines, copiers, printers, calculators, fax machines, and similar types of products. The standards require that access features be built into the system so users do not have to attach an assistive device to it. Other specifications address mechanisms for private listening (handset or a standard headphone jack), touchscreens, auditory output and adjustable volume controls, and location of controls in accessible reach ranges.
- **Zero Emission Vehicles (ZEV):** any vehicle driven only by an electric motor that is powered by advanced technology batteries (BEV) or a hydrogen fuel cell (FCEV) and produces zero tailpipe emissions or pollution when stationary or operating





Compilation of Guidebook Hyperlinks

Publication acknowledgements

Bay Area and Monterey Area Plug-In Electric Vehicle Readiness Plan – http://www.pevcollaborative.org/sites/all/themes/pev/files/docs/ba_pev_plan.pdf

Ready, Set, Charge, California! – http://www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf

San Diego Plug-In Electric Vehicle Readiness Plan – http://www.pevcollaborative.org/sites/all/themes/pev/files/docs/SD_PEV_Readiness_Plan_Main.pdf

A California Roadmap: Bringing Fuel Cell Electric Vehicles to the Golden State – [http://cafcp.org/sites/files/20120814_Roadmapv\(Overview\).pdf](http://cafcp.org/sites/files/20120814_Roadmapv(Overview).pdf)

A Toolkit for Community Plug-In Electric Vehicle Readiness – http://pevcollaborative.org/sites/all/themes/pev/files/docs/toolkit_final_website.pdf

2013 ZEV Action Plan – [http://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_\(02-13\).pdf](http://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_(02-13).pdf)

Southern California Plug-In Electric Vehicle Readiness Plan – http://www.pevcollaborative.org/sites/all/themes/pev/files/docs/SouthCoast_PEV_Readiness_Plan_Main.pdf

Preface

Governor Brown's ZEV Executive Order – <http://gov.ca.gov/news.php?id=17463>

ZEV Action Plan – [http://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_\(02-13\).pdf](http://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_(02-13).pdf)

Overview of Zero-Emission Vehicles

U.S. Department of Energy ZEV Overview – <http://www.afdc.energy.gov/fuels/>

California Fuel Cell Partnership Road Map – [http://cafcp.org/sites/files/20120814_Roadmapv\(Overview\).pdf](http://cafcp.org/sites/files/20120814_Roadmapv(Overview).pdf)

Benefits of Zero-Emission Vehicle Community Readiness

DriveClean – <http://www.driveclean.ca.gov/index.php>

Environmental and Economic Leadership Awards Program – <http://www.calepa.ca.gov/Awards/GEELA/>

Current State Policy on Zero-Emission Vehicles

Governor Brown's ZEV Executive Order – <http://gov.ca.gov/news.php?id=17472>

Executive Order B-16-2012 – <http://gov.ca.gov/news.php?id=17472>

California's ZEV Regulation – <http://www.arb.ca.gov/msprog/zevprog/zevprog.htm>

California's Advanced Clean Cars Program – http://www.arb.ca.gov/msprog/zevprog/factsheets/advanced_clean_cars_eng.pdf

Assembly Bill 118 (Nuñez, Chapter 750, Statutes of 2007) – http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0101-0150/ab_118_bill_20110630_chaptered.pdf

Air Quality Improvement Program – <http://www.arb.ca.gov/msprog/aqip/aqip.htm>

Alternative and Renewable Fuel and Vehicle Technology Program – <http://www.energy.ca.gov/drive/index.html>

Low Carbon Fuel Standard (LCFS) – <http://www.arb.ca.gov/fuels/lcfs/lcfs.htm>

Executive Order S-01-07 (2007) – <http://www.arb.ca.gov/fuels/lcfs/eos0107.pdf>

Directory of local air districts – <http://www.arb.ca.gov/capcoa/roster.htm>

Senate Bill 71 (Padilla, Chapter 10, Statutes of 2010) – http://leginfo.ca.gov/pub/09-10/bill/sen/sb_0051-0100/sb_71_bill_20100324_chaptered.pdf

California Clean Vehicle Rebate Program – <http://energycenter.org/index.php/incentive-programs/clean-vehicle-rebate-project>

Clean Vehicle Rebate Project – <http://energycenter.org>

Senate Bill 535 (Yee, Chapter 215, Statutes of 2010) – http://www.evcollaborative.org/sites/all/themes/pev/files/sb_535_bill_20100830_chaptered.pdf

Assembly Bill 2405 (Blumenfield, Chapter 674, Statutes of 2012) – http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml;jsessionid=a8d177d08a198c56158d731ba5f3?bill_id=201120120AB2405

Assembly Bill 2502 (Blumenfield, Chapter 675, Statutes of 2012) – http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB2502

Assembly Bill 475 (Butler, Chapter 274, Statutes of 2011) – http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0451-0500/ab_475_bill_20110907_chaptered.html

Senate Bill 880 (Corbett, Chapter 6, Statutes of 2012) – http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB880

Current California Plug-In Electric Vehicle Policies – <http://www.evcollaborative.org/current-california-pev-policy>

Zero-Emission Vehicles Codes and Standards

Building Standards Commission website – <http://www.bsc.ca.gov/codes.aspx>

CALGreen Code (Part 11, Title 24) – <http://www.iccsafe.org/cs/codes/Errata/State/CA/5570S1002.pdf>

Building Standards Commission Website on ordinances – <http://www.bsc.ca.gov/codes/localfilings.aspx>

Los Angeles Municipal Code, Chapt. IX, Art. 9 – http://ladbs.org/LADBSWeb/LADBS_Forms/Publications/LAGreenBuildingCodeOrdinance.pdf

Complete Los Angeles Green Building Code – <http://ladbs.org/LADBSWeb/green-bldg.jsf>

Alternative Fuels Data Center ZEV Codes and standards – http://www.afdc.energy.gov/codes_standards.html

National Greenhouse Gas and Corporate Average Fuel Economy Standards for Vehicles – <http://www.afdc.energy.gov/afdc/laws/law/US/385>

Energy Policy Act – <http://www1.eere.energy.gov/vehiclesandfuels/epact/>

Renewable Fuel Standard – <http://www.epa.gov/otaq/fuels/renewablefuels/>

Electric Vehicle Everywhere Workplace Charging Challenge – http://www1.eere.energy.gov/vehiclesandfuels/electric_vehicles/workplace_charging.html

DoD Plug-In Electric Vehicle Program – <http://www.government-fleet.com/channel/green-fleet/news/story/2012/02/u-s-dod-unveils-plug-in-ev-program-plans.aspx>

H2USA – <http://energy.gov/articles/energy-department-launches-public-private-partnership-deploy-hydrogen-infrastructure>

US Green Building Council website – <http://www.usgbc.org/>

Funding and Financing for Zero-Emission Vehicle Readiness

California Energy Commission – <http://www.energy.ca.gov/contracts/transportation.html>

California Air Resources Board – <http://www.arb.ca.gov/ba/fininfo.htm>

Air Quality Improvement Program – <http://www.arb.ca.gov/msprog/aqip/aqip.htm>

DriveClean – http://www.driveclean.ca.gov/Calculate_Savings/Incentives.php

FundingWizard – <http://www.coolcalifornia.org/funding-wizard-home>

Alternative Fuels Data Center – <http://www.afdc.energy.gov/laws/>

Adopt a Charger – <http://adoptacharger.org/>

Community Development Block Grant – http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs

EV Project – http://www.theevproject.com/downloads/documents/FAQ_DOE_ECotality_The_EV_Project_20120924.pdf

Sign up for Energy Commission mailing lists – <http://www.energy.ca.gov/listservers/index.html>

Plug-In Electric Vehicle Collaborative Resource Center – http://www.pevcollaborative.org/sites/all/themes/pev/files/PEV_Incentives_120827.pdf

Plug-In Electric Vehicle Tax Credit – <http://www.irs.gov/businesses/article/0,,id=214841,00.html>

Fuel Cell Vehicle Tax Credit – <http://www.irs.gov/pub/irs-drop/n-08-33.pdf>

Low speed, 2/3 Wheel PEVs Tax Credit – <http://www.irs.gov/newsroom/article/0,,id=207051,00.html>

Employee Corporate Incentives – <http://www.hybridcars.com/corporate-incentives.html>

Alternative Fuel Vehicle Refueling Property Credit – <http://www.irs.gov/pub/irs-pdf/f8911.pdf>

Clean Vehicle Rebate Project – <http://www.arb.ca.gov/msprog/aqip/cvrp.htm>

California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project – http://www.californiahvip.org/docs/HVIP_Year%203_Implementation%20Manual_2012-11-14.pdf

Hybrid Off-Road Equipment Pilot Project – <http://www.cert.ucr.edu/research/efr/Off-Road%20Pilot%20Implementation%20Manual.pdf>

Enhanced Fleet Modernization Program – <http://www.arb.ca.gov/msprog/aqip/efmp.htm>

Carl Moyer Program: On-Road Heavy-Duty Voucher Incentive Program – http://www.arb.ca.gov/msprog/moyer/guidelines/2011gl/2011cmp_offvip_4_28_11.pdf

Carl Moyer Program: Off-Road Voucher Incentive Program – http://www.arb.ca.gov/msprog/moyer/guidelines/2011gl/2011cmp_offvip_4_28_11.pdf

Good Movements Emission Reduction Program – <http://www.arb.ca.gov/bonds/gmbond/gmbond.htm>

PLACE Program – <http://www.arb.ca.gov/ba/loan/off-road/off-road.htm>

Alternative and Renewable Fuel and Vehicle Technology Program – <http://www.energy.ca.gov/altfuels/index.html>

LADWP Residential Home Charger Rebate – https://www.ladwp.com/cs/idcplg?IdcService=GET_FILE&dDocName=LADWP004809&RevisionSelectionMethod=LATESTRELEASED

City of Corona Alternative Fuel Vehicle Rebate Program – <http://www.discovercorona.com/City-Departments/PublicWorks/Public-Services-and-Information/Alternative-FuelVehicle-Rebate-Program.aspx>

City of Riverside Rebate – <http://www.riversideca.gov/air/alternativefuel.asp>

City of Riverside Employee Rebate – <http://www.riversideca.gov/air/alternativefuel.asp>

San Joaquin Valley Emission Reduction Incentive – <http://www.valleyair.org/Home.htm>

LADWP – <http://www.ladwp.com/ladwp/cms/ladwp002056.jsp>

Pacific Gas and Electric – http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHS_E-9.pdf

SMUD – <https://www.smud.org/en/residential/environment/plug-inelectric-vehicles/PEV-rates.htm>

SCE – <http://www.sce.com/wps/portal/home/residential/electric-cars/>

SDG&E – <http://sdge.com/clean-energy/electric-vehicles/electric-vehicles>

City of Hermosa Beach – <http://www.hermosabch.org/modules/showdocument.aspx?do%20%20cumentid=815>

City of Santa Monica – <http://www.smgov.net/Departments/OSE/Categories/Transportation/%20Automobiles.aspx>

LAX Parking – <http://www.lawa.org/parking/>

City of Sacramento – <http://www.cityofsacramento.org/transportation/parking/offstreetother.html>

Identifying Plug-In Electric Vehicle Infrastructure Needs in Communities

Governor's ZEV Action Plan – [http://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_\(02-13\).pdf](http://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_(02-13).pdf)

Electric Vehicle Charging Infrastructure Deployment Guidelines for the Greater San Diego Area – <http://www.theevproject.com/downloads/documents/Electric%20Vehicle%20Charging%20Infrastructure%20Deployment%20Guidelines%20for%20the%20Greater%20San%20Diego%20Area%20Ver%203.2.pdf>

Alternative Fuels Data Center – http://www.afdc.energy.gov/fuels/electricity_locations.html

PlugShare – <http://www.plugshare.com/>

Statewide Plug-In Electric Vehicle Infrastructure Plan – http://www.energy.ca.gov/altfuels/notices/pev_infrastructure_workshop/

General Plans, Zoning and Building Codes for Plug-In Electric Vehicles

General Plan Guidelines – http://www.opr.ca.gov/s_generalplanguidelines.php

Learn more about Santa Clara's building code updates – <http://www.sccgov.org/sites/opa/nr/Documents/State%20of%20the%20County%20Address%202013.pdf>

Learn more about the California Electrical Code – <http://www.bsc.ca.gov/>

TIA 11-2 – <http://www.nfpa.org/Assets/files/AboutTheCodes/70/TIA70-11-2.pdf>

TIA 11-3 – <http://www.nfpa.org/Assets/files/AboutTheCodes/70/TIA70-11-3.pdf>

Building Standards Commission Information Bulletin 13-02 – http://www.documents.dgs.ca.gov/bsc/cd_qustns/documents/2013/BSC-BULLETIN-13-02-Final.pdf

California Green Building Standards Code – http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf

California Electrical Code – <http://www.bsc.ca.gov/pubs/codeson.aspx>

Plug-In Electric Vehicle Infrastructure Permitting

Clean Cities YouTube Channel – <http://www.youtube.com/playlist?list=PLTTHf6mU88syVztERNF6iw088IWHZ11k4>

City of Berkeley Website – <http://www.ci.berkeley.ca.us/EVresidentialcharging/>

Natural Resources Agency's CEQA flowchart – <http://ceres.ca.gov/ceqa/flowchart/>

Single-Family Residential Charging

City of Los Angeles – <http://www.ladbs.org/LADBSWeb/e-permit.jsf>

Los Angeles County's checklist – http://www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf

South Bay uniform guidelines – http://www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf

City of Riverside's guide to EVSE permitting – <http://www.riversideca.gov/building/pdf/handouts/EV-Charger-Guidelines.pdf>

Riverside's "virtual" inspection – <http://www.riversideca.gov/econdev/riverside-streamlines-the-building-inspection-process-for-certain-residential-projects/>

Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations – http://www.pevcollaborative.org/sites/all/themes/pev/files/PEV_Permitting_120827.pdf

Charging and Permitting in Multi-Unit Dwellings

NFPA website – <http://www.nfpa.org/Assets/files/AboutTheCodes/70/TIA70-11-3.pdf>

Senate Bill 880 (Corbett, Chapter 6, Statutes of 2012) – http://leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_880_bill_20120229_chaptered.pdf

Civil Code, Section 1353.9 – <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=01001-02000&file=1352-1353.9>

Civil Code, Section 1363.07 – <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=01001-02000&file=1363.03-1363.09>

UL Website – <http://www.ul.com/global/eng/pages/offerings/industries/powerandcontrols/electricvehicle>

Prepping for Plug-In Electric Vehicles at Condos, Townhomes, and Apartments – <http://www.sdge.com/sites/default/files/documents/PreppingMultiUnitsforPlugInVehicles.pdf?nid=3350>

PEV Resource Center – <http://www.evcollaborative.org/pev-resource-center>

Workplace Charging

Learn more about Google's workplace charging – <http://www.google.org/recharge>

IRS Publication 15-B – <http://www.irs.gov/pub/irs-pdf/p15b.pdf>

Electric Vehicle Everywhere Workplace Charging Challenge – http://www1.eere.energy.gov/vehiclesandfuels/electric_vehicles/workplace_charging.html

List of participating companies – http://www1.eere.energy.gov/vehiclesandfuels/electric_vehicles/partners.html

PEV Resource Center's resources for businesses – http://www.driveclean.ca.gov/pev/Resources_For_Businesses.php

CALSTART – <http://www.evworkplace.org/>

PEV Resource Center – <http://www.evcollaborative.org/pev-resource-center>

Retail and Public Sector Charging

Plug-In Electric Vehicle Handbook for Public Charging Station Hosts – <http://www.afdc.energy.gov/pdfs/51227.pdf>

Fast Charging

Learn more about Thousand Oaks' fast charging – http://www.toaks.org/government/depts/public_works/green_n_electric_vehicles/electric_vehicle_charging.asp

Working with Utilities for Plug-In Electric Vehicle Readiness

PG&E Plug-In Electric Vehicle Savings Calculator – <http://www.pge.com/cgi-bin/pevcalculator/PEV>

SCE Plug-In Car Rate Assistant – <https://www.sce.com/nrc/pev/index.html>

AB 631 (Ma, Chapter 480, Statutes of 2011) – [http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_AB%20631%20\(Ma,%20Chapter%20480,%20Statutes%20of%202011\)%20id=201120120AB631&search_keywords](http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_AB%20631%20(Ma,%20Chapter%20480,%20Statutes%20of%202011)%20id=201120120AB631&search_keywords)

Learn more about San Diego Zoo's Solar-to-EV – <http://www.smartcitysd.org/projects/zoo>

California Municipal Utilities Association (CMUA), Electric Trans. Committee – <http://www.cmua.org/electric-transportation.html>

LA Department of Water and Power (LADWP) – <http://www.ladwp.com/ev>

Pacific Gas & Electric Company – <http://www.pge.com/pev>

Sacramento Municipal Utility District – <https://www.smud.org/en/residential/environment/plug-in-electric-vehicles/>

San Diego Gas & Electric – <http://www.sdge.com/electric-vehicles>

Southern California Edison – <http://www.sce.com/wps/portal/home/residential/electric-cars/>

PEV Resource Center Information on Charging and Electricity Rates – <http://www.driveclean.ca.gov/pev/Costs/Electricity.php>

Plug-In Electric Vehicle Infrastructure and Equipment Accessibility

United States Access Board – <http://www.access-board.gov/>

DOR's Disability Access Services unit – <http://dor.ca.gov/DisabilityAccessInfo/index.html>

Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices (DRAFT) – http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf

Identifying Fuel Cell Electric Vehicle Infrastructure Needs in Communities

DriveClean Website – http://www.driveclean.ca.gov/Search_and_Explore/Technologies_and_Fuel_Types/Hydrogen_Fuel_Cell.php

H2 Stations.Org – <http://www.netinform.net/h2/H2Stations/Default.aspx>

California Fuel Cell Partnership – <http://cafcp.org/>

A California Road Map: Bringing Hydrogen Fuel Cell Vehicles to the Golden State – http://cafcp.org/sites/files/20120814_Roadmapv%28Overview%29.pdf

Permitting Hydrogen Fueling Stations

California Stationary Fuel Cell Collaborative website – <http://www.casfcc.org/>

California Fuel Cell Partnership website – <http://www.cafcp.org/>

Introduction to Hydrogen for Code Officials – http://www.hydrogen.energy.gov/code_official_training.html

H2BestPractices.org – <http://www.h2bestpractices.org/>

Hydrogen Fueling Station Case Studies – http://www.hydrogen.energy.gov/permitting/stations_studies.cfm

Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations – <http://www.nrel.gov/docs/fy13osti/56223.pdf>

CaFCP’s educational materials for authorities having jurisdiction and first responders – <http://www.er.cafcp.org/>

California Emergency Management Agency – [http://www.calema.ca.gov/HazardousMaterials/Pages/Accidental-Release-Prevention-\(CalARP\).aspx](http://www.calema.ca.gov/HazardousMaterials/Pages/Accidental-Release-Prevention-(CalARP).aspx)

DriveClean – <http://www.driveclean.ca.gov/>

Characteristics of Hydrogen as a Fuel

Senate Bill 76 (Committee on Budget and Fiscal Review, Chapter 91, Statutes of 2005) – http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=2005200605B76&search_keywords=

Introduction to Hydrogen Safety for First Responders – <http://hydrogen.pnl.gov/FirstResponders/>

Hydrogen Safety Bibliographic Database – <http://nrelpubs.nrel.gov/Webtop/ws/hsdb/www/hydrogen/SearchForm>

H2Incidents.org – <http://www.h2incidents.org/>

2012 Emergency Response Guidebook – <http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Hazmat/ERG2012.pdf>

CaFCP’s Educational materials – <http://cafcp.org/toolkits/ER>

Hydrogen Highway Listserve – <http://cafcp.org/node/1593>

Hydrogen and Fuel Cell Safety Report – <http://www.hydrogensafety.info/>

California Fuel Cell Partnership – <http://www.er.cafcp.org/>

Hydrogen Safety Fact Sheet – http://fchea.org/core/import/PDFs/factsheets/Hydrogen%20Safety_NEW.pdf

Partnering with Community Stakeholders

Business Council on Climate Change – <http://www.bc3sfbay.org/index.html>

EV Guide for Business – <http://www.bc3sfbay.org/ev-guide-for-business.html>

Los Angeles Economic Development Corporation – <http://laedc.org/>

Charge Across Town – <http://www.chargeacrosstown.com/>

Plug In Santa Barbara – <http://www.cecsb.org/pluginsb>

California Employment Training Panel – <http://www.etp.ca.gov/>

Plug in America – <http://www.pluginamerica.org/about-us/our-history>

EV Project – <http://www.theevproject.com/index.php>

Electric Vehicle Infrastructure Training Program – <http://www.evitp.org/>
California Fuel Cell Partnership – <http://cafcp.org/maps/inmycommunity>
California Plug-in Electric Vehicle Collaborative – <http://www.evcollaborative.org/>
CALSTART – <http://www.calstart.org/Homepage.aspx>
Business Council on Climate Change – <http://www.bc3sfbay.org/>
Los Angeles Economic Development Corporation “e-Mobility task force” – <http://laedc.org/green-economy-committee/>
SoCal EV – <http://www.socalev.org/index.htm>
California Center for Sustainable Energy – <http://energycenter.org/>
Department of Energy’s Clean Cities Program – <http://www.eere.energy.gov/cleancities/>
San Diego Region – <http://www.sdcleanfuels.org/>
Coachella Valley – <http://www.c3vr.org/>
Western Riverside – <http://www.wrcog.cog.ca.us/content/cleancitiescoalition.asp>
Long Beach – <http://www.longbeach.gov/pw/longbeachcleancities/default.asp>
Southern California Association of Governments – <http://www.scag.ca.gov/cleancities/>
Los Angeles – <http://www.environmentla.org/Clean%20Cities/cleancitieshome.htm>
Antelope Valley – <http://www.antelopecleancities.com/>
Central Coast – <http://www.c-5.org/>
San Joaquin Valley – <http://www.valleycleancities.com/>
Silicon Valley – <http://www.svcleancities.org/>
San Francisco – <http://www.sfenvironment.org/transportation/clean-fuels-vehicles/san-francisco-clean-cities-coalition-sfccc>
East Bay – <http://www.cleancitieseastbay.org/>
Sacramento – <http://www.cleancitiessacramento.org/>
Eastern Sierra – <http://www.afdc.energy.gov/cleancities/coalition/nevada>
Regional Air Districts – <http://www.arb.ca.gov/drdb/dismap.htm>
Bay Area Air District – <http://www.bayareapevready.org/>
Regional Transportation Planning Agencies and MPOs – <http://www.dot.ca.gov/hq/tpp/offices/orip/>
Regional Readiness Plans – <http://www.evcollaborative.org/pev-readiness-reports>

Zero-Emission Vehicle Incentives and Outreach

“Drive Clean” Buying Guide – http://www.driveclean.ca.gov/Calculate_Savings/Incentives.php
“Electrify Your Business” – http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/electrify_your_business.pdf

IRS Publication 15-B – <http://www.irs.gov/pub/irs-pdf/p15b.pdf>

Plug-in Electric Vehicle Communication Guides – <http://www.evcollaborative.org/communication-guides>

Fuel Cell Electric Vehicle Benefits – <http://cafcp.org/goodforca>

Zero-Emission Vehicle Signs and Pavement Markings

Traffic Operations Policy Directive 13-01 – <http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/13-01.pdf>

Vehicle decals – <http://www.dmv.ca.gov/vr/decal.htm>

List of qualified vehicles – <http://www.arb.ca.gov/msprog/carpool/carpool.htm#vehicles>

Directory of Caltrans district contacts – <http://www.dot.ca.gov/localoffice.htm>

Directory of California Planning Agencies – <http://opr.ca.gov/docs/2012DOPA.pdf>

Directory of Caltrans district contacts – <http://www.dot.ca.gov/localoffice.htm>

Zero-Emission Vehicle Signs and Pavement Markings Policy Directive – <http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/13-01.pdf>

California Manual on Uniform Traffic Control Devices (MUTCD) – http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2012.htm

Greening Fleets with Zero-Emission Vehicles

Learn more about the Bay Area Climate Collaborative's work – <http://www.baclimate.org/bay-area-climate-collaborative-blog/rollout-of-50-mitsubishi-all-electric-vehicles-to-city-of-san-jose-town-of-los-gatos-city-of-campbell-and-city-of-mill-valley-marks-significant-electric-vehicle-milestone.html>

UC Irvine's Advanced Power and Energy Program – <http://www.apep.uci.edu/3/>

ZEV-NET – <http://zevnet.fastfleet.net/about>

DGS website – <http://www.dgs.ca.gov/buyinggreen/Home/BuyersMain/Transportation/Cars.aspx>

Plug-In Electric Vehicle Handbook for Fleet Managers – http://www.afdc.energy.gov/pdfs/pev_handbook.pdf

Economic Benefits of Zero-Emission Vehicle Readiness

Rio Hondo College Alternative Fuel Program – <http://www.riohondo.edu/tech/auto/alternativefuels.htm>

Saddleback College's alternative fuel technologies program – <http://www.saddleback.edu/atas/autotech/AlternativeFuelTechnologies.html>

EV Project – <http://www.theevproject.com/index.php>

Electric Vehicle Infrastructure Training Program – <http://www.evitp.org/>

Careers in Electric Vehicles – http://www.bls.gov/green/electric_vehicles/electric_vehicles.pdf

Featured Resources

General Plan Guidelines – http://www.opr.ca.gov/s_generalplanguidelines.php

Zero-Emission Vehicle Signs and Pavement Markings Policy Directive – <http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/13-01.pdf>

California Manual on Uniform Traffic Control Devices – http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2012.htm

Statewide Plug-In Electric Vehicle Infrastructure Plan – http://www.energy.ca.gov/altfuels/notices/pev_infrastructure_workshop/

California Green Building Standards Code – http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf

California Electrical Code – <http://www.bsc.ca.gov/pubs/codeson.aspx>

Streamlining the Permitting and Inspection Process for Plug-In Electric Vehicle Home Charger Installations – http://www.pevcollaborative.org/sites/all/themes/pev/files/PEV_Permitting_120827.pdf

PEV Resource Center – <http://www.evcollaborative.org/pev-resource-center>

CALSTART – <http://www.evworkplace.org/>

PEV Resource Center – http://www.driveclean.ca.gov/pev/Resources_For_Businesses.php

Plug-In Electric Vehicle Handbook for Public Charging Station Hosts – <http://www.afdc.energy.gov/pdfs/51227.pdf>

California Municipal Utilities Association (CMUA) – <http://www.cmua.org/electric-transportation.html>

Los Angeles' Department of Water and Power (LADWP) – <http://www.ladwp.com/ev>

Pacific Gas & Electric Company – <http://www.pge.com/pev>

Sacramento Municipal Utility District (SMUD) – <https://www.smud.org/en/residential/environment/plug-in-electric-vehicles/>

San Diego Gas & Electric – <http://www.sdge.com/cleantransportation>

Southern California Edison – <http://www.sce.com/wps/portal/home/residential/electric-cars/>

Plug-In Electric Vehicle (PEV) Resource Center – <http://www.driveclean.ca.gov/pev/Costs/Electricity.php>

Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices (DRAFT) – http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf

A California Road Map: Bringing Hydrogen Fuel Cell Vehicles to the Golden State – http://cafcp.org/sites/files/20120814_Roadmapv%28Overview%29.pdf

Drive Clean – <http://www.driveclean.ca.gov/>

Hydrogen Safety Fact Sheet – http://fchea.org/core/import/PDFs/factsheets/Hydrogen%20Safety_NEW.pdf

Regional Readiness Plans – <http://www.evcollaborative.org/pev-readiness-reports>

Bay Area and Monterey Bay Area – http://www.evcollaborative.org/sites/all/themes/pev/files/docs/ba_pev_plan.pdf

Central Coast – http://www.evcollaborative.org/sites/all/themes/pev/files/docs/cc_pev_plan.pdf

Los Angeles (South Coast) – http://www.evcollaborative.org/sites/all/themes/pev/files/docs/SouthCoast_PEV_Readiness_Plan_Main.pdf

Sacramento – http://www.evcollaborative.org/sites/all/themes/pev/files/docs/sac_pev_plan.pdf

San Diego – http://www.evcollaborative.org/sites/all/themes/pev/files/docs/SD_PEV_Readiness_Plan_Main.pdf

San Joaquin Valley – http://www.evcollaborative.org/sites/all/themes/pev/files/docs/SJV%20PEV_Readiness_Plan_Main.pdf

Plug-in Electric Vehicle Communication Guides – <http://www.evcollaborative.org/communication-guides>

Fuel Cell Electric Vehicle Benefits – <http://cafcp.org/goodforca>

Plug-In Electric Vehicle Handbook for Fleet Managers – http://www.afdc.energy.gov/pdfs/pev_handbook.pdf

Careers in Electric Vehicles – http://www.bls.gov/green/electric_vehicles/electric_vehicles.pdf

Recommended Tools

California Plug-In Electric Vehicle Collaborative Resources – <http://www.pevcollaborative.org/resources>

California Fuel Cell Partnership Resources – <http://cafcp.org/>

DriveClean.Ca.Gov – http://www.driveclean.ca.gov/Think_Clean/Tips_And_Advice/Why_Drive_Clean.php

Zero-Emission Vehicle Incentives – http://www.driveclean.ca.gov/Calculate_Savings/Incentives.php

GoElectric Drive Resources – <http://www.goelectricdrive.com/index.php/resources>

Alternative Fueling Station Locator – <http://www.afdc.energy.gov/locator/stations/>

eGallon Calculator – <http://energy.gov/articles/egallon-how-much-cheaper-it-drive-electricity>

Vehicle Cost Calculator – <http://www.afdc.energy.gov/calc/>

Petroleum Reduction Planning Tool – <http://www.afdc.energy.gov/prep/>

Electric Vehicle Safety Training – <http://www.evsafetytraining.org/>

Permitting Hydrogen Facilities – <http://www.hydrogen.energy.gov/permitting/>

Greening Fleets with Zero-Emission Vehicles: Example Ordinance

Electrify Heartland Plan – <http://electrifyheartland.org/wp-content/uploads/J-complete.pdf>

Zero-Emission Vehicle Infrastructure Permitting: CEQA Exemptions

CEQA Statute and Guidelines – http://ceres.ca.gov/ceqa/docs/CEQA_Handbook_2012_wo_covers.pdf

Notice of Exemption Form – <http://opr.ca.gov/docs/NOE.pdf>

Plug-In Electric Vehicle Community Readiness Scorecard

Plug-In Electric Vehicle Community Readiness Scorecard – <https://www.afdc.energy.gov/pev-readiness>

Plug-In Electric Vehicle Infrastructure Permitting Checklist

California Plug-In Electric Vehicle Collaborative – <http://www.pevcollaborative.org/>

Single-Family Residential Permitting Application Example

City of Davis's Application for Residential Building Permit – <http://community-development.cityofdavis.org/Media/Default/Documents/PDF/CDD/building/forms/Permit-Application-Residential.pdf>

City of San Diego's online E-Permit – <http://www.sandiego.gov/development-services/pdf/industry/infobulletin/ib187.pdf>

U.S. Department of Energy's Permit for Charging Equipment Installation – http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf

City and County of San Francisco's Worksheet for Electric Permit – <http://www.sfdbi.org/modules/showdocument.aspx?documentid=2755>

Plug-In Electric Vehicle Load Calculator for Level 2 Charging

City of Riverside's Residential Electric Vehicle Charger Guidelines – <http://www.riversideca.gov/building/pdf/handouts/EV-Charger-Guidelines.pdf>

Plug-In Electric Vehicle Checklists for Residents and Businesses

DriveClean's Plug-In Electric Vehicle Owner Checklist – http://www.driveclean.ca.gov/pev/Plug-in_Electric_Vehicles/Owner_Checklist.php

DriveClean's Plug-In Electric Vehicle Readiness Policy Checklist for HOAs, Owners, and Management – http://driveclean.ca.gov/pev/Charging/Home_Charging/Multi-unit_Dwellings.php

CALSTART's Plug-In Electric Vehicle Workplace Charging Checklist – <http://www.evworkplace.org/best-practices.html>

Zoning Example for Installation of Plug-In Electric Vehicle Charging Stations

Lancaster's Municipal Code – <http://www.cityoflancasterca.org/index.aspx?page=38>

Example Building Codes for Plug-In Electric Vehicle Charging

Lancaster's Municipal Code – <http://www.cityoflancasterca.org/index.aspx?page=38>

Plug-In Electric Vehicle Parking Code Example

Traffic Operations Policy Directive 13-01 – <http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/13-01.pdf>

City of Santa Monica's Municipal Code – <http://www.qcode.us/codes/santamonica/>

Consumer Awareness Guides

Plug-in Electric Vehicle Handbook for Consumers – <http://www.afdc.energy.gov/pdfs/51226.pdf>

Residential Plug-In Electric Vehicle Charging System Permit Guide – http://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/PEV%20guide.pdf

Guide to Electrical Vehicle Supply Equipment Permits for Residential – http://www.cityofsacramento.org/dsd/customer-service/documents/CityofSac_ElectricVehiclePermitGuidePacket_Oct_20_11.pdf

The ABCs of Plug-In EVs – <http://www.sdge.com/sites/default/files/documents/The%20ABCs%20of%20Plug-In%20EVs.pdf>

Prepping for Plug-in Vehicles at condos, townhomes and apartments – <http://www.sdge.com/sites/default/files/documents/Prepping%20for%20EVs%20Condos.pdf?nid=3105>

Hydrogen Safety Checklist

Hydrogen Safety Panel's Hydrogen Safety Checklist – <http://h2bestpractices.org/docs/HydrogenSafetyChecklist.pdf>

Resources for Zero-Emission Vehicle Readiness

State of California Resources

Governor's ZEV Executive Order – <http://gov.ca.gov/news.php?id=17463>

ZEV Action Plan – [http://opr.ca.gov/docs/Draft2012ZEVActionPlan\(09-21-12\).pdf](http://opr.ca.gov/docs/Draft2012ZEVActionPlan(09-21-12).pdf)

California Air Resources Board Advanced Clean Cars Program – http://www.arb.ca.gov/msprog/consumer_info/advanced_clean_cars/consumer_acc.htm

California Department of General Services, Office of Fleet and Asset Management – <http://www.dgs.ca.gov/ofam/Programs/FARS/AFVP.aspx>

California Energy Commission "Drive" website – <http://www.energy.ca.gov/drive/>

California Energy Commission Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program – <http://www.energy.ca.gov/2012-ALT-2/>

Plug-in Electric Vehicle Resource Center – <http://www.driveclean.ca.gov/pev>

The Emergency Response Guide to Alternative Fuel Vehicles – <http://osfm.fire.ca.gov/training/pdf/alternativefuelvehicles/Altfuelintroduction.pdf>

State of California Departments

California Air Resources Board (CARB) – <http://www.arb.ca.gov/>

California Building Standards Commission – <http://www.bsc.ca.gov/>

California Department of Food and Agriculture, Division of Measurement Standards – <http://cdfa.ca.gov/dms/>

California Department of General Services, Division of the State Architect – <http://www.dsa.dgs.ca.gov/>

California Department of Housing and Community Development – <http://www.hcd.ca.gov/>

California Department of Rehabilitation – <http://www.rehab.cahwnet.gov/>

California Department of Transportation (Caltrans) – <http://www.dot.ca.gov/>

California Energy Commission – <http://www.energy.ca.gov/>

Governor's Office of Planning and Research (OPR) – <http://opr.ca.gov/>

Federal Resources

Department of Energy Alternative Fuels Data Center – <http://www.afdc.energy.gov/>

Department of Energy Clean Cities – <http://www1.eere.energy.gov/cleancities/index.html>

Electric Vehicle and Infrastructure Codes and Standards Citations – <http://www.afdc.energy.gov/pdfs/48605.pdf>

GPAT: Government Product/Service Accessibility Template (GPAT) – https://app.buyaccessible.gov/baw/tell_me_more/what_is_gpat.htm

Hydrogen Vehicle and Infrastructure Codes and Standards Citations – <http://www.afdc.energy.gov/pdfs/48608.pdf>

Safety Planning Guidance for Hydrogen and Fuel Cell Projects – http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/safety_guidance.pdf

Reaching the U.S. Fire Service with Hydrogen Safety Information – <http://www.nfpa.org/assets/files/pdf/research/report%20final%20h2fs.pdf>

Resources from Other States

Washington Electric Vehicle Infrastructure Deployment Guidelines for Local Government – http://www.psrc.org/assets/4325/EVI_full_report.pdf

Oregon Electric Vehicle Infrastructure Deployment Guidelines – <http://www.oregon.gov/ODOT/HWY/OIPP/docs/evdeployguidelines3-1.pdf>

West Coast Electric Highway – <http://www.westcoastgreenhighway.com/electrichighways.htm>

Hawaii's ZEV Guidebook – http://energy.hawaii.gov/wp-content/uploads/2011/09/updated-EV-Guidebook_FINAL_Sep-25_2012.pdf

New Jersey Information about Permitting Charging Stations – <http://www.nj.gov/dep/sage/docs/ev-charging-stations.pdf>

Nonprofit Resources

California Fuel Cell Partnership (CaFCP) – <http://www.cafcp.org/>

California Plug-in Electric Vehicle Collaborative – <http://www.evcollaborative.org/>

The EV Project – <http://www.theevproject.com/documents.php>

California and Regional PEV Data Resource – <http://www.energycenter.org/cvrp>

Center for Climate and Energy Solutions PEV Initiatives – <http://www.c2es.org/initiatives/pev>

California Plug-in Electric Vehicle Owner Survey – http://energycenter.org/index.php/incentive-programs/clean-vehicle-rebate-project/vehicle-owner-survey?utm_source=pev-survey&utm_medium=url&utm_campaign=cvrp

Plug-in America – <http://www.pluginamerica.org/>

Hybrid and EV First and Second Responder Recommended Practice – http://standards.sae.org/j2990_201211/

Hydrogen Fuel Cell Safety Meetings and Events – <http://www.hydrogenandfuelcellsafety.info/meetings.asp>

Hydrogen/Fuel Cell Codes and Standards – <http://www.fuelcellstandards.com/>

Publications

A California Road Map – Bringing Hydrogen Fuel Cell Electric Vehicles to the Golden State – <http://cafcp.org/carsandbuses/caroadmap>

A Road Map for Fuel Cell Electric Buses in California: A zero-emission solution for public transit – <http://cafcp.org/carsandbuses/busroadmap>

Accessibility and Signage for Plug-In Electric Vehicle Charging Infrastructure – http://www.evcollaborative.org/sites/all/themes/pev/files/PEV_Accessibility_120827.pdf

Evaluating Land Use Opportunities and Existing Charge Stations – http://164.67.121.27/files/Downloads/luskincenter/EV/PEV_Readiness_Plan_Ch4_Land_Use.pdf

Luskin Center for Innovation: Financial Viability of Non-Residential EV Charging Stations – http://luskin.ucla.edu/sites/default/files/Non-Residential%20Charging%20Stations.pdf?utm_source=EV+August+Announcement&utm_campaign=EV+MUD%2FCharging+Stations&utm_medium=email

Luskin Center for Innovation: Increasing Electric Vehicle Charging Access in Multi-Unit Dwellings – http://luskin.ucla.edu/sites/default/files/EV%20Charging%20in%20LA%20MUDs.pdf?utm_source=EV+August+Announcement&utm_campaign=EV+MUD%2FCharging+Stations&utm_medium=email

Luskin Center for Innovation: Southern California Plug-in Electric Vehicle Readiness Plan – http://164.67.121.27/files/Downloads/Luskincenter/ev/PEV_Readiness_Plan_Ch05.pdf

Powering Innovation: California is Leading the Shift to Electric Vehicles from R&D to Early Adoption – <http://www.next10.org/powering-innovation-california-leading-shift-electric-vehicles-rd-early-adoption>

Ready, Set, Charge, California! – <http://www.baclimate.org/impact/evguidelines.html>

Streamlining the Permitting and Inspection Process for Plug-in Electric Vehicle Home Charger Installations – http://www.evcollaborative.org/sites/all/themes/pev/files/PEV_Permitting_120827.pdf

Title 24, California Code of Regulations – <http://www.bsc.ca.gov/codes.aspx>

UC Los Angeles and UC Berkeley Law School: Electric Drive by '25 – http://cdn.law.ucla.edu/SiteCollectionDocuments/Environmental%20Law/Electric_Drive_by_25.pdf

Codes and Standards Developers

Institute of Electrical and Electronic Engineers (IEEE) – <http://www.ieee.org/index.html>

International Code Council (ICC) – <http://www.iccsafe.org/Pages/default.aspx>

National Electrical Manufacturers Association (NEMA) – <http://www.nema.org/pages/default.aspx>

National Fire Protection Association (NFPA) – <http://www.nfpa.org/>

Society of Automotive Engineers (SAE) – <http://www.sae.org/>

Underwriters Laboratories (UL) – <http://www.ul.com/usa/eng/pages/>

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