San Joaquin Valley

# PLUG-IN ELECTRIC VEHICLE READINESS PLAN

May 2014

Preparing the San Joaquin Valley for Plug-in Electric Vehicles

Center for Sustainable Energy® CALIFORNIA

San Joaquin Valley AIR POLLUTION CONTROL DISTRICT

# Contents

# Appendix

**Fact Sheets**

1. The Basics: A Guide to Plug-in Electric Vehicles and Charging Infrastructure
2. Charging Environments: Single-family Residences and Multi-unit Dwellings
3. Charging Environments: Retail and Public Locations
4. Charging Environments: Workplaces
5. Homeowner's Guide for Permitting and Inspecting EV Chargers
6. Sample Zoning Code Provisions
7. Local Utilities: Solutions and Programs for Plug-in Electric Vehicle Charging
8. Local Government Action Plans: Best Practices for Plug-in Electric Vehicle Readiness

**Electric Vehicle Charging Station Installation Guidelines**

1. Fleet
2. Residential
3. Nonresidential

**Considerations for Public Agencies that Provide Charging**

1. Considerations for Public Agencies that Provide Charging
2. Request for Proposals Template

**Fleet Electrification Case Study: UPS in the San Joaquin Valley**

**Costs and Benefits of Switching to a Plug-in Electric Vehicle**

**Regional Residential Solar and Plug-in Electric Vehicle Adoption**

**San Joaquin Valley Utilities' Electricity Sources**

**Works Cited**

**Compilation of Plan and Resource Hyperlinks**

**Glossary of Terms, Abbreviations and Acronyms**

# List of Tables and Figures

# Executive Summary

The San Joaquin Valley Plug-in Electric Vehicle Readiness Plan (the Plan) serves as a tool to support local government officials, including planners, code officials and building inspectors when planning for plug-in electric vehicle (PEV) and charging infrastructure deployment, and assists local policymakers and regional stakeholders in addressing the complexities behind barriers to PEV adoption in the region. The Plan builds on previous PEV readiness efforts conducted statewide and in the San Joaquin Valley. In December 2012, the San Joaquin Valley Air Pollution Control District (SJVAPCD) released the San Joaquin Valley PEV Community Assessment, evaluating the level of PEV readiness among jurisdictions in the region. The assessment results showed that, in addition to the barriers found throughout the state, the San Joaquin Valley region (Valley) exhibits additional barriers due to its unique geographic and socioeconomic characteristics.

The most prevalent of these barriers is the up-front cost of an electric vehicle. In a region where more than 20% of the population lives below the poverty line, the concept of purchasing or leasing a new car – let alone, a PEV – is seemingly out of reach for many Valley residents. With this in mind, the Plan was developed to introduce innovative strategies that can make PEVs affordable and accessible for the majority of Valley residents, which include people living in environmental justice communities. These strategies allow continuous implementation beyond the Plan and include near- and long-term "PEV readiness recommendations" for regional stakeholders.

In order to maximize the Plan's effectiveness, an advisory group of regional stakeholders from public agencies, local energy utilities and charging station manufacturers, organized as the San Joaquin Valley Plug-in Electric Vehicle Coordinating Council (PEVCC), used the results of the 2012 assessment and prioritized 11 market barriers to the deployment of PEVs and public charging infrastructure (also known as electric vehicle supply equipment or EVSE). Valley-specific resources and recommendations were created to address each market barrier. Table 1 lists the barriers and corresponding resources in order of priority.

These resources range from easy-to-read fact sheets to EVSE installation guidelines and outreach strategies to environmental justice communities. These materials are intended for distribution among members of the community, city and county staff, local elected officials and other stakeholders interested in growing the PEV market in communities throughout the Valley. These resources can be found in the Appendix of the Plan.

Table 1: Market Barriers to PEV Adoption in the San Joaquin Valley

| Market Barriers | Resources |
|---|---|
| Lack of Public Awareness of PEVs and Economic Challenges | The Basics: A Guide to Plug-in Electric Vehicles and Charging Infrastructure<br><br>Costs and Benefits of Switching to a Plug-in Electric Vehicle |
| Zoning Policies, Parking and Signage | Sample Zoning Code Provisions |
| Training for Electrical Contractors | Electric Vehicle Charging Station Installation Guidelines: Fleet, Residential, Nonresidential |
| Permitting and Inspection | Homeowner's Guide for Permitting and Inspecting EV Chargers |
| Utility System Impacts and Rate Design | Local Utilities: Solutions and Programs for Plug-in Electric Vehicle Charging<br><br>San Joaquin Valley Utilities' Electricity Sources |
| Workplace Charging | Charging Environments: Workplaces |
| Building Codes for PEV Charging | Local Government Action Plans: Best Practices for Plug-in Electric Vehicle Readiness |
| Charging at Multi-unit Dwellings | Charging Environments: Single-family Residences and Multi-unit Dwellings |
| Fleet Electrification | Electric Vehicle Charging Station Installation Guidelines: Fleet<br><br>Fleet Electrification Case Study: UPS in the San Joaquin Valley |
| Leveraging Renewable Energy | Regional Residential Solar and Plug-in Electric Vehicle Adoption<br><br>San Joaquin Valley Utilities' Electricity Sources |
| Regional Charging Station Siting Analysis and Geographic Challenges | Charging Roadmap: Optimal Locations for Public Charging Stations in the San Joaquin Valley<br><br>Considerations for Public Agencies that Provide Charging<br><br>Request for Proposals Template |


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12
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# Introduction

The San Joaquin Valley Air Basin comprises eight counties in California's Central Valley: San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and the western portion of Kern. There are more than 60 incorporated cities within the Valley's approximately 27,000 square miles, which are home to approximately 4.1 million residents.

The characteristics that make the Valley the state's top-performing agricultural region and a beautiful place to live also create conditions for forming and trapping air pollution. Surrounding mountains, stagnant weather patterns, hot summers and foggy winters make the formation of air pollution in the Valley inevitable and prevent air pollutants from dispersing. In addition to local pollution created from industry and agriculture, air quality in the San Joaquin Valley is influenced by transported air pollution from the Bay Area and Sacramento and on-road vehicles that travel through the Valley's highway and interstate corridors.

Mobile sources account for 80% of the Valley's smog problem.[1] Light-duty vehicles emit the third most nitrogen oxides, a main ingredient of smog, of all other on-road motor vehicles (about 14.7 tons per day).[2] Increased smog leads to adverse health effects, including childhood asthma and premature births. As vehicle miles traveled continues to grow alongside the region's booming population, air pollution from mobile sources will remain an issue. Widespread PEV adoption has been identified as a goal statewide to mitigate pollution generated from light-duty vehicles.[3]

To enable widespread adoption of PEVs, all segments of the population, especially low income and rural communities, must be considered. The San Joaquin Valley Air Pollution Control District (SJVAPCD) has a history of successfully developing and implementing innovative strategies to reduce air pollution in the Valley and ensuring programs are accessible to all Valley residents. The SJVAPCD's Drive Clean! Rebate Program is the largest region-specific PEV rebate program in the state. Current or future incentive programs, such as Drive Clean!, will need to continually adapt to a growing PEV market to ensure that PEVs are affordable and accessible for all Valley residents and businesses.

1 San Joaquin Valley Air Pollution Control District (2013). *Air Quality in the San Joaquin Valley*. **http://www.valleyair.org/kids/docs/Generalpptforwebsite-2013.pdf**
2 California Air Resources Board. Almanac Emissions Projection Data (2010).
3 San Joaquin Valley Air Pollution Control District. 2012-13 *Annual Report*. Page 25.

## Background

This Plan is part of larger efforts to prepare communities throughout the state and the country for plug-in vehicles. In early 2011, the U.S. Department of Energy Clean Cities Program funded 16 grants for PEV readiness planning in 24 states. The State of California was awarded one of these grants and subsequently funded PEV planning efforts in six regions across the state, including the San Joaquin Valley.

The California Energy Commission (Energy Commission) provided a second round of investment to nine regions across the state in 2012 to fund the establishment of local PEV coordinating councils tasked with creating region-specific PEV plans. The SJVAPCD was one of the recipients of this grant funding. The funding provided for the creation of the San Joaquin Valley PEVCC and the development of this Plan. The Energy Commission will use each regional plan to build a statewide PEV infrastructure plan.

In order to encourage extensive PEV deployment in environmental justice communities and help address the region's air quality, the SJVAPCD Governing Board authorized the establishment of the San Joaquin Valley PEVCC in October 2012. It was organized to provide policy direction and guide efforts to create collaboration among regional stakeholders to address regional PEV readiness.

The San Joaquin Valley PEVCC is a 28-member advisory group composed of local metropolitan planning organizations, cities, counties, utilities, the San Joaquin Valley Clean Cities Coalition, electric vehicle service providers, local consultants and nonprofit organizations. The PEVCC met regularly during 2013 and served as an advisory committee to ensure the Plan is tailored to local conditions and responsive to local needs.

This Plan also aligns with state policies for deploying PEVs across California. In March 2012, Governor Jerry Brown issued **Executive Order B-16-2012**, which calls for 1.5 million zero-emission vehicles (ZEVs) on California roadways by 2025 and directs state government agencies to incorporate ZEVs into their light-duty fleets. In addition, the governor executed **Executive Order B-18-2012** that directs state agencies to "identify and pursue opportunities to provide electric vehicle charging stations, and accommodate future charging infrastructure demand, at employee parking facilities in new and existing buildings."

PEV Coordinating Council
San Joaquin Valley

## Challenges Unique to the San Joaquin Valley

The Valley is an expansive region with many disadvantaged, rural and small communities that are very spread out. As much as 33% of Kings County, 27% of Merced County and 19% of San Joaquin County are disadvantaged communities, with the city of Fresno labeled as the most disadvantaged community in California.[4] Unemployment in the region is as high as 15% and is far higher than that of any other community in California.[5]

Unlike the Bay Area or Los Angeles, which may be denser and have public transit opportunities in disadvantaged communities, mobility through personal vehicles is the primary way for Valley residents to get access to jobs. Six percent of commutes take more than 90 minutes a day, which is more than double the statewide rate of 3 percent.[6] Families in the Valley spend over a third of their gross income on vehicle expenses whereas the average U.S. household spends only 15 percent.[7]

A one-size-fits-all approach to encouraging investment in PEVs is not feasible for the Valley due to its unique socioeconomic conditions. PEVs must be perceived as not just economical for a household, but the market itself must be seen as an opportunity for investment in the community.

## Environmental Benefits from Plug-in Electric Vehicle Deployment in the Region

### Background

The San Joaquin Valley Air Basin is one of only two areas in the nation designated as "extreme nonattainment" for the federal ozone standard.[8,9] Ground-level ozone pollution, commonly known as smog, forms when sunlight reacts with air containing hydrocarbons and nitrogen oxides (NOx), both of which are emitted by the combustion of fossil fuels.

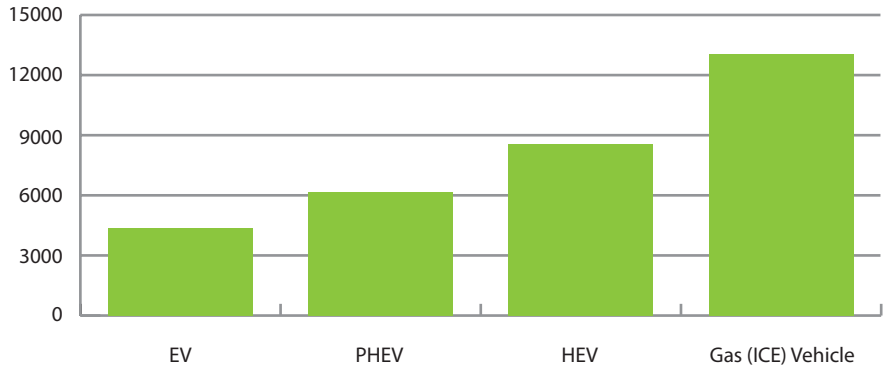
Diesel trucks and mobile agriculture equipment are the single largest source of NOx emissions as the San Joaquin Valley is dominated by interstate trucks and other through traffic.[10] Heavy-duty vehicles contribute 6% of particulate matter (PM) and 46% of NOx in the Valley. Such emissions lead to hazardous health conditions.

4 As defined by CalEPA's CalEnviroScreen, which calculates and ranks disadvantaged communities throughout California.
5 U.S. Census Bureau: State and County QuickFacts. **http://quickfacts.census.gov/**
6 Margonelli, L. (2014). *Driving Out of the Red with Greener Cars*. New America Foundation.
7 Center for Neighborhood Technology. *H+T Affordability Index*.
8 California Air Resources Board "Vision for Clean Air Public Review Draft," June 27, 2012.
9 On Nov 14, 2013, the SJVAPCD announced that they had zero violations of the hourly ozone standard and submitted a formal request to the U.S. Environmental Protection Agency to declare the Valley in attainment.
10 "Vision for Clean Air"

## Smog-forming Emissions – Plug-in Electrics vs. Gasoline

Research into the well-to-wheel smog-forming emissions of different fuel types shows that current gasoline (internal combustion engine, or ICE) vehicles emit seven times more pollutants than an electric vehicle and more than twice as much as a plug-in hybrid electric vehicle (PHEV).[11] Even as gasoline vehicles become more efficient and use less fuel per mile, plug-in electric vehicles (PEVs) will still emit considerably fewer smog-forming pollutants. Despite advances in vehicle technology, projections for 2020 show gasoline vehicles will continue emitting more than five times the smog-forming pollutants as all-electric vehicles and nearly twice as much as PHEVs.

### Figure 1: Annual Emissions Per Vehicle (lb. of $CO_2$ equivalent)[12]




While much of these avoided emissions come from the fuel cycle – the extraction, transportation, refining and manufacture or generation of a specific fuel – whose reductions would not have large immediate environmental benefits for the Valley, the reduction in emissions attributed to vehicle use would directly impact the Valley's air quality.

## Why is this Important?

Although substantial progress has been made to improve the region's air quality, all eight counties in the San Joaquin Valley Air Basin still suffer significant ozone and PM levels due to several unique variables, including the Valley's topography, geography, climate and emissions generated by motor vehicles traveling through the Valley on transportation corridors that connect the northern and southern regions of the state.

11 California Air Resources Board, "Advanced Clean Cars Summary," **http://www.arb.ca.gov/msprog/clean_cars/acc%20summary-final.pdf**.
12 **http://www.afdc.energy.gov/vehicles/electric_emissions.php**

In 2013, the San Joaquin Valley reached a historic milestone by achieving attainment of the hourly ozone standard established under the federal Clean Air Act. Through a variety of air quality management strategies, including prohibitory measures and voluntary incentives established by the San Joaquin Valley Air Pollution Control District (SJVAPCD), and with the commitment and sacrifices made by Valley businesses and residents, the Valley will become the first region in the nation with an "extreme" nonattainment classification that has met the federal standard. The SJVAPCD has formally requested the Environmental Protection Agency to redesignate the region and is currently awaiting approval of its request. Despite this momentous achievement, the San Joaquin Valley Air Basin remains in nonattainment for other federal air quality standards and further emission reduction strategies are required to continue improving the air quality in the region. The use of PEVs in the Valley to replace vehicle miles traveled by gasoline vehicles is one important strategy that can assist the Valley in reaching attainment and protecting the health of its residents.

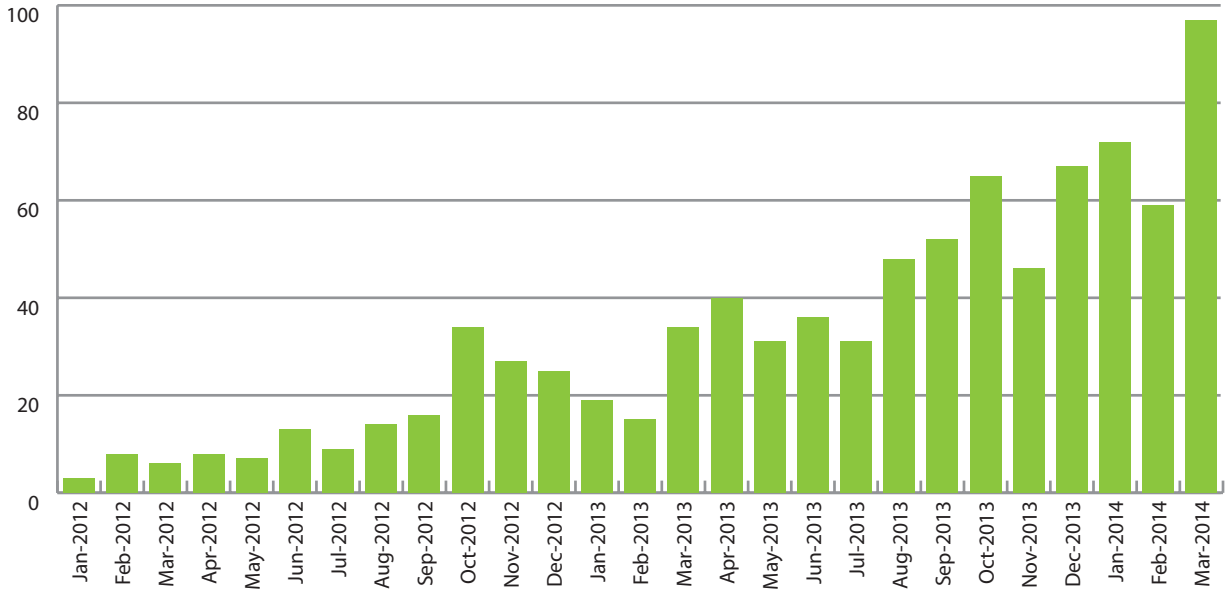
## PEV Landscape in the Valley

The Valley holds a small share of the California PEV market. Approximately 1.5% of California PEVs are registered in the Valley whereas air districts such as the Bay Area, South Coast and San Diego hold 35%, 45% and 8.5% of the state's market, respectively.

Though there is a large disparity that exists between the Valley and the other regions in the state, the San Joaquin Valley experienced a thirteenfold increase in PEV adoption between December 2011 and December 2013.

To support this tremendous growth, the region needs a robust charging network along with greater efforts to expand opportunities for everyone to enter the PEV market. The following table displays the total number of newly purchased or leased PEVs in the San Joaquin Valley APCD territory by month from May 2010 to March 2014.

**Figure 2: San Joaquin Valley PEV Adoption**[13]




## The Use of Incentives to Encourage PEV Adoption

### Background

Despite the numerous benefits and reports of widespread owner satisfaction with plug-in electric vehicles (PEVs), their high initial purchase price compared to conventional internal combustion engine (ICE) vehicles remains an obstacle to adoption.[14] This price differential discourages consumers who are reluctant to spend more up front on a new vehicle despite the fact that PEVs have lower total cost of ownership than many ICEs.[15]

As was the case when hybrid vehicles were introduced, incentives in the form of rebates and tax credits have been instrumental in enticing early adopters to purchase PEVs. According to statistics from the 2013 California Plug-in Electric Vehicle Driver Survey (released May 2013), 91% of San Joaquin Valley respondents indicated that the state rebate was an important motivation for purchasing a PEV; nearly 68% said it was a "very important" or "extremely important" motivation. These results are almost identical to survey respondent motivations statewide.

13 PEV adoption numbers are from Clean Vehicle Rebate Project data.
14 California Center for Sustainable Energy, "*California Plug-in Electric Vehicle Driver Survey Results*," May 2013. **http://energycenter.org/clean-vehicle-rebate-project/vehicle-owner-survey/may-2013-survey**
15 Electrification Coalition, "*State of the Plug-in Electric Vehicle Market: EV Market Outlook*" July 25, 2013. **http://www.Electrificationcoalition.org**.

The San Joaquin Valley is composed of many low-income, disadvantaged communities and the median household income in the Valley is much lower than other regions of the state where the adoption of PEVs is more widespread. Clearly, providing incentives to Valley residents is crucial to encourage and increase the adoption of PEVs.

## San Joaquin Valley Incentive Programs

SJVAPCD administers three unique incentive programs to encourage consumer PEV demand: Drive Clean! Rebate Program, New Alternative Fuel Vehicle Purchase Program[16] and Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP) Plus-up. Purchasing an alternative fuel vehicle seems economically feasible thanks to such generous incentives.

Table 2 is an overview of the incentives available for PEV drivers in the San Joaquin Valley.

### Table 2: PEV Incentives Available in the San Joaquin Valley

| Incentive | Benefits |
|---|---|
| **Statewide** | |
| California Clean Vehicle Rebate Project (CVRP) | Rebates of up to $2,500 are available for Californians purchasing or leasing light-duty zero-emission vehicles and PEVs. For fiscal year 2014/2015, the California Air Resources Board has proposed a number of changes to the CVRP including limiting program eligibility to vehicles with an MSRP below $60,000, lower rebate amounts, limiting two rebates per person in perpetuity (exempting fuel-cell vehicles), and increased incentive amount for fuel-cell vehicles. |
| Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP) | Grants vouchers from $8,000 to $45,000 for the purchase of each eligible hybrid or electric truck or bus. |
| **San Joaquin Valley-specific** | |
| HVIP Plus-Up | San Joaquin Valley fleets can add up to $30,000 more per HVIP voucher. |
| Drive Clean! | Provides rebates for SJV residents purchasing new, clean vehicles. Rebates range from up to $2,000 for PHEVs and up to $3,000 for BEVs. |
| New Alternative Fuel Vehicle Program | Provides a maximum of $20,000 per vehicle with a cap of $100,000 per public agency per year for new alternative fuel vehicle purchases. |
| **City-specific** | |
| PACE HERO Financing | Fresno residents can now benefit from Western Riverside Council of Governments (WRCOG)'s HERO program. It allows financing for permanently affixed energy efficiency and renewable energy products, including electric vehicle supply equipment. |

16 This program is part of the Public Benefit Grants Program.

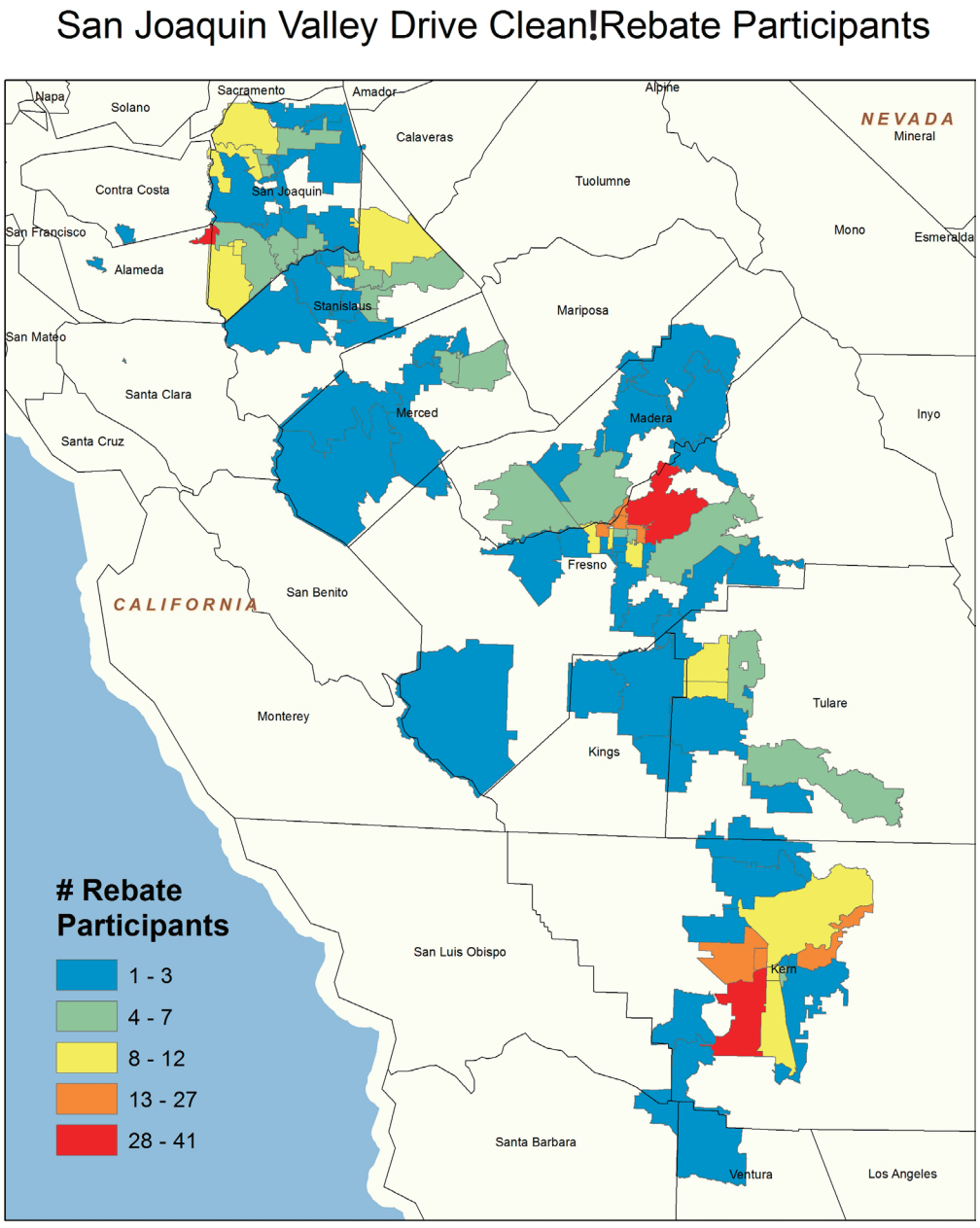
### *Drive Clean! Rebate Program*

The Drive Clean! Rebate Program was launched by the SJVAPCD to increase outreach efforts and deployment of clean-air vehicles, including PEVs, in the San Joaquin Valley. Valley residents can combine the rebates received through the Drive Clean! Rebate Program and the California Air Resources Board's Clean Vehicle Rebate Project (CVRP) to reduce the total cost of the vehicle and make ownership of a PEV more feasible.

Since the introduction of the Drive Clean! Rebate Program in March 2012, the CVRP has seen an uptick in rebate activity for the San Joaquin Valley as shown in Figure 4. However, the pattern of rebates in the SJVAPCD largely follows that of the state as a whole. As a result, it is difficult to attribute the increase in PEV adoption (as measured by CVRP applications) to the implementation of the Drive Clean! Rebate Program.

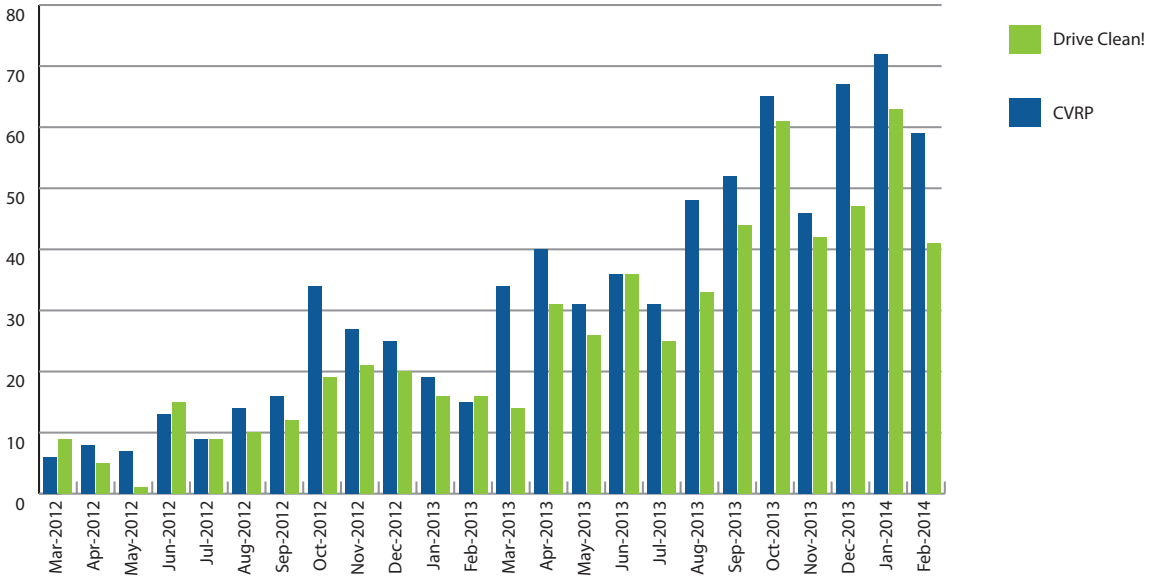
One additional opportunity to support PEV adoption is to provide incentives for EVSE. The SJVAPCD is planning to expand its Drive Clean! Rebate Program to include rebates for the purchase and installation of eligible Level 2 EVSE. When the charging station rebate becomes available, it is anticipated to be provided on a first-come, first-served basis as long as funding is available. The charging station rebate will be available for residential and commercial installations.

Figure 3: Map of San Joaquin Valley Drive Clean! Rebate Participants



As of April 1, 2014, more than 880 CVRP rebates have been issued and 628 Drive Clean! rebates have been approved in the SJVAPCD. In total, over $1.83 million in CVRP funds and more than $1.7 million in Drive Clean! funds have been issued in the Valley since March 2012 (the beginning of the Drive Clean! program).

**Figure 4: Applications for CVRP and Drive Clean! Rebates in the SJVAPCD**

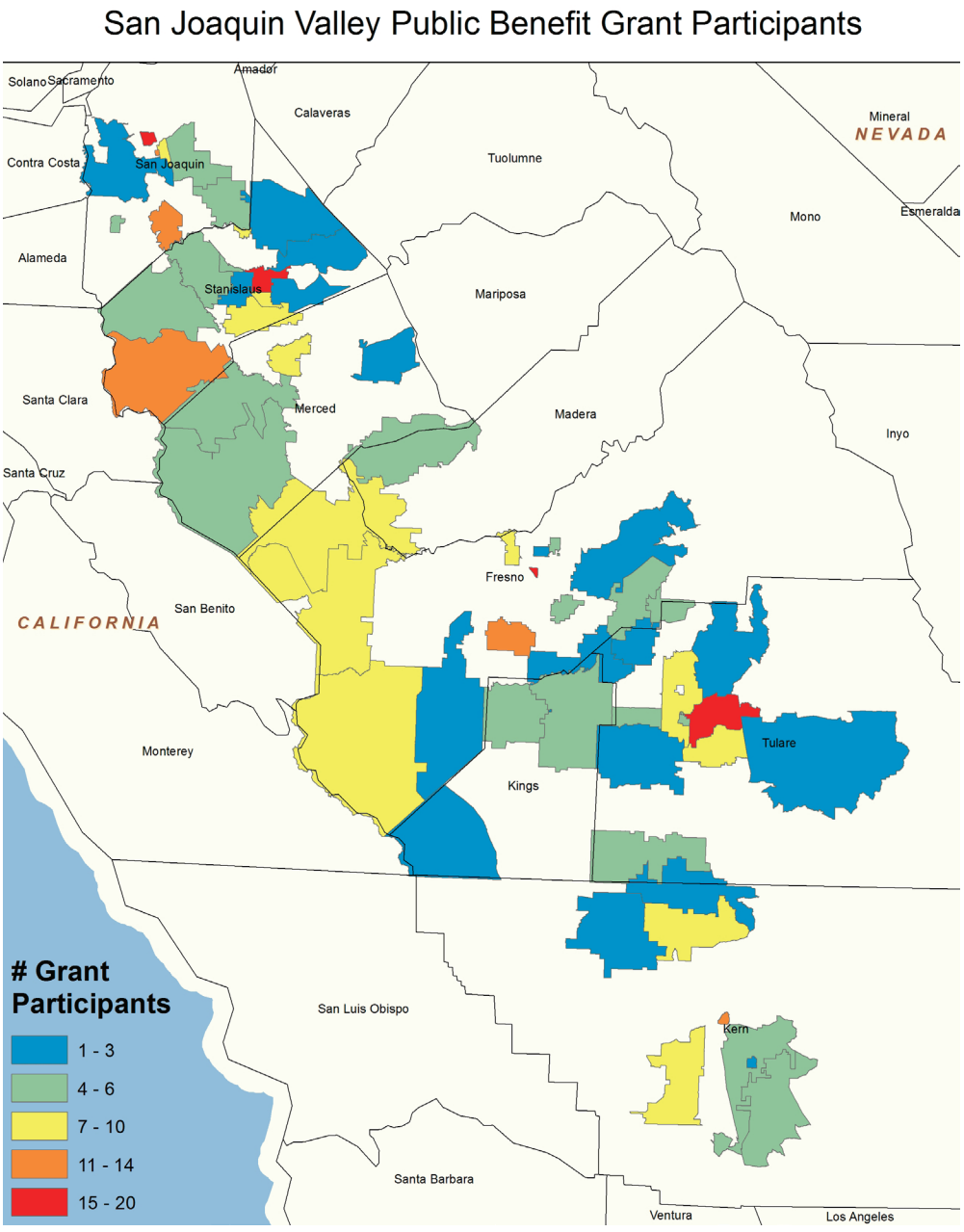



### *Public Benefit Grants Program*

The Public Benefit Grants Program was created as a means of supporting clean-air projects by Valley public agencies, such as PEV adoption among public agency fleets. The program is the only one of its kind offered by an air district in California and the grant funding that is provided through the program covers a significant portion of the cost of most PEVs. As of April 1, 2014, the SJVAPCD has awarded more than $6 million towards the purchase of 384 PEVs. Funding provided by the SJVAPCD's Public Benefit Grants Program can be combined with rebates from the CVRP for additional savings.

Providing incentive funding for electric vehicle charging infrastructure is an additional option to support the investment and continued adoption of PEVs by public agencies. Accordingly, the SJVAPCD plans to expand its Public Benefit Grants Program to provide funding to install Level 2 charging stations for community and workplace charging. Funding will be provided as a grant and would be open to all eligible public agencies located in the Valley.

**Figure 5: Map of San Joaquin Valley Public Benefit Grant Participants**



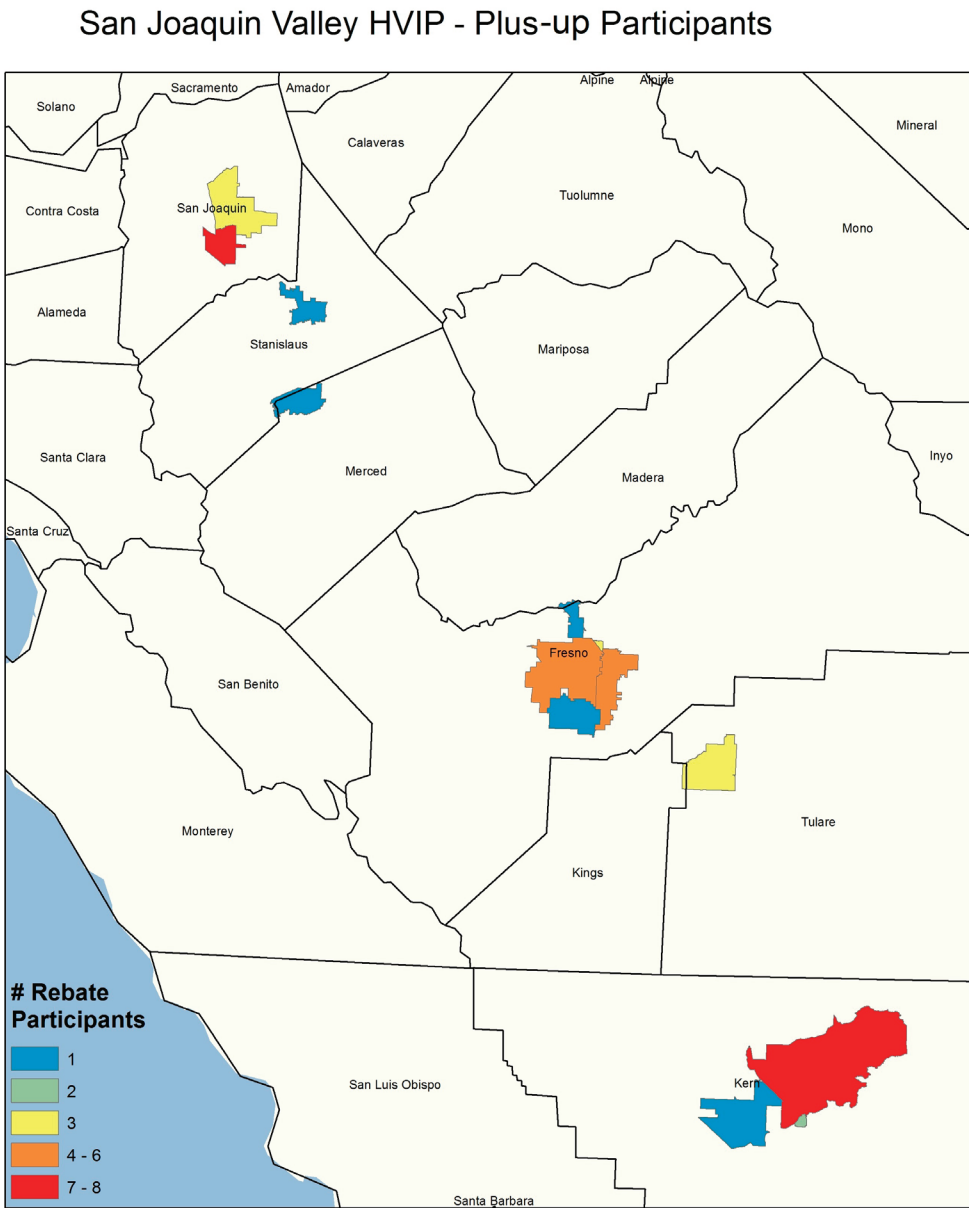
### *Hybrid and Zero Emission Truck and Bus Voucher Incentive Project (HVIP) and San Joaquin Valley Air Pollution Control District HVIP Plus-up*

The California Air Resources Board created the HVIP program in 2009 to accelerate the deployment of hybrid and zero-emission medium- and heavy-duty vehicles and vehicle technology in California.[17] Funding through the program is provided in the form of a voucher that can be used toward the purchase of an eligible vehicle. In July 2012, the SJVAPCD began offering incentives in addition to the California Air Resources Board's program, known as the HVIP Plus-up, to fleet owners who purchase and operate eligible vehicles in the Valley. Since its start, the SJVAPCD has disbursed funding for 42 vehicles totaling $875,000 through HVIP Plus-up.

Although there are currently a limited number of electric medium- and heavy-duty vehicles commercially available, continued incentive funding is a recommended strategy to assist fleet owners to consider the technology. Electric medium- and heavy-duty vehicles can be significantly more expensive than equivalent diesel-powered vehicles. Incentives will help lower the cost of the vehicles and make them more viable options for fleet owners. To support the adoption and utilization of these electric vehicles in the Valley, the SJVAPCD anticipates continuing its HVIP Plus-up Program.

17 California HVIP website. **http://www.californiahvip.org/about-the-project**

## Figure 6: Map of San Joaquin Valley HVIP Plus-up Participants



# Recommendations

## Low-income Valley Residents

There is minimal penetration of low-income or rural residents into the PEV market in the San Joaquin Valley, partly due to the lack of understanding of PEV technology, but largely because of the current high cost of many PEVs. This does not mean that these residents cannot take part in this growing market. In order to support their entry into the market, it is important to incentivize PEV adoption in the following ways.

- Increase and expand existing incentives and create additional state and local programs to provide additional incentives, rebates, financing assistance and reduced public charging costs for low- and fixed-income residents and residents with low or poor credit.
- Create an incentive or rebate program that allows low-income individuals to receive a significant subsidy when purchasing a secondhand PEV.
- Financially incentivize car-sharing companies to develop PEV car-sharing programs in Valley cities.
- Increase the amount of charging opportunities at blue-collar workplaces and deploy a free or low-cost public charging network.
- Create rebates to inexpensively purchase charging stations for low-income homeowners and businesses that are located and/or operate in disadvantaged communities, or a loan program that provides long-term, low-interest payback similar to PACE/HERO programs. Create options to allow low-income renters to participate where feasible.
- Continue to coordinate existing and new state and local PEV incentive programs to leverage, maximize and combine incentives and rebates to make PEVs a more affordable option for low-income residents.
- Coordinate incentive programs directly with dealerships or vehicle manufacturers to reduce the up-front purchase price of PEVs to make financing more accessible to low-income residents with poor or no credit.
- Coordinate with state agencies and local utility companies to implement strategies that would subsidize electricity costs for low-income residents or businesses that are located and/or operate in disadvantaged communities.

Although robust incentives programs can be created and significant funding can be provided to support adoption of PEVs in low-income communities, extensive and targeted marketing, outreach and education will be required to sustain PEV growth in this demographic. In addition, it is recognized that for many low-income residents in the Valley, PEVs may ultimately not be a feasible option despite the many incentives that are available. For these residents, a focus on alternative solutions that would allow them to benefit from other lower-emission vehicle technology or options is recommended. Using this approach

as a stepping stone, long-term strategies can be developed to transition these low-income residents to PEVs that provide greater economic and environmental benefits.

Potential incentive strategies for low-income residents where PEVs may not be a feasible option include the following.

- Introduce clean-air vehicle technology to low-income residents with incentives and rebates for traditional low-emission hybrids to create familiarity with the technology and understanding of associated economic benefits.
- Continue vehicle repair programs for low-income residents with vehicles that do not pass the smog check test required to register their vehicles with the Department of Motor Vehicles. Enhance the program by providing additional subsidies that would be used toward the purchase of low-emission new or used vehicles for those low-income residents whose vehicles cannot be repaired.
- Continue vehicle retirement programs and provide increased subsidies for low-income residents. Complement the program with additional subsidies that low-income residents can use toward the purchase of low-emission new or used vehicles in lieu of purchasing another older vehicle. Where feasible, create the potential to leverage state and local subsidies to maximize incentives.
- Coordinate incentive programs directly with dealerships to reduce the up-front purchase price of low-emission used vehicles to make financing more accessible to low-income residents with poor or no credit.

It is important to note that a significant portion of funding to create and administer air quality and clean-vehicle incentive programs is provided under state legislation. Advocating legislation that provides funding for these incentive programs, especially legislation that prioritizes funding for low-income disadvantaged communities, is crucial to increase PEV adoption in the Valley. The absence of incentive programs to reduce the cost of PEVs and EVSE create a significant economic barrier for low-income consumers. In addition, many middle-income consumers who are budget-conscious would also be affected as they may be deterred from purchasing a PEV that has a higher initial cost than a gas-powered equivalent vehicle.

## Local Elected Officials

Local elected officials can be encouraged to invest in public charging infrastructure in the following ways.

- Have a public EVSE incentive program that allows public agencies in the Valley to purchase and install chargers at zero to minimal cost.

- Work with state agencies to develop tax credits for entities that pursue public charging projects, especially those located in environmental justice communities.
- Work with state agencies and local utilities to subsidize electricity rates for electric vehicle charging in their low income programs such as **California Alternate Rates for Energy** (CARE) and **Family Electric Rate Assistance** (FERA).

## Conclusion

Rebates and incentives for PEV purchases help lower the initial cost of ownership. This is especially important for San Joaquin Valley residents who may shy away from the high cost of PEVs. Although it is unclear whether the rise in PEV adoption in the Valley is due to rebates and incentives, they are certainly a significant inducement for purchasing a new PEV. Many Valley households spend more than a third of their income on vehicle expenses, so finding an affordable option for every day commuting is essential.[18] Incentives can significantly lower the cost of a new clean vehicle, which would ultimately help households spend less on gas, maintenance and other external costs (which is often high because many households keep either very old vehicles or buy used vehicles with predatory loans).[19]

To further incentivize PEV adoption, there needs to be a way to lower the cost of EVSE installations as well. Even though a Level 2 EVSE costs as little as $500, its installation is often double the price of the equipment. Therefore, further incentives for equipment or installation would encourage EVSE deployment.[20] Currently, there are not many incentives for the procurement and installation of EVSE. Incentives that can provide both a lower purchase or lease price for new or used clean vehicles as well as financial assistance with EVSE installations may offer the assistance needed for middle- and low-income households to enter the PEV market.

Given the socioeconomic challenges that exist in the Valley, there must be continued support of incentive programs to encourage more Valley residents, especially the low-income population, to adopt PEVs. Current incentive programs have provided opportunities for many Valley residents to be exposed to the technology and the associated economic benefits of owning one. In combination with effective outreach strategies, incentive programs can be effective tools that allow PEVs to be affordable options for low-income residents. Coordinated regional support of state legislation that provides for the continuation and development of air quality and clean-vehicle incentive programs is necessary to continue the growth of PEVs in the Valley.

18 Center for Neighborhood Technology. "H+T Affordability Index". **http://htaindex.cnt.org/map/.**
19 Bensinger, Ken. "A vicious cycle in the used-car business." *Los Angeles Times*. October 30, 2011.
20 Ricky Hanna, CEO of Electric Vehicles International, comments made at August 1, 2013, SJV PEV Planning Meeting.

# PEV and EVSE Installation Impacts on Workforce and Economy

## Background

Electric vehicle chargers are essential to owning and driving a PEV. EVSE is often located inside residential garages so that PEVs can charge overnight and found at public locations and workplaces so that drivers can extend electric miles traveled during the day. There is a serious need to install more publicly available EVSE to support California's expanding PEV market.

The global revenue of EVSE sales in 2013 was $567 million and is expected to increase to $5.8 billion by 2022.[21] Electric vehicles sales also are increasing and predicted to contribute to nearly 100,000 additional jobs by 2030. [22] The Valley has untapped talent that can join in this growing market and reap the economic benefits.

Currently, the San Joaquin Valley faces a challenging economic situation. Unemployment is staggering throughout the Valley. Merced, Tulare, Kings and Fresno counties have some of the highest unemployment rates in California at 15.9%, 15.2%, 14.9% and 13.6%, respectively.[23] These rates are abnormally high compared to the state unemployment rate of 8.5% and the national rate of 6.7%.[24] The median household income throughout the region is also very low — about $47,661, approximately $15,000 below the state average.[25]

As the number of PEVs increase in the Valley, there must be further development of industries that support the deployment of both PEVs and EVSE, which can help revive the local economy. Communities throughout the San Joaquin Valley can gain economically by positioning themselves to participate in the growing EVSE and PEV markets.

## Current Infrastructure and PEVs in the San Joaquin Valley

Despite holding a small share of the California PEV market, the San Joaquin Valley is host to a growing community of PEV drivers living and traveling in the region. The number of light-duty PEVs in the region is rapidly increasing each year as well as the number of medium- and heavy-duty electric vehicles.

21 *Electric Vehicle Charging Equipment*, Navigant Research. **http://www.navigantresearch.com/research/electric-vehicle-charging-equipment**
22 Roland-Holst, David, "Plug-in Electric Vehicle Deployment in California: An Economic Assessment" University of California, Berkeley. September 2012. **http://are.berkeley.edu/~dwrh/CERES_Web/Docs/ETC_PEV_RH_Final120920.pdf**
23 State of California Employment Development Department. "Monthly Labor Force Data for Counties.". Labor Market Information Division. January 2014.
24 Bureau of Labor Statistics. "Local Area Unemployment Statistics." March 2014.
25 US Census Bureau: State and County QuickFacts. Retrieved March 2014, from **http://quickfacts.census.gov/**.

To support these drivers, there are 10 publically available Level 1 EVSE, 39 Level 2 EVSEs and seven DC fast chargers in the San Joaquin Valley.[26,27] Publically available charging infrastructure in the Valley is significantly lower than other large regions in California. San Francisco alone has 97 Level 1 EVSE, 228 Level 2 EVSE and six DC fast chargers; Los Angeles County has more than 135 Level 1 EVSE and over 830 Level 2 EVSE with 18 DC fast chargers. While the San Joaquin Valley is larger in area, the lower population density and low PEV adoption rates may have contributed to this lack of EVSE infrastructure in the area. Increased workforce training in EVSE installations will be needed as the PEV population continues to increase in the Valley.

## Jobs Needed for PEV and EVSE Development

According to a 2011 Brookings Institute study, the battery manufacturing and electric vehicle industries have supported more than 32,000 permanent jobs in the United States. Job growth in electric vehicle technologies has been increasing by more than 6% each year. Approximately 54% of electric vehicle technology jobs require a high school diploma or less, and the average annual salary in the industry exceeds $38,000. [28]

## Plug-in Electric Vehicle Occupations

The following occupations are needed for the development, production, sale and maintenance of electric vehicles.[29]

### Table 3: Occupations that Support PEVs

| Occupations that Support PEVs | |
|---|---|
| Customer service representatives | Team assemblers |
| Computer software engineers, applications and systems software | Electricians |
| Computer programmers | Machinists |
| Electronics/electrical/industrial/mechanical/materials/ chemical engineers | Engineering technicians |
| Engine and other machine assemblers | Automotive service technicians/mechanics |
| Retail sales/marketing | Community college/university training programs |

26 These fast chargers are Tesla Superchargers, intended only for Tesla use.
27 As of April 2014.
28 *Sizing the Clean Economy*, Brookings Institute. 2011.
29 *Electric Vehicles: The Market and Its Future Workforce Needs*, Los Angeles County Economic Development Corporation (August 2012).

## Electric Vehicle Supply Equipment Installation Occupations

EVSE installations are made by local service providers and cannot be outsourced. EVSE manufacturers find local contractors and businesses to procure and install charging stations.

### Table 4: EVSE Installation Occupations

| EVSE Installation Occupations | |
|---|---|
| Electricians | General contractors (concrete cutting, trenching, etc.) |
| Electronics/network specialists | Software developers |
| Sales/marketing | Maintenance/cleaning |
| Engineering (civil, electrical) for larger installations | |

## Electric Vehicle Supply Equipment Installation – Utility Side

Upgrades to local and regional electric transmission lines may be necessary to accommodate EVSE infrastructure. Investments by local public utilities will have positive impacts on local workforce and economies as much of this work is contracted to local construction firms. Therefore, electricians, engineers, construction trade/contractors and network specialists will be in demand.

## Job Growth in the San Joaquin Valley[30]

There are several counties within the San Joaquin Valley whose fastest growing jobs are occupations needed in the EVSE and PEV market.

### Table 5: List of Fastest-growing Job Occupations for the PEV and EVSE Market by County

| County | Occupation |
|---|---|
| Kern County | Environmental technician, software developers, systems software |
| Madera County | Automotive body and related repairs, team assemblers, product promoters |
| Tulare County | Information security analysts, web developers computer network architects |
| Stanislaus County | Helpers, construction trades, supervisors, construction and extraction workers |
| Fresno County | Helpers, construction trades |

Electric Vehicle International (EVI) is a medium- and heavy-duty electric vehicle manufacturing company based in Stockton. Notably, the company has supplied large companies such as UPS, Frito-Lay and Pacific Gas & Electric with zero-emission delivery and bucket trucks. In 2013, the company, in partnership with

30 California Employment Development Department. **http://www.edd.ca.gov**.

UPS, deployed 100 electric commercial delivery vehicles in California — the world's largest deployment of zero-emissions commercial vehicles.[31]

Originally, the company was headquartered in Toluca, Mexico, and made its move to Stockton in 2009 to be strategically positioned in California, the country's largest market for alternative fuel vehicles. The company's arrival is expected to indirectly create more than 450 total jobs in California and directly create over 100 green jobs in Stockton.[32] EVI's successes are a prime example of potential benefits the thriving electric vehicle industry can bring to the local economy.

## Economic Impact

### Reduced gasoline consumption fuels local growth through expenditure shifting

A 2012 study looking at the economic impact of PEVs details how money saved at the gas pump is spent on other goods and services desired by households, creating on average 16 times more jobs in the local economy.[33] Household and enterprise funds diverted from the fossil fuel supply chain finance new demand for consumer goods and local, in-state services. Furthermore, the jobs created from expenditures shifting away from fossil fuels are distributed broadly across sectors and are not restricted to green technology jobs.

### EVSEs generate economic benefits to nearby retail shops

Public charging stations (generally Level 2) can have positive impacts on local businesses by drawing PEV drivers who want to charge while they shop or dine. Installing public charging stations in central business districts can be an added visit motivation for customers looking to shop, dine or experience other entertainment options.

DC fast chargers, which are often installed near transit corridors, draw PEV drivers for a 15-30 minute charge. Placing these chargers near coffee shops, convenience stores or shopping areas can attract out-of-town visitors.

If retail shops add charging stations, they can have their customers pay a fee for use. Hosting EVSE can cost as little as $500 for the infrastructure with more than $27,000 in financial returns.[34, 35]

**Money saved at the pump from driving a PEV is money spent on other goods and services that create on average 16 times more jobs in the local economy.**

31 Electric Vehicle International. "Governor Brown Celebrates the Deployment of 100 Zero-Emission, California-made Delivery Vehicles." February 2013.
32 Electric Vehicle International. "Governor Schwarzenegger leads launch of electric vehicle pioneer EVI's new Stockton headquarters." November 2009.
33 Roland-Holst, David, "Plug-in Electric Vehicle Deployment in California: An Economic Assessment"
34 This is the present value of financial returns for one-hour connections if there are ten connections per day (priced at $1 per hour plus a $1 connection fee).
35 *Southern California Plug-in Electric Vehicle Readiness Plan*, UCLA Luskin Center. December 2012.

## Conclusion

Every facet of the electric vehicle industry can create economic benefits for local economies. The manufacturing and installation of EVSE, as well as the potential economic benefits generated for an EVSE host after the installation of a public charging station, can be especially noteworthy. With the highest rates of unemployment in California, the San Joaquin Valley has much to gain from this budding industry.

Relatedly, the San Joaquin Valley is experiencing job growth in many occupations represented in the EVSE industry. Due to the required training, as well as the industry's cutting-edge nature, occupations within the EVSE industry come with a relatively high level of compensation and include a high level of esteem.

Leveraging technical programs, such as the Electric Vehicle Infrastructure Training Program, is necessary to continue to develop a workforce adequately trained to actively participate in the EVSE industry. Further, local schools and colleges should also anticipate the skills needed for success in the PEV industry and plan accordingly. With the proper foresight and workforce preparation, the San Joaquin Valley is poised to have the EVSE industry play a positive role in the region's future economic development.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FOX
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CHURCH ON THE BIG SCREEN
Valley Bible
VISALIA FOX THEATER
Sundays @ 11:00 AM
Pastor Ron Viets
FOX THEATRE PRESENTS
CELTIC CROSSROADS
APR 1 730 PM
LAST COMIC STANDING
FELIPE ESPARZA
MAR 26 8 PM
LYLES-PORTER AUDITORIUM
HEBREW NATIONAL
PREMIUM
Beef Franks

# Lack of Public Awareness and Economic Challenges

**The Valley Air District in partnership with Valley Clean Air Now (Valley CAN) have organized events, called Tune In & Tune Up (TITU), for local residents to get a free emissions test and a voucher of up to $500 for vehicle repairs. In the past two years, TITU events have drawn in over 9,000 Valley vehicles. Participants are mostly low-income, making it an ideal location for educating consumers with diverse backgrounds about the possibility of replacing old vehicles that do not pass an emissions test with a hybrid or PEV.**

## Background

Limited public understanding and awareness of the many facets of purchasing and using PEVs, from available incentives and total cost of ownership to vehicle capabilities, are the foremost challenges facing the Valley for widespread adoption. PEV technology is unfamiliar to most consumers and requires significant behavioral changes in the way drivers use and refuel their cars. People also may have concerns regarding vehicle range and limited availability of public charging. However, research shows that once people gain a basic understanding of PEV technology and have the opportunity to drive PEVs, barriers and concerns diminish considerably.[36] To fully achieve widespread PEV adoption in the Valley, low-income and rural communities must be included.

Targeted education and outreach focused on total cost of ownership as well as the practicality of PEV use is necessary to overcome barriers. There is a need to initiate outreach directed toward local elected officials and consumers, especially in environmental justice communities.

The up-front cost of a PEV is another significant market barrier in the Valley that correlates with the public's lack of understanding and awareness of PEVs. Despite current federal, state and regional incentives and recent price drops on some vehicle models, many consumers in the San Joaquin Valley believe they cannot afford a PEV because of the higher initial cost. In a region where vehicle operation and maintenance costs typically consume more than a third of household income, consumers need to be aware of the low total cost of PEV ownership to see beyond the initial cost. Comprehensive strategies must be developed to address concerns relating to the initial cost of purchasing a PEV, especially with low-income consumers, and even many middle-income consumers.

36 Navigant Research (n.d.). *For EVs It's Love at First Drive.* Retrieved October 2013, from **http://www.navigantresearch.com/blog/for-evs-its-love-at-first-drive**

## Key Issue: Lack of Pulic Awareness

### Outreach to Consumers and Environmental Justice Communities

Marketing focused on the environmental benefits of PEVs can be ineffective as a leading message to the majority of Valley residents. To connect with consumers in the Valley, effective messaging must consider the socioeconomic realities and ethnic diversity of Valley residents. In a region where 52% of the population lives in an environmental justice community, outreach must focus on the potential cost savings of a PEV and its ability to be used as a primary vehicle. Marketing efforts should also include methods to introduce and expose residents of environmental justice communities to PEVs outside of owning or leasing (e.g., PEV car sharing).

**Barriers**

- Focus on high cost of purchase/lease and not low total ownership of a PEV
- Perception that PEVs can't be a principal vehicle
- Lack of consumer knowledge of PEV technology
- Perception of PEVs being a status symbol

### Outreach to Local Elected Officials

Local elected officials are a high priority for outreach. These officials need to be encouraged to further immerse themselves in background information on PEV market barriers and feel empowered to learn how to overcome them. Local elected officials may be hesitant to consider planning for or developing policies that will encourage adoption of high-cost technologies such as PEVs, especially if their constituents are low-income or disadvantaged. Further educating local elected officials on the financial benefits available to PEV drivers (including incentives and fuel savings), as well as the public health benefits resulting from an increase in lower emission vehicles in their communities is a critical first step when encouraging PEV-friendly policies.

## Recommendations to Increase Public Awareness

It is recommended that a marketing campaign be created to address the lack of public awareness among Valley consumers and local elected officials. The marketing campaign described in this Plan will need to be a funded program in the near-term future. The following sections describe the goals of the marketing campaign, how to develop the campaign plan and strategies for implementation.

### Marketing Campaign Goals

A marketing campaign should build awareness and demand for PEVs among the Valley's diverse communities. It is recommended that a marketing campaign achieve the following goals.

- Educate low-income and rural communities on the benefits of PEVs with a focus on the relative low total cost of ownership using multilingual methods and materials.
- Shape the perception of PEVs as a viable transportation method and as a reliable primary household vehicle for all Valley residents, not one specific socioeconomic group.
- Target consumers in environmental justice communities with specific resources necessary to promote the viability of PEVs.
- Leverage existing state and SJVAPCD incentives that promote PEV affordability.

### Market Research and Campaign Plan

In-depth market research is necessary to identify effective marketing strategies for exposing the diverse Valley population to PEV technology. Leveraging partnerships with local community groups and their respective expertise is critical to ensuring all Valley populations are equally represented in the final campaign plan. Consumer surveys, an evaluation of current PEV marketing and outreach activities and focus groups should all be included in the market research informing the campaign plan. The results will identify brand strategies to reach key target audiences, outline a broad process for campaign implementation and include evaluation metrics with which to evaluate campaign effectiveness. The estimated time to develop a full-fledged PEV marketing campaign in the Valley is approximately 6 to 9 months.

## Marketing Campaign Implementation

Implementation of the marketing campaign will be directed through methods and techniques outlined in the campaign plan. It is recommended that the PEV marketing campaign in the Valley be implemented over 12 to 18 months. Following is a list of recommended implementation strategies for the two key target audiences of the campaign, consumers and elected officials.

### Implementation strategies for consumer outreach

- Identifying highly visited events or locations (e.g., farmers markets, cultural events) and setting up a presence through test-drives and local media advertisements.
- Conducting consumer outreach through multiple media channels, such as online targeting, radio and mobile marketing.
- Increasing awareness of PEV-related incentives for consumers.
- Organizing and facilitating informational sessions and meetings for different community groups to learn about ways in which PEVs spur economic growth.
- Creating multilingual messages in local media, including newspaper articles and public radio ads.
- Identifying and documenting the experiences of a diverse group of PEV drivers who live and commute in environmental justice communities in the San Joaquin Valley.
- Increasing awareness and knowledge of PEVs, charging infrastructure and related incentives among local car dealerships to better inform consumers.

### Implementation strategies for local elected officials

- Presenting the following topics to encourage PEV-friendly policy adoption.
  - Model Local Ordinances – Use sample ordinances to achieve consistent regional PEV policies by replicating or adapting best practices (see Appendix: *Considerations for Public Agencies that Provide Charging*).
  - PEV Definitions – A sample list of key vocabulary and industry terms (see the Appendix: *Glossary*).
  - Building Codes – Adopting codes that support prewiring or installing EVSE during construction of commercial, public and residential structures to promote cost-effective EVSE deployment (see *Building Codes for Plug-in Electric Vehicle Charging*).
  - Zoning and Allowed Uses – Zoning regulations can set safety and accessibility standards for consistent parking and signage rules. Zoning codes establish allowable public EVSE locations according to density and land use (see Appendix: *Sample Zoning Code Provisions*).
- Encourage officials to take part in National Plug-in Day or a different local plug-in electric vehicle event.
- Provide officials with the California **Zero-Emission Vehicle Community Readiness Guidebook**.

## Key Issue: Economic Challenges

The Valley has many low- and middle-income residents who face significant challenges in overcoming the up-front cost of a PEV simply because many PEVs are priced in a range that is unaffordable for these consumers. PEVs can cost substantially more than a gas equivalent and many gasoline-powered vehicles in today's market are priced competitively and offer fuel efficiency appealing to many consumers concerned about rising gas prices.

Many low-income consumers can only afford one vehicle per household, and purchasing a used vehicle is more economical and feasible than financing a higher cost PEV. Although many middle-income consumers can afford two vehicles, the inexpensive and more appealing option would be to purchase a lower priced gasoline vehicle than a new PEV. For many consumers on budgeted incomes, a vehicle's up-front purchase price has significant influence on their decision to purchase the vehicle. These consumers make purchases that connect with immediate savings, and it is difficult for them to associate with the long-term lower cost of owning a PEV.

## Recommendations to Address Economic Challenges

Currently, the most effective strategies to reduce the initial cost of PEVs are incentive programs. Funding provided under current incentive programs can be combined to provide greater savings. Strategies and recommendations for addressing economic challenges through incentive programs, specifically with the Valley's low-income population, are detailed in *The Use of Incentives to Encourage PEV Adoption*.

The PEV market in California has seen substantial growth in recent years with state mandates and more widespread acceptance of the technology. As the PEV market continues to grow and evolve, and more vehicles become commercially available, a competitive reduction in the price of PEVs may continue to occur and more affordable financing and leasing options may become available for Valley consumers. It will be important to maintain watch on PEV market trends and align incentive programs and outreach strategies to optimally address the economic challenges in the Valley.

# Zoning Policies for Plug-in Electric Vehicles

## Background

Consistency across jurisdictions and regional standardization of codes that facilitate the installation and access to publicly available charging infrastructure is necessary to support the growth of infrastructure for PEVs. The regional adoption of zoning code provisions for electric vehicle charging stations will help expand the PEV market by ensuring that charging is an allowed land use in as many types of zoning districts as possible, either as an accessory or as a principal use as appropriate. Zoning generally determines the number of parking spaces required for a certain land use; although, some jurisdictions have used building codes to specify the number of spaces that need to have PEV-ready wiring in new construction.

**San Joaquin Valley Case Study**

The City of Lodi introduced an ordinance amending a municipal code to address parking and PEV charging spaces. The ordinance states that parking spaces designated for PEV charging must be used exclusively for charging and parking a vehicle that is connected for charging. It prohibits any obstruction or blocking of PEV-designated stalls or spaces.

## Key Issues

Determining whether PEV charging should be a principal or accessory land use will dictate what kind of permit and planning review process is needed. Principal use refers to the main purpose of the site and the uses allowed, such as stores in a business district or houses in a residential district. Accessory uses are secondary to the principal use, such as a garage in a house. Accessory uses can avoid the need for additional planning review.

Level 1 and Level 2 charging can be seen as an accessory use by default and therefore only need an electrical permit to install. In addition, other cities can clearly define PEV chargers as a permitted use or list a PEV charger directly as a principal or accessory use to better help guide planners on which permits are needed for the installation.

## Recommendations

Local governments can use zoning to leverage PEV charger installations using the following methods. [37]

- Allow charging as an accessory use that does not require more than a simple planning clearance, as long as charging is not the primary purpose of the site.
- Allow installation of chargers 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 or alternative fuel vehicles should be able to meet the minimum parking requirements for business owners and developers. Planners should consider reducing parking requirements in exchange for the site host providing PEV charging spaces.
- Require 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.

A sample zoning code provision for electric vehicle charging stations is in the Appendix (*Sample Zoning Code Provisions).*

37 Adopted from the South Coast PEV Readiness Plan, UCLA Luskin Center.


EV

# Parking and Signage

## Background

Unlike vehicles with conventional internal combustion engines that can refuel in a matter of minutes, PEVs need more time to charge. Therefore, areas where people tend to park for longer periods, such as gyms, parks, shopping centers and movie theaters, present ideal locations for installing EVSE and allowing a PEV to charge. Designating parking for PEVs provides the opportunity for a driver to charge their car battery to ensure they can continue to travel throughout the day without having to alter their driving patterns. Proper planning can ensure that EVSE in public, retail and residential locations is accessible, visible and safe to use.

This chapter is designed to guide planners and local jurisdictions on how to allocate public parking for PEVs, where to place public EVSE and how to enforce PEV parking rules.

## Key Issues

### Parking Space Requirements for Charging Equipment

Requiring that there are parking spaces available for charging equipment and alternative fuel vehicles ensures that PEV drivers can successfully charge their vehicles when at home, work or running errands. Codes and policies that provide clear definition of the number of spaces made available for charging promote the growth of the local PEV market.

Following are examples of state and municipal codes that require parking space requirements for charging equipment.

### Table 6: Parking Space Requirements for Charging Equipment

| Source | Building or Land Use Type | Number/Percent of Spaces Dedicated to EV Charging |
|---|---|---|
| CALGreen | One- and two-family dwellings | **1** per dwelling unit |
| CALGreen | Multifamily dwellings | **3%** of all spaces; at least one space |
| CALGreen | Nonresidential | **2%** (varies by size of lot) |
| CALGreen | Nonresidential | **10-12%** (varies by tier and size of lot) |
| **City of Sunnyvale Building Code** | Single-family dwellings | **1** per dwelling unit |
| **City of Sunnyvale Building Code** | Residential developments with common shared parking area | **12.5%** of all spaces |
| City of Emeryville Draft Planning and Zoning Code | Multi-unit residential and lodging with 17+ parking spaces | **3%** of all spaces |
| **City of Los Angeles** | Residential occupancies with common shared parking area | **5%** of total number of parking spaces |
| **City of Lancaster** | New multifamily projects with 10 dwelling units or fewer | **20%** of total parking spaces |
| **City of Lancaster** | New multifamily projects with 10 dwelling units or more | **10%** of total parking spaces |
| **Mountain House** | New houses and buildings | **220** volt electrical outlet for recharging EVs required in each garage |

*Adopted from the Bay Area and Monterey Bay Area Plug-in Electric Vehicle Readiness Plan (2012).*

## Accessibility Requirements

The Governor's Office of Planning and Research (OPR) has addressed accessibility requirements for EVSE in their document, "**Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices**," which expands upon the California Division of the State Architect's "Interim Disabled Access Guidelines for Electric Vehicle Charging Stations" (Policy #97-03), dated June 5, 1997.

While Policy #97-03 is only applicable to facilities under the Division of the State Architect's regulatory jurisdiction, it is possible that these voluntary 2013 guidelines will eventually become regulations within *California Building Code Chapter 11B Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing*.

The OPR guidelines address accessible PEV charging stations on both public and private sites and within public right-of-ways. The following chart is a guideline for the number of disabled-accessible charger spaces required.

### Table 7: Parking Accessibility Requirements

| Number of Chargers Provided at a Site | Number of Disabled Accessible Charger Spaces Required |
|---|---|
| 1 to 25 | 1 |
| 26 to 50 | 2 |
| 51 to 75 | 3 |
| 76 to 100 | 4 |

## Signage

Signs for PEV charging should be visible to ensure utilization. The *California Manual on Uniform Traffic Control Devices* contains a series of signs and markings for PEV charging stations and parking stalls.

Following are examples of the recommended signs for EVSE provided by the California Department of Transportation.

### *Regulatory Signs*


**PEV Tow-Away Symbol**

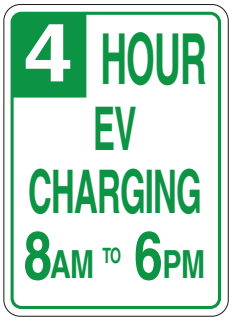
This sign indicates that vehicles will be towed if not utilizing the available charging station (per CVC 21511). This sign will include the tow-away symbol with the following language, "UNAUTHORIZED VEHICLES NOT CONNECTED FOR ELECTRIC CHARGING PURPOSES WILL BE TOWED AWAY AT THE OWNER'S EXPENSE…" with red text on a white background and be 24" x 24".


**No Parking Symbol**

This sign indicates no parking is allowed unless it is for charging a PEV. This will include the following language, "EXCEPT FOR ELECTRIC VEHICLE CHARGING" with red text on a white background and be 12" x 18".

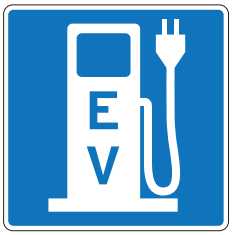
**Permissive Charging Symbol**

This sign indicates the time that charging will be available and will include the following language "[Electric Vehicle] __ HOUR CHARGING-__AM TO __PM" with green text on a white background and be 12" x 18".




**General Directional Signs**

*Electric Vehicle Charging Station Symbol and Word Message Signs*: These signs will assist in directing PEV drivers to charging stations from the freeway, local streets and at charging locations. The sign includes the EV charging station symbol.




Find more examples and detailed information at the **California Department of Transportation**.

## Parking Enforcement Rules

Often, parking infractions occur despite rules and clear signage – a non-PEV parked in a PEV-only space or PEVs not actively charging in a PEV-only space. There must be ways to enforce PEV parking rules, and several cities and states have passed ordinances and bills addressing PEV parking. Following are examples of rules and enforcement measures currently in place or in discussion.

### Table 8: Examples of Parking Enforcement Rules

| Agency | Description |
|---|---|
| **City of Lodi** | Amends Lodi Municipal Code Chapter 10.44 by adding section 10.44.125 "Electric Vehicle Charging Stalls" that states parking spaces designated for PEV charging must be used exclusively for charging and parking a vehicle that is connected for charging. It prohibits any obstruction or blocking of PEV-designated stalls or spaces. |
| **City of Santa Monica** | Code 3.12.835 notes that the Director of Planning and Community Development is authorized to designate parking spaces or stalls in an off-street parking facility owned and operated by the city or the parking authority for the exclusive purpose of charging and parking a vehicle that is connected for electric charging. |
| **City of Laguna Beach** | Passed a resolution to make PEV charging free for the first four hours, but the city charges $5.00/hour for each additional hour to reduce longer plug-in times. |
| **City of Knoxville, Tenn.** | Passed an ordinance that allows the city to ticket or tow any nonelectrical vehicle parked in a PEV-designated spot. In addition, the city will tow any PEV not plugged in and charging. |
| **State of Washington** | Senate Bill 5849 prescribes a penalty for vehicles that are parked in a PEV-only space or stall but not connected to the charging equipment. Infractions result in a $124 fine. |
| **State of New York** | Senate Bill 5190 establishes fines for vehicles parked in a PEV-only stall, but not actively charging, with fines set from $50 to $75 for a first offense and $75 to $100 for a second offense. |

## Siting and Design Guidelines for Plug-in Electric Vehicle Parking

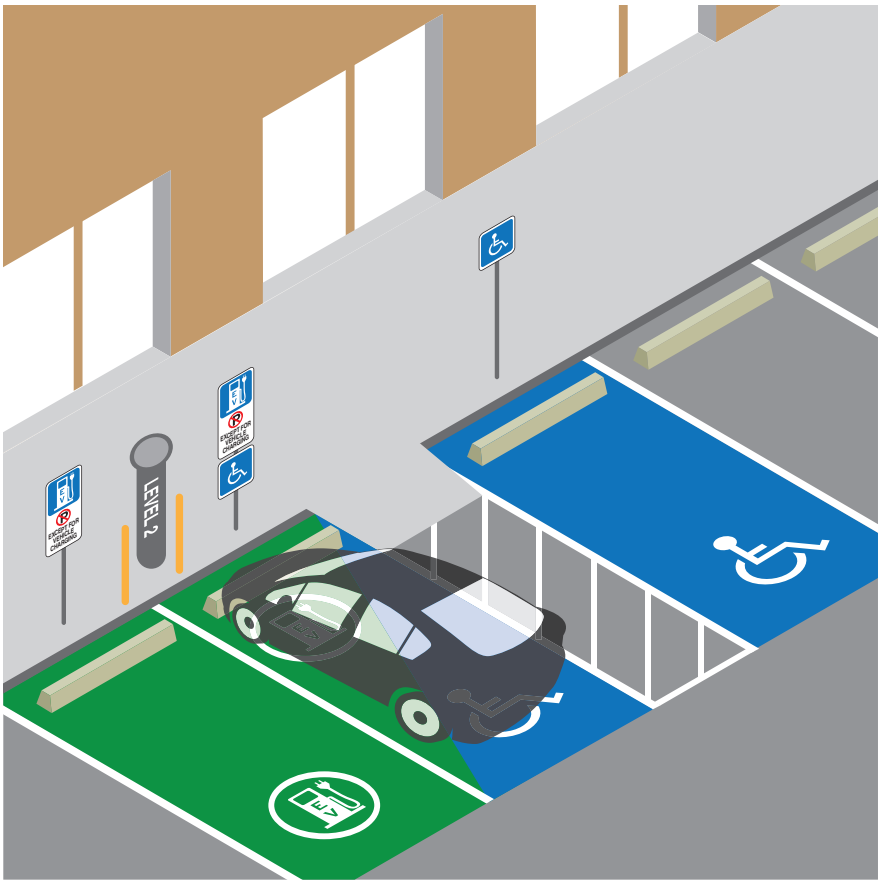
Local planners can decide between on- and off-street parking for PEVs according to the local environment, costs and locations; however, on-street parking installations may face more considerations, such as the public right-of-ways and metered parking.

Before deciding where to place EVSE, there are several factors to take into consideration.

- The source of electricity and location of electrical panel/circuits
- The load level of the electrical panel and its capacity to handle charging
- The locations for disabled-accessible parking spaces for PEVs
- If cables from charging units will pose a safety hazard for pedestrian walkways
- The opportunity cost of parking spaces dedicated to PEV charging
- What kind of parking policies will be established?

The following provides siting and design guidelines for PEV parking at commercial parking lots and on-street locations.

### Figure 7: Commercial Parking Lot




The following are important factors to consider when siting and designing charging units in commercial parking lots.

1. Include an ADA (Americans with Disabilities Act) spot that is accessible to the charging equipment.

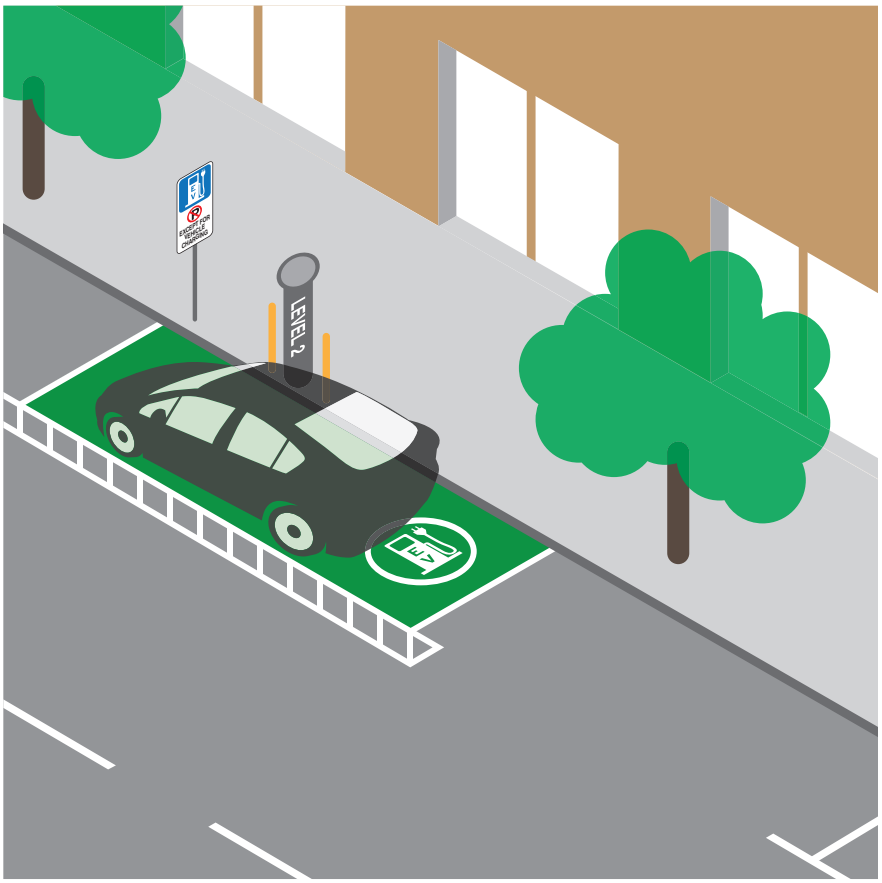
2. Make sure pedestrian walkways are unobstructed.

3. Place proper signage for the charging equipment.

4. PEV chargers at storefronts near the entrance are attractive for consumers, but installation may be more expensive. Electrical panels tend to be in the back of buildings, so adding wiring to the front could be costly.

5. Charging equipment at the front of a building may deter vandalism and other damage, but without proper signage, non-PEV drivers may take charging spots.

### Figure 8: On-street Parking




For on-street parking, the following are important factors to consider when placing charging units.

1. Proper signage indicating where electric vehicle charging is located, especially in a crowded urban area.

2. In addition to signs, the parking space should be properly striped or painted to indicate that it is intended for PEV charging only.

3. Charging equipment should not interfere with pedestrian walkways.

4. The power supply for the charger can come from multiple sources. Nearby businesses and shops could provide electricity in partnership, or the electricity could come from existing on-street sources such as streetlights, phone booths or other sources.

5. Provide the charging space with enough room for the driver to safely insert and remove the charging plug.

## Recommendations

The following recommendations will help local governments determine the best practices and mechanisms to allocate public PEV parking in their jurisdictions.

1. Allow PEV parking spaces to count toward minimum parking requirements.

2. Adopt regulations and enforcement policies for PEV parking spaces.

3. Specify design guidelines for PEV parking spaces for on- and off-street EVSE installations.

# Training for Electrical Contractors

## Background

With the growing number of PEVs in the San Joaquin Valley, there will be increasing opportunities for qualified and properly trained electrical contractors to install PEV charging stations at residential and nonresidential sites. EVSE have specialized requirements, and electrical contractors are needed to ensure installations are completed safely and up to code. They also are expected to perform the following tasks.

- Facilitate communication between the PEV owner, electric vehicle service provider, inspector and local government permitting officials.
- Understand electrical requirements for EVSE installations.
- Perform an accurate and thorough site assessment of existing electrical capacity.
- Estimate the cost of an electrical upgrade.
- Pull the proper permits and schedule an inspection.

## Key Issues

As PEV adoption continues to grow, installers with the proper expertise, information, tools and training with EVSE will be in high demand. Following are further considerations for contractors when installing EVSE.

### Regulation Compliance

All EVSE installations must comply with local, state and national codes and regulations. Electrical contractors can learn more about the codes and standards for EVSE on the **Alternative Fuels Data Center website** and at certain specialized courses (listings follow). Before installation, an electrician should consult with the EVSE manufacturer to determine the product's specifications.

### General Installation and Inspection Process

A successful EVSE installation begins with a site assessment and planning for the appropriate EVSE. Common installation steps are provided in Advanced Energy's ***Charging Station Installation Handbook for Electrical Contractors and Inspectors***.

### Load Calculations

The National Electric Code (NEC) considers EVSE as a continuous load. EVSE-specific information is located in NEC Article 625. The City of Irvine provides an exemplary **load calculation worksheet** for EVSE.

Guides for residential and nonresidential installations are in the Appendix: *Electric Vehicle Charging Station Installation Guidelines*.

## Electric Vehicle Infrastructure Training for Electrical Contractors

The International Brotherhood of Electrical Workers, in conjunction with the National Electrical Contractors Association, offers EVSE installation training courses. Their Electric Vehicle Infrastructure Training Program (EVITP) provides certification for electricians installing EVSE at residential or commercial locations. Courses are offered across the country at various regional community colleges and electric training centers. For information and a list of EVITP training opportunities, visit the **EVITP website** or email **info@evitp.org**.

Training benefits for electrical contractors include

- Learning about new and emerging technologies
- Gaining competitive knowledge
- Qualifying to submit for bids, RFQs and RFPs for EVSE installations
- Supporting California's goal to reach 1.5 million zero-emission vehicles by 2025

EVITP training is available at the following locations in the San Joaquin Valley.

**Fresno, Madera, Kings and Tulare JATC**
5420 E. Hedges Avenue
Fresno, CA 93727
(519) 251-5174

**Alameda County Electrical JATC**
3033 Alvarado Street
San Leandro, CA 94577
(510) 351-5282

# Permitting and Inspection

## Background

Permits are usually required when EVSE are installed at residential, commercial and public locations. However, currently, there are no regionwide standards for permitting EVSE in the San Joaquin Valley. Many local jurisdictions may require several different permits for an installation and often differ in permit fees and application processes. These inconsistencies are a barrier to local PEV market growth. Consistency in permit requirements, fees and applications across jurisdictions is necessary in order to empower consumers and workplaces to install EVSE. Permits are meant to ensure that an EVSE installation is performed safely and to code and is therefore an important part of the installation process. This chapter describes key issues of the permitting and installation process and provides best practices for specific charging situations.

## Key Issues

San Joaquin Valley jurisdictions can facilitate PEV adoption and reduce the overall cost of EVSE installation by streamlining the permitting process and better educating local officials about PEVs.

Detailed information on EVSE installation and permitting guidelines for new PEV owners at single-family residences is included in the Appendix (*Homeowner's Guide for Permitting and Inspecting EV Chargers)*.

Following are some of the barriers identified in the EVSE permitting process.

- The number and type of permits required in order to install EVSE.
- Whether permits are required for additional work to comply with the Americans with Disabilities Act.
- The number of business days between permit request and issuance.
- Whether there is a standard checklist for installing and inspecting charging installations.

### Types of Permits

There are no standard permits for the exclusive purpose of installing EVSE. Most often, local jurisdictions require only building permits, electrical permits and/or planning entitlements. Some jurisdictions in the San Joaquin Valley require inspections during preinstallation, postinstallation or both. However, not all installations require a permit or inspection.

The California PEV Collaborative identified a range of charging permit options for installations depending on complexity; the more complex the installation, the more documents required. The following table provides a general idea of the types of permit processes when installing EVSE.

### Table 9: Installation Scenarios and Relevant Permits

| Permits Needed | Installation Description |
|---|---|
| No Permit | Contractor prepermits and self-inspects for standard installation |
| Online Permit | Standard installation, 120-volt outlet, panel upgrade, meter reprogram, charger specification sheet |
| Over-the-Counter Permit | Possible trenching, panel upgrade, line drawing, meter install, charger specification sheet |
| Over-the-Counter Permit w/ Plan Check | Possible trenching, panel upgrade, detailed site plan, load calculation, wiring diagram, meter install, charger specification sheet |
| Plan Check Required | Trenching, panel upgrade, engineering drawings, load calculation, wiring diagram, meter install, charger specification sheet |

*Adopted from the UCLA Luskin Center Plug-in Electric Vehicle Readiness Plan (2012).*

Creating a simplified, streamlined permitting system will provide clear guidelines and give local officials and other relevant stakeholders a better understanding of the issues and processes involved in EVSE siting and installation.

## Recommendations

Local governments should consider the following actions in order to streamline the permitting process for residential and nonresidential EVSE installations.

1. Train staff and other stakeholders about the permitting process so they can explain it clearly to any entity seeking a permit.
2. Make online and over-the-counter permitting available for most basic installations.
3. Avoid requiring an electrician to be present during inspection to decrease consumer costs.
4. Waive plan check requirements if an installation does not require rewiring or panel upgrades.
5. Remove inspections needed for simple installations.
6. Establish a unique permit for installing EVSE.

# Utility System Impacts and Rate Design

## Background

The roles of utilities in the PEV sector are to educate customers throughout the PEV purchasing decision, provide cost-effective home and business charging options, ensure grid reliability and support charging infrastructure. Utilities in the San Joaquin Valley, such as Southern California Edison (SCE), Pacific Gas and Electric (PG&E) and the City of Lodi Electric Utility, have developed methods to manage these operations and plan for future PEV deployment.

**Benefits of a second meter**

- Ability to easily account for GHG emissions reductions for Low-Carbon Fuel Standard
- Built-in assessment of need for local grid upgrades
- Ability to analyze real-time PEV charging behavior

## Key Issues

Electric utility and distribution companies work with local planners to deliver power to residential neighborhoods and individual homes. When several PEVs are in the same neighborhood, "clustering"[38] occurs, and more power is drawn from the neighborhood electrical transformer. This is a concern to local utilities, and to mitigate impacts, it is essential for them to evaluate and estimate PEV charging demand in their territory.

Following are issues that utilities experience when managing PEV charging in their service territory.

- **Load Impacts** – Increased electricity demand from PEV charging may strain existing generation and distribution infrastructure, although current electric distribution is sufficient to handle PEV charging during off-peak hours into the near future.
- **Rate Structure** – The traditional tiered rate structure is helpful in promoting energy conservation, but it offers no incentive for PEV owners to charge during off-peak hours.
- **Secondary Metering** – Predicting and tracking impacts from PEVs will be especially challenging in single-meter dwellings. However, installing a secondary meter dedicated to a home charging station has multiple benefits that can help utilities manage PEV impacts.
- **Infrastructure** – Increasing demand from home PEV charging can overwhelm local-level infrastructure. As mentioned, this is especially problematic due to the propensity for PEV ownership to cluster in specific neighborhoods, increasing the demand on local-level transformers.
- **Renewable Energy Options** – Many PEV owners are concerned about

38 Studies show that PEV drivers tend to live in the same neighborhoods.

the generation sources of the electricity they use to charge their vehicles. There is increasing demand for options to purchase "green" electricity produced (completely or partially) using renewable sources. Increasingly, states are pursuing renewable energy portfolios for electricity generation. California utilities, for example, are required to achieve a 33% renewable energy portfolio by 2020.

## Time-of-use Rates

Some utilities in the San Joaquin Valley have addressed these PEV charging issues. One important result is that utilities are providing PEV owners time-of-use (TOU) rates. TOU rates allow customers to obtain economic incentives from charging their vehicles during off-peak hours.

Usually, there are two types of TOU rates offered: whole-house TOU (TOU-WH) and EV TOU (TOU-EV).

- TOU-WH provides customers with savings by having their whole house on a TOU rate. This way, households get energy at a discount when the entire house uses energy during off-peak hours.
- TOU-EV provides customers with savings by having their PEV charger on a TOU rate. This rate allows households to get energy at a discount only when their PEV is charging during off-peak hours.

Local utilities can look at the Appendix, *Local Utilities: Solutions and Programs for Plug-in Electric Vehicle Charging*, to see what other utilities in the San Joaquin Valley are doing to accommodate PEVs.

PEV owners charging at home in Fresno using PG&E's TOU-EV rates can save up to $1,190 a year in fuel costs.[1]

1 Union of Concerned Scientists (2012). *State of Charge: Electric Vehicles' Global Warming Emissions and Fuel-Cost Savings Across America*.

## Recommendations

The following recommendations are for utilities to better accommodate PEVs in their service territory.

1. Educate customers about local utility TOU rates, and help them choose the appropriate rate for their household and PEV charging needs.

2. Understand the potential growth of PEVs in the utility service area and begin to reassess infrastructure and capacity for future PEV charging.

3. Coordinate with local planning and building departments to assure utility notification when issuing a permit for an EVSE installation.

4. Municipal utilities within the San Joaquin Valley can model new rate structures or EV programs after larger investor-owned utilities.


VOLT

# Workplace Charging

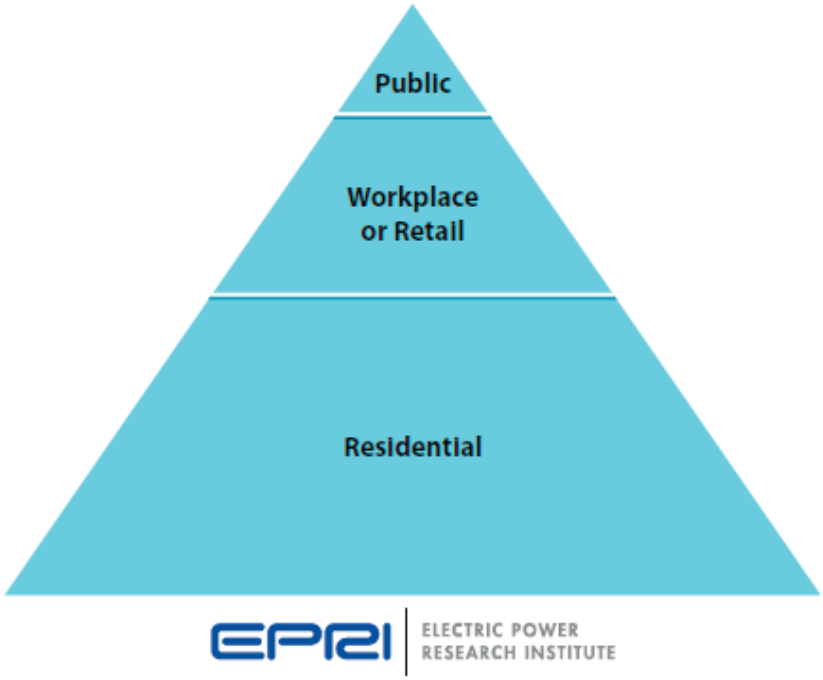
## Background

While the majority of PEV charging takes place at home, the workplace is an ideal location for charging because of the long dwell time it offers. Charging at work allows commuters the possibility of driving extra miles at the end of the day and helps promote sustainability standards for the employer. In the San Joaquin Valley, there are existing programs supporting public charging stations, but very little is currently targeted directly at workplace applications.

Commutes in the San Joaquin Valley can be longer than average, when considering rural transportation. Residents in San Joaquin County are known by the census bureau as "mega-commuters," travelling on average 61 miles to work.[39] The largely rural landscape in the Valley also causes longer driving times. Workers from rural areas drive an average of 47% more miles per day than those from urban areas, according to the 2009 National Household Travel Survey.

This commuting situation means workplace charging is vital for the San Joaquin Valley commuter. Facing long commutes, workplace charging can ameliorate any potential fear of depleting a car battery before getting home.

The Electric Power Research Institute (EPRI) pyramid illustrates charging priorities for PEV drivers.




39 Rapino, M. & Fields, A. *Mega Commuting in the U.S.* U.S. Census Bureau.

## Key Issues

Before installing workplace charging, many organizations should consider the following questions.

- Does the employer own or lease the building and parking lots?
- Is the electricity source easily accessible?
- What is the cost of EVSE equipment and installation?
- Can the employer make accurate estimates of operating costs?
- Is it better to own the EVSE or have a third party own and operate the EVSE?

Another question employers will often have is whether to charge employees for vehicle charging. Typically, employers who offer charging want it to be seen as an extra employee benefit; however, often employers do not want to bear solely the burden of electricity and maintenance costs. Despite the high up-front costs to employers, studies have shown that employers who do not charge their employees for charger use end up having employees use the workplace as their primary means of charging.

Workplace charging resources and tools that address these issues are found in the Appendix (*Charging Environments: Workplaces and Electric Vehicle Charging Station Installation Guidelines).*

## Planning for Workplace Charging in the San Joaquin Valley

Local government officials should consider these items when planning for workplace charging in the San Joaquin Valley.

- How many employees are there in different areas of the San Joaquin Valley region?
- Who are the largest employers?
- How significant are workplaces compared to other types of land uses?

Areas with many employers provide planners and stakeholders opportunities to conduct concentrated outreach for workplace charging. Jurisdictions with a high density of employers and employees can benefit from targeted actions such as permit streamlining and PEV-ready building codes.

There are advantages in targeting outreach to the largest workplaces in the Valley. Workplaces with large numbers of employees are more likely than small businesses to adopt new EVSE as they have more workers (and a higher probability of PEV owners) and more resources to devote to charging. Although most outreach strategies focus on white-collar workplaces and high-tech industries because early PEV adopters tend to have high incomes and work in technology industries, more strategic outreach to the diverse labor market and low-wage, blue-collar workforce is needed in the Valley.

Following is a table showing the number of employees per white-collar industry in each county.[40]

### Table 10: Employee Numbers in the San Joaquin Valley

| Industry | # of Employees | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Fresno* | *Kern* | *Kings* | *Madera* | *Merced* | *San Joaquin* | *Stanislaus* | *Tulare* |
| **Financial** | 12,800 | 9,000 | 1,100 | 800 | 1,700 | 7,400 | 5,400 | 3,700 |
| **Professional & Business Services** | 28,700 | 26,200 | 1,500 | 3,000 | 4,500 | 16,900 | 12,600 | 9,700 |
| **Educational & Health Services** | 42,400 | 28,800 | 4,600 | 6,000 | 6,300 | 29,600 | 24,100 | 10,900 |
| **Manufacturing** | 23,400 | 13,400 | 4,300 | 3,400 | 8,500 | 17,700 | 20,800 | 11,500 |
| **Construction** | 12,100 | 16,500 | N/A | N/A | N/A | 7,600 | N/A | N/A |
| **Transportation, Warehousing &** | 11,600 | 9,100 | 800 | 800 | 2,500 | 15,100 | 6,800 | 5,700 |

40 Source: California Employment Development Department, July 2013.

## Benefits of Hosting Workplace Charging

There are several reasons employers should consider a proactive role in initiating workplace charging as a value proposition despite the installation costs. For example, the availability of EVSE helps attract and retain employees and contributes to company sustainability goals as well as green credentials such as LEED certification.

A good first step before installing equipment is for employers to take the pledge with the DOE's Workplace Charging Challenge. This commits employers to developing a plan to install charging stations at work. A map of partner organizations and more information about the **Workplace Charging Challenge** is online.

For more guidance, employers can refer to DOE's **Plug-in Electric Vehicle Handbook for Workplace Charging Hosts**. Further, CALSTART's **Employer EV Initiative** website provides a comprehensive set of resources for employers, including case studies, statistics and best practices for installing charging.

## Recommendations

It is crucial that workplace charging installations be as easily accomplishable as possible for widespread action. To enable swift installations, local governments should consider the following steps.

1. Provide an easy to fill out application for workplace permitting.
2. Reduce permit fees for commercial installations to spur EVSE adoption.
3. Incentivize workplaces to install EVSE through an installation rebate.

Workplaces should follow these steps when making the decision to install chargers.

1. Identify and approach key stakeholders to serve as advisors or make decisions, such as a management-level designee, a sustainability lead, the building owner (if different from the employer), the parking lot operator (if different from the employer), facilities operations staff, human resources staff and legal counsel.
2. Conduct an employee survey to gauge potential employee demand for charging.
3. Contact the local utility to learn about tariff structure and potential rate impacts of EVSE use.
4. Consider an 80/20 rule where 80% of charging equipment is Level 1 and 20% is Level 2.
5. Consider providing Level 1 charging for free with Level 2 charging supplied for a fee.

# Building Codes for Plug-in Electric Vehicle Charging

## Background

Building codes can help facilitate PEV charging infrastructure in two ways. The first is to require prewiring for EVSE in all new construction to reduce future costs (prewiring consists of installing the conduit, outlets and space necessary for EVSE installations). The second is to ensure that EVSE installations are safe and accessible.

## Key Issues

There is a lack of approved regional building codes to support charging infrastructure. Part 11 of the 2010 Title 24 Building Standards Code in California is the **California Green Building Standards Code**, otherwise known as CALGreen. CALGreen has voluntary EVSE-specific codes that local jurisdictions can choose to adopt.

Adopting EVSE requirements in building codes help enable EVSE deployment by saving money on installation cost. Prewiring and installing EVSE during construction are significantly cheaper than retrofitting older buildings for EVSE because of the potential need for trenching, rewiring or upgrades to electric panels. The following table displays the average EVSE installation costs at commercial sites and single-family residences without prewiring.

**Table 11: Installation Costs**

| EVSE Site | Costs |
|---|---|
| Commercial | Up to an additional $1,100 per station for surface lots and $800 for parking garages |
| Residential Single-family | Level 2 installations can cost $900 more than preparing the home during new construction. |

### Legislation

California **Assembly Bill 1092** (October 2013) requires the next edition of the California Building Standards Code to adopt, approve, codify and publish mandatory building standards for the installation of electric vehicle charging infrastructure for parking spaces in multifamily dwellings and nonresidential developments.

While it is not possible to predict exactly what will be required for EVSE in the next edition of the California Building Standards Code, San Joaquin Valley jurisdictions can be proactive and begin to consider ways in which they can expand existing policies to encompass current voluntary codes. However, the voluntary code in CALGreen to install one EVSE unit in new residential projects may be too aggressive in the region given the low number of PEVs.

## Recommendations

Local government officials can adopt the following recommended steps to update their building codes to support PEV infrastructure now in anticipation of future codes and standards.

1. Require the installation of a raceway for future EVSE wiring for one parking stall for new commercial and nonresidential construction.

2. In multi-unit dwellings, designate a common area for EVSE rather than handle resident-specific EVSE needs.

# Charging at Multi-unit Dwellings

## Background

Multi-unit dwellings (MUDs) pose unique issues for PEV charging. Commonly, parking spaces assigned to MUD residents are far from the resident's electricity meter, which leads to higher infrastructure and installation costs. Homeowner associations (HOAs) and property managers may not want to bear the installation costs of EVSE, especially if it is for limited use, so charger costs may become too high. In addition, there may be deficiencies with the electrical load of the property, lack of on-site parking to designate to EVSE and uncertainty in the type of EVSE ownership model to pursue.

This chapter describes the key issues and provides recommendations for property managers and local government planners to properly plan for charging infrastructure at multifamily communities throughout the Valley.

## Key Issues

### How many people will use the charger?

Before installing charging equipment, it is best to find out how many residents will actually use the charger. Property management should survey residential owners and tenants to learn more about their current and future charging needs. This entails asking residents and tenants if they already own a PEV or if they plan to own one in the future.

Planners can also compare MUD data with the number of employees and single-family residences that exist in their vicinity. Cities and counties that have a large number of employees around areas with MUDs may benefit from workplace charging initiatives. On the other hand, areas with high numbers of MUDs and low numbers of employees may be strong candidates for MUD charging.

### What type of charging to offer?

Property managers can decide between offering Level 1 or Level 2 charging for their residents. Because of the low number of MUDs in the San Joaquin Valley, offering Level 1 charging may be a cost-effective option to increase charging opportunities at MUDs. Level 1 infrastructure is relatively cheaper than other equipment and may serve the majority of charging needs for many PEV drivers who would charge at home in the evening and at night.

### How to recover the cost of use

Aside from charging MUD tenants and residents to pay per charge, there is the option for property managers and HOAs to create paid use contracts with PEV owners. Such contracts with residents can help ensure that the EVSE is used regularly. In addition, there are three other fee strategies: an hourly use rate, an hourly rate plus a connection fee or slightly mark up the price of electricity.

## Multi-unit Dwellings in the San Joaquin Valley

MUD charging may not be a high priority in the San Joaquin Valley since the majority of residents live in single-family residences. The average percentage of California housing units in MUDs is about 31%, whereas Valley counties have an average of fewer than 18% of housing units in MUDs. However, it is still important to prepare for MUD charging because it poses the most complexities for installations.

The following ranks the counties in the Valley and the corresponding percentage of housing units in MUDs. This will help local governments with outreach and prepare for MUD EVSE permitting opportunities.

**Table 12: Percent Housing in MUDs by County**

| Jurisdiction | Percent of Housing Units in MUDs (2007-2011) |
|---|---|
| Fresno County | **25.6%** |
| Kings County | **18.5%** |
| San Joaquin County | **18.5%** |
| Kern County | **18.4%** |
| Merced County | **17.8%** |
| Stanislaus County | **16.6%** |
| Tulare County | **14.5%** |
| Madera County | **11.2%** |

Following are the top ten cities (with over 20,000 population) that have the highest percentage of MUDs as a share of housing.

**Table 13: Cities with Highest Percentage of MUDs as Share of Housing**

| City | Percent of Housing Units in MUDs (2007-2011) |
|---|---|
| Merced | 33.5% |
| Fresno | 33.4% |
| Lodi | 28.7% |
| Stockton | 26.6% |
| Coalinga | 25.3% |
| Bakersfield | 24.3% |
| Clovis | 24.0% |
| Modesto | 23.5% |
| Madera | 23.2% |
| Lemoore | 23.0% |

## Recommendations

Property managers will need guidance on how to handle issues regarding installing and using EVSE in their parking lots.

**Property manager recommendations**

1. Survey residential owners and tenants to learn more about their current and future charging needs.
2. If EVSE is installed at an MUD in a common-area parking space, consider a pay-for-use meter to recoup costs.

**Local government officials' recommendations**

1. Adopt building codes that promote the prewiring of EVSE in new MUD construction (see Building Codes for Plug-in Electric Vehicle Charging).
2. Expedite the approval process for permit applications for MUD EVSE installations.
3. Conduct targeted PEV outreach to communities that have a high density of MUDs.

# Fleet Electrification

## Background

In the San Joaquin Valley, goods movement is a large contributor of greenhouse gas (GHG) emissions. Two major transportation highways, the I-5 and Route 99, traverse through the entire 300 miles of the region. The mountains that surround the Valley create a bowl that traps the pollution from the highways, affecting the entire region. Heavy-duty diesel trucks contribute 6% of particulate matter (PM) and 46% of the nitrogen oxides (NOx) emissions in the region. NOx leads to the formation of ground-level ozone, and high levels of NOx and PM put the local population at risk of asthma and respiratory infection.

Light-duty public and private fleets are also a cause for concern for Valley residents. Passenger vehicles are the second largest source of NOx emissions in the San Joaquin Valley.[41] Public fleets that go electric will provide environmental and health benefits for the communities they serve by reducing pollutants released in the air. In addition, green public fleets set a positive example for the community.

Converting a conventional light-duty fleet into an electric fleet can be simple, as there are many vehicle types available. PEVs can offer long-term savings for fleet managers and operators. Delivery trucks, such as those used by UPS, and busses have seen particular success in switching to electric power. However, the electric technology for heavy-duty goods movement trucks are still very limited.

## Key Issues

When switching to an electric fleet, it is important to make sure that the conversion makes economic sense and will not hinder fleet performance. There are a few factors to consider when adding PEVs to a fleet.

- If your fleet is small and the vehicles travel fewer than 100 miles per day with the opportunity to plug in at night, BEVs can be a viable option. However, if your fleet vehicles travel more than 100 miles per day, a PHEV may be better suited.
- BEVs require less lifetime maintenance than a PHEV or a conventional gasoline vehicle and though up-front costs may be higher, on average, a BEV costs about three times less to drive. (More information on PEV costs and savings in Appendix: *Costs and Benefits of Switching to a Plug-in Electric Vehicle*)
- The selection of light- and heavy-duty PEVs available is growing. For an updated list, go to the Alternative Fuel Data Center's vehicle search tool to find **heavy-duty vehicles** and **light-duty vehicles**.

41 California Air Resources Board (2012). *Vision for Clean Air: A Framework for Air Quality and Climate Planning*.

Fleets that are interested in adopting PEVs can follow the steps outlined in *Electric Vehicle Charging Station Installation Guidelines* found in the Appendix.

### Financial Incentives

California offers incentives for converting conventional fleets to electric vehicles. The state's **Hybrid Truck and Bus Voucher Incentive Project** offers between $8,000 and $45,000 for the purchase of eligible new hybrid or electric trucks and buses. Fleets in the Valley that redeem this incentive also can apply for up to $30,000 in additional funds for their vehicles.

In addition, the SJVAPCD offers a **Public Benefit Grants Program** that provides $20,000 per new alternative fuel vehicle purchased by a public institution. The SJVAPCD **Drive Clean! Rebate Program** also provides rebates for up to $3,000 for Valley residents and businesses that purchase a PEV. Both the Public Benefit Grants Program and DriveClean! are for medium- and light-duty vehicles only. More information can be found in the *Use of Incentives to Encourage PEV Adoption* section.

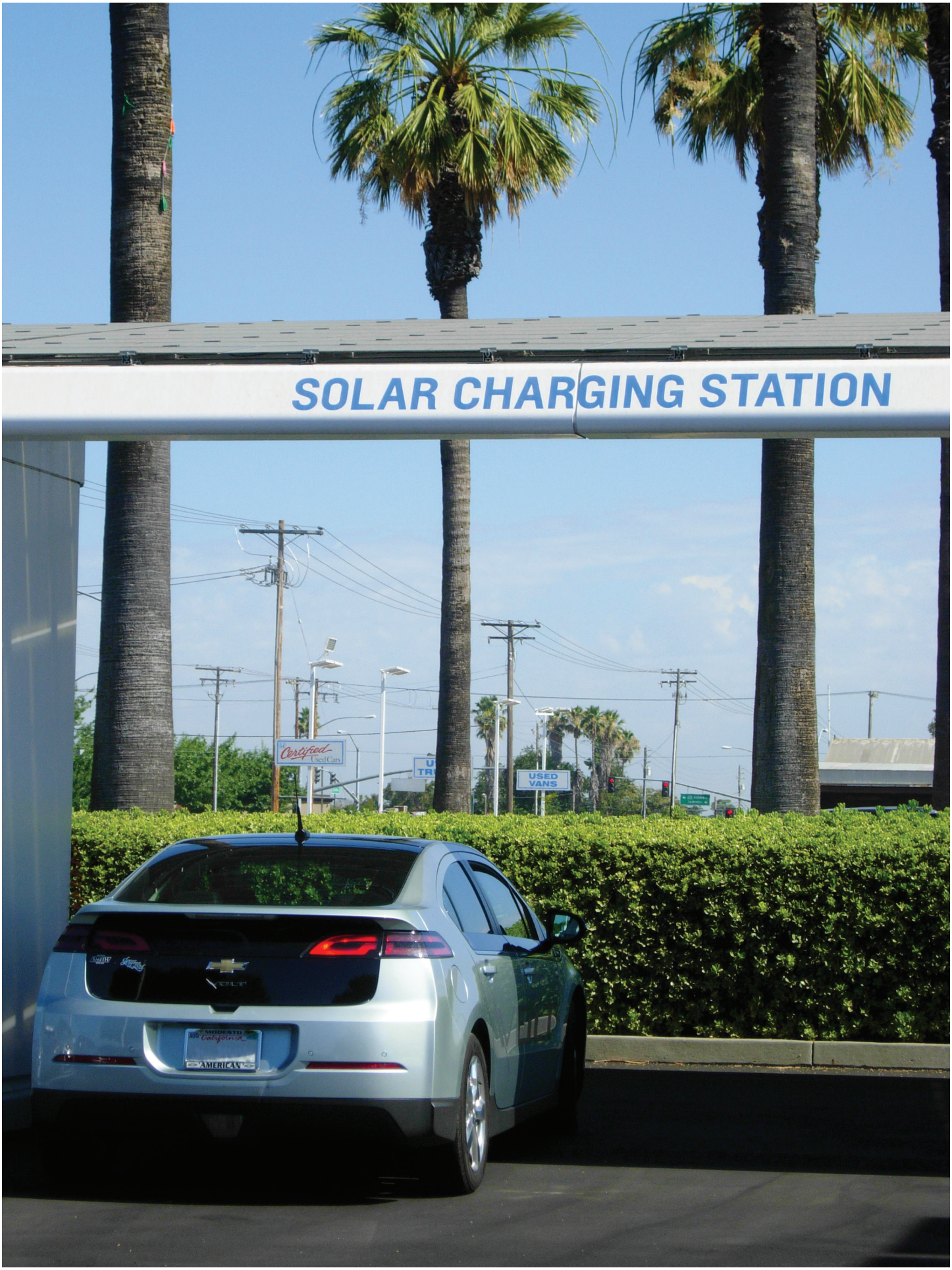
## San Joaquin Valley Examples

There are several examples of Valley companies integrating PEVs into their fleets.

- The City of Stockton adopted Northern California's first battery electric transit buses in May 2013. By recharging 10 minutes every two hours, the bus can operate throughout the daily operation cycle.
- UPS deployed 100 electric vans and 50 serve the SJVAPCD's jurisdiction. (For a case study of UPS, see *Fleet Electrification Case Study*: *UPS in the San Joaquin Valley* in the Appendix.)
- Ikea uses TransPower electric trucks at its distribution center in Tejon, Calif.
- Electric Vehicle International, a manufacturer specializing in trucks and vans, is headquartered in Stockton.
- Kings Canyon Unified School District debuted the nation's first all-electric school bus in March 2014. The bus has a range of 80-100 miles and is expected to save the district $10,000 in running costs.

## Recommendations

1. Fleet managers should conduct fleet analysis to determine if they will benefit from electric vehicles.
2. Use the Alternative Fuels Data Center's **Petroleum Reduction Planning Tool** to create a plan to reduce your fleet's petroleum usage.
3. When adopting PEVs into a fleet, all drivers should receive training on the technology to optimize battery performance.
4. Distribute the UPS case study to regional stakeholders.


SOLAR CHARGING STATION
Certified Used Cars
USED VANS
VOLT
MODESTO
California
AMERICAN

# Leveraging Renewable Energy

## Background

One motivating factor for PEV adoption is the desire to reduce the volume of greenhouse gas emissions created by conventional gasoline-powered vehicles. While fully electric BEVs produce no tailpipe emissions, there is concern that vehicle charging could increase emissions related to generating electricity from nonrenewable sources. In California, however, utilities have a renewable energy portfolio mandate to increase procurement of energy from renewable resources to 33% of total procurement by 2020. Despite this policy, it is difficult for local PEV drivers to know exactly what type of energy source is charging their vehicle.[42] One method of overcoming this situation is for PEV drivers to install and charge with a residential solar photovoltaic (PV) system.

## Key Issues

### Charging Plug-in Electric Vehicles with Residential Solar Systems

Electric vehicles and PV systems are compatible and complementary technologies. While charging a PEV will add an additional electrical load to a driver's residence, a PV system can produce up to 100% of the power required for all household appliances and the vehicle. This will depend on certain variables including how much drivers charge their vehicle each day, the efficiency of the car and the size (wattage) of the PV system. As a long-term investment, PEV drivers with larger solar electric systems, sized to meet their household needs and charge the PEV, can be considerably more cost-effective than continuously buying electricity from a utility provider. After the system has paid itself off, the cost of powering a PEV becomes minimal.

Solar-EV households also can take advantage of special time-of-use (TOU) utility rates. They are usually the best choice for PEV owners because they offer very low electricity prices at night when PEVs are normally charged. On the other hand, TOU rates are significantly higher during the day. A solar electric system helps offset the higher-priced electricity consumed by the household during peak hours. In this way, homeowners can take advantage of inexpensive electricity at night and generate their own energy during the day when TOU rates are higher.

42 *San Joaquin Valley Utilities' Electricity Sources* in the Appendix shows in-depth information about SJV utilities' renewable energy portfolios.

### Regional Landscape: Solar and Plug-in Electric Vehicle Adoption Rates

According to market research by Sunible, a California solar installer, the cities of Bakersfield, Fresno and Clovis are among the top ten solar adopters in the state. These top solar cities are also the top adopters of electric vehicles in the San Joaquin Valley.[43] In fact, 36% of PEV owners in the Valley have a residential solar system installed at their homes, according to the **California Plug-in Electric Vehicle Driver Survey Results** (February 2014). More than half of these solar and PEV owners have sized their PV systems for their EV load.

Overall, the rate of solar adoption is higher than the rate of PEV adoption in the San Joaquin Valley. In the City of Clovis, for example, 4.6% of households have installed solar panels whereas only 0.25% of Clovis households are PEV owners. The data imply that many Valley residents are solar adopters or likely to have a positive view of solar. Effective PEV outreach strategies to solar adopters could spur PEV growth in the region.

Detailed statistics on regional solar and PEV adoption rates are found in the Appendix: *Regional Residential Solar and Plug-in Electric Vehicle Adoption*.

## Case Study: Manteca Unified School District

The Manteca Unified School District (MUSD) has pursued a solar project that allows for electric vehicle charging. In September 2013, MUSD's $30 million solar energy project went online after a year of planning.

The project installed solar panels at 26 sites in the district expects to produce 6,720 MWh (6.72 million kWh) per year. In all, the district and expects to reduce their electricity bill by more than 60%.

Students will track the energy savings and renewable energy usage, and classroom studies will emphasize the energy technologies.

Solar panels at the school district offices, as well as at the Environmental Studies Center (photo on next page), will also power PEV charging equipment. Electric vehicle charging will be available directly from the solar power generated during on-peak daylight hours and at night, during off-peak hours, by energy stored on site.

Funding for this project came from an ultralow interest (less than 1%) Qualified Zone Academy Bond (QZAB).

Read more about Manteca Unified School District in the Appendix

43 This uses rebate information from both the California Solar Initiative and the California Clean Vehicle Rebate Project. Number of rebate applications act as a proxy for number of solar and PEV adopters.

## Recommendations

There are several ways for local governments, businesses and residents to leverage renewable energy for charging electric vehicles.

1. Renewable energy generation and storage technologies should be encouraged in incentive programs for electric vehicles.

2. When installing renewable energy projects, such as larger commercial solar projects, add the necessary prewiring required for future PEV charging.

3. Incentivize battery storage projects to spur investment and growth.

# The Road Ahead

Currently, the PEV adoption rate in the San Joaquin Valley represents less than two percent of the California PEV market. The region's socioeconomic diversity could be a main factor. While there are clearly early adopters in the region, there are also a large number of disadvantaged communities. Some communities have poverty rates exceeding 30% and over a third of household spending in low-income households goes to vehicle expenses.[44] Vehicles are an asset to low-income and rural households because many areas are not dense enough to support a robust public transportation network. A 45-minute car commute gives Valley residents access to over 165,000 jobs, whereas the same commute on public transit offers merely 1,895 jobs.[45]

On the road ahead, the economic and environmental benefits of PEVs must be emphasized to the diverse communities in the Valley. Many local residents drive old, unregistered vehicles to save on costs. Used hybrids or electric vehicles can be adopted by these communities with the help of greater consumer awareness and higher-value incentives. The PEV market is expected to grow at a rapid pace. California, a leader in PEV adoption, represents up to 35% of the U.S. market. Projections indicate that California's PEV ownership could reach 100,000 by 2014-2015 and 500,000 by 2018-2020.

The Valley, too, will witness an increase in PEVs in the region, considering its adoption rate has doubled each year since 2010. Accordingly, infrastructure will be needed to support increased numbers of electric vehicles on the road and the long distances between urban centers. The following chart shows forecasted PEV numbers in the San Joaquin Valley and the estimated number of Level 1 and Level 2 publically available chargers needed to meet the charging demand.

44 U.S. Census Bureau
45 Margonelli. *Driving Out of the Red With Greener Cars*.

### Table 14: PEV and EVSE Forecasts

| Year | PEV Forecast[1] | L1 and L2 EVSE Estimates | | |
|---|---|---|---|---|
| | | Low[2] | High[3] | Work[4] |
| 2015 | 1,340 | 268 | 402 | 134 |
| 2020 | 4,919 | 983 | 1,475 | 491 |
| 2025 | 10,995 | 2,199 | 3,298 | 1,099 |

1 U.S. PEV light-duty stock is from **http://www.eia.gov/forecasts/aeo/tables_ref.cfm**. Calif. PEV stocks estimated as 1/3 of U.S. stock. San Joaquin Valley PEV stock calculated to be 1.6% of the Calif. stock.

2 CPUC recommends two chargers per 10 PEVs.

3 EV manufacturers recommend three chargers per 10 PEVs.

4 The Idaho National Laboratory recommends one workplace charger per 10 PEVs.

Considering there are only 36 public Level 2 chargers in the San Joaquin Valley at present, to meet the demands of the PEV forecast, the number of Level 1 and Level 2 chargers will need to increase significantly. In addition, creating an extensive network of fast charging infrastructure is important to support PEV drivers who travel throughout the San Joaquin Valley. Ideally, the location of these fast charging stations would be along highways and between long stretches of open space. Fast charging stations will also need to find a way to have an extensive presence in the rural areas of the San Joaquin Valley, which are not close to major transportation corridors. A regional siting analysis of fast charging infrastructure is explored in the San Joaquin Valley Regional Charging Siting Analysis, *Charging Roadmap: Optimal Locations for Public Charging Stations in the San Joaquin Valley*.

# Appendix

**Fact Sheets**

1. The Basics: A Guide to Plug-in Electric Vehicles and Charging Infrastructure
2. Charging Environments: Single-family Residences and Multi-unit Dwellings
3. Charging Environments: Retail and Public Locations
4. Charging Environments: Workplaces
5. Homeowner's Guide for Permitting and Inspecting EV Chargers
6. Sample Zoning Code Provisions
7. Local Utilities: Solutions and Programs for Plug-in Electric Vehicle Charging
8. Local Government Action Plans: Best Practices for Plug-in Electric Vehicle Readiness

**Electric Vehicle Charging Station Installation Guidelines**

1. Fleet
2. Residential
3. Nonresidential

**Considerations for Public Agencies that Provide Charging**

1. Considerations for Public Agencies that Provide Charging
2. Request for Proposals Template

**Fleet Electrification Case Study: UPS in the San Joaquin Valley**

**Costs and Benefits of Switching to a Plug-in Electric Vehicle**

**Regional Residential Solar and Plug-in Electric Vehicle Adoption**

**San Joaquin Valley Utilities' Electricity Sources**

**Works Cited**

**Compilation of Plan and Resource Hyperlinks**

**Glossary of Terms, Abbreviations and Acronyms**

San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness

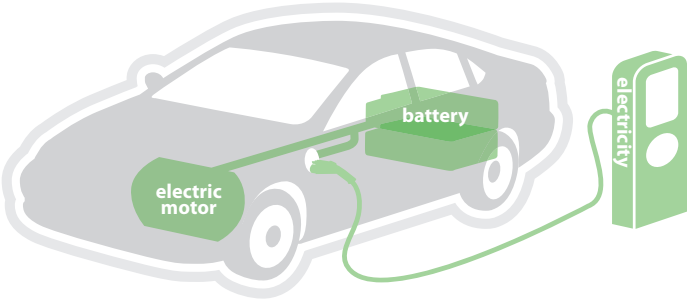
# The Basics: A Guide to Plug-in Electric Vehicles and Charging Infrastructure

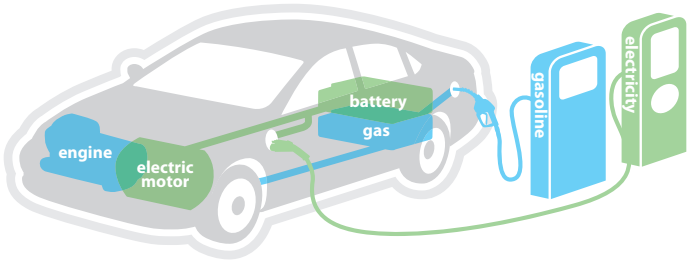
## What is a Plug-in Electric Vehicle?

A plug-in electric vehicle (PEV) is a vehicle fueled at least partially by an onboard battery charged from the electrical grid. There are two types of PEVs that are commercially available: battery electric vehicles and plug-in hybrid electric vehicles.

A **battery electric vehicle** (BEV) is a fully electric vehicle fueled only by the onboard battery. Most BEVs available on the market have a range of approximately 60-100 miles on a full charge.

A **plug-in hybrid electric vehicle** (PHEV) uses both an onboard battery charged from the electrical grid and gasoline. After battery power dips below a specific charge threshold, the vehicle seamlessly switches to gasoline power.




PEVs are not limited to light-duty passenger vehicles. There are many trucks and heavy-duty vehicles that also run on electric power. For a complete list of heavy-duty electric vehicles and drivetrains, visit the Department of Energy's **Alternative Fuels Data Center** (AFDC) website.

## How Do You Charge a PEV?

The time needed to charge a PEV depends on factors such as the size of the battery, the battery's initial state of charge, the size of the onboard charger and available power from the charging station. In general, BEVs have a larger battery compared to PHEVs. Both the onboard charger and available power from the charging source determine the vehicle's specific rate of charge. DC fast charging is often referred to as "Level 3 charging" and uses direct current to charge PEVs. It typically provides the fastest PEV charging times available.

| Type of Charging | Power Levels (installed circuit rating) | Miles of Range per Hour of Charge* | Where to Charge |
|---|---|---|---|
| **Level 1** | 110/120 VAC at 15 or 20 Amps | ~4–6 miles/hour | Standard three-pronged outlet |
| **Level 2**<br>3.3 kW (low)<br>6.6 kW (medium)<br>9.6 kW (high)<br>19.2 kW (highest) | 208/240VAC at 30 Amps<br>208/240VAC at 40 Amps<br>208/240VAC at 50 Amps<br>208/240VAC at 100 Amps | 8-12 miles/hour<br>16-24 miles/hour<br>32-48 miles/hour<br>>60 miles/hour | At home, workplace or public charging station |
| **DC Fast Charging** | 440 or 480 VAC | ~80% in < 30 min. | Public or commercial sites |

* Refer to vehicle specifications for exact ratings.

*Source:* Adapted from PEV Collaborative MUD Guidelines

## Types of Charging Equipment

Level 1 charging infrastructure consists of a charging cord set that comes standard with every PEV. The charging cord can be plugged into any standard three-pronged, 120-volt outlet.

Level 2 charging infrastructure consists of a designated charging unit (known as electric vehicle supply equipment, or EVSE) that plugs into or hardwires into a 208/240-volt circuit.

There are two common types of Level 2 installation styles.

| Level 2 Installation Style | Installation Method | Considerations |
|---|---|---|
| Floor mount (bollard style) | Mounted to the ground and wired through the base | Generally requires concrete work along with underground trenching |
| Wall/Pole mount | Installed on any wall or pole and can be wired through a garage wall | Offers flexible placement options and takes up less floor space than a floor mount |

DC fast charging infrastructure is complex and requires commercial-grade electrical capacity. The equipment can cost more than $10,000, and installations of a single unit can cost up to $50,000.


## Where are Public Charging Stations?

Publically available charging locations in the San Joaquin Valley can be found easily online through the AFDC's station locator at **www.afdc.energy.gov/locator/stations/** and by mobile apps such as PlugShare (**www.plugshare.com/**).

The map displays Level 2 charging station locations in the San Joaquin Valley as of March 2014.

# Charging Environments: Single-Family Residences and Multi-Unit Dwellings

## Charging at Single-family Residences

The majority of plug-in electric vehicle (PEV) charging will take place at a single-family residence because it is convenient and more cost-effective than paying for public charging or charging at the workplace. Data show that PEV owners tend to live in clusters in the same neighborhoods and plug in at similar times, usually in the evening.

The following are important stakeholders for single-family residence charging.

- **Utilities** provide the fuel for PEV drivers to charge their vehicle. Typically, PEV drivers can plug in and charge at home at any time, but some utilities in the region offer cost-effective options for customers to charge at night. These rates are typically called time-of-use (TOU) rates and incentivize charging during off-peak hours, generally after 8 p.m.
- **Local governments** may require PEV owners to obtain permits to install electric vehicle supply equipment (EVSE) at home.
- **EVSE vendors** provide charging systems to PEV owners. Many EVSE manufacturers sell through certified distributors and other manufacturers have products at big-box retail stores. Some manufacturers also make charging equipment available to purchase online.
- **Electrical contractors** ensure that EVSE installations are made safely and according to electrical code standards.

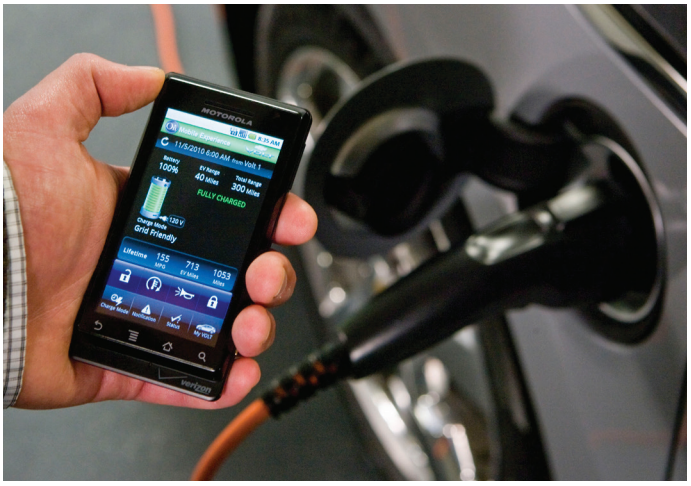
Homeowners have the option of using either Level 1 or Level 2 for charging their vehicles. Level 1 charging requires no installation for the PEV owner, but may require an amperage upgrade, particularly for older homes. Level 2 requires professional installation of a dedicated EVSE system if the EVSE is to be permanently affixed to the house. Recently, new portable Level 2 charging cords have come to market that allow drivers to plug into a 120-volt outlet, but get the charging speed of 240-volts from the cord. These do not require professional installations and can be used anywhere.[1]

## Charging at Multi-Unit Dwellings

A multi-unit dwelling (MUD) is a property that comprises of two or more housing units. Installing EVSE at MUDs presents a few obstacles. A resident's dedicated parking spot may be located far from their household meter, thereby increasing installation costs. Another problem arises if EVSE is provided as a common good (such as a laundry machine), requiring a decision on whether all tenants, even those without PEVs, should pay for EVSE maintenance and operation.

Installing charging equipment at MUDs is a challenge requiring the coordination of several participants.

- **Property owners and managers** managers should be cognizant of PEV charging opportunities. If there is a desire for EVSE, they will need to work with the homeowners association (HOA) or individual residents to develop operation and use policies. Further, owners and managers will need to work with tenants who drive PEVs to figure out how to fund the installation and hardware.
- **Electrical contractors** can coordinate with property owners and managers to install EVSE at the MUD site.
- **Tenants and residents** who own PEVs should be involved in the EVSE planning process by engaging the HOA about the topic and bringing attention to charging needs in the area.
- **Utilities** can review the EVSE installation and perform electric service upgrades if needed.




1 **http://www.edmunds.com/car-news/new-portable-plug-in-car-charger-offers-increased-flexibility-for-ev-drivers.html**

# Charging Environments: Retail, Commercial and Public Locations

## Background

Charging at retail stores, commercial sites and public locations allows plug-in electric vehicle (PEV) drivers to extend their driving range and trip duration. Certain retail and public locations, such as sporting facilities and parks, attract visitors who stay for several hours at a time, which is ample time to charge a PEV. Among the advantages for retail and public locations to offer PEV charging are attracting more visitors and generating revenue from user fees.

Installing electric vehicle supply equipment (EVSE) at retail, commercial and public locations requires the cooperation of employees and managers, property owners, consumers and local government agencies.

## Retail and Public Locations

There are three factors to consider when installing EVSE at retail and public locations: dwell time (i.e., how long a vehicle is parked), time of use and the value of parking spots.

The value of non-PEV parking spots is important to consider because a site host would not want to limit the number of visitors to its facilities because of adding EVSE. Locations with few parking spaces and a high volume of activity throughout the day would not benefit from adding EVSE, which may inhibit non-PEV drivers from parking. Alternatively, sites with available parking spaces would benefit from EVSE because it would not impede non-PEV drivers to park and shop at that location.


If a location charges a user fee for EVSE, it is most cost-effective to allow charging at all times, even when a location might not be open for regular business. Doing so allows the site host to recoup some of the cost of electricity used for charging during peak hours (typically from 2 p.m. to 6 p.m.).

PEV drivers will visit a site for reasons beyond simply charging their vehicle. Therefore, it is strategic to place EVSEs at retail and public locations in which people generally stay for one to two hours. While Level 2 chargers provide a faster charge, when PEVs are parked for longer times, installing Level 1 chargers may be more practical, with lower equipment and installation costs for the host.

Common travel destinations and their dwell times have been identified by an analysis of 2009 National Household Transportation Survey data (Krumm 2012). The following is a list of public locations where vehicles tend to park for two hours or more on average.

- Government workplaces
- Transportation stations (e.g., light rail, subway, bus, airports)
- Public parking facilities
- Recreational, natural and cultural facilities (e.g., sports parks, pools, parks, museums, libraries, theaters)
- Nonprofit sites (e.g., houses of worship, clubs, cultural centers)

The following are commercial sites that have average dwell times of longer than one hour.

| Site | Average Dwell Time (approximation) |
|---|---|
| Theaters | 2.39 hours |
| Sports events | 2.39 hours |
| Bars and nighttime entertainment venues | 2.39 hours |
| Exercise and sporting facilities | 1.76 hours |
| Medical and dental services | 1.14 hours |
| Nail, beauty or hair salons | 1.11 hours |

Retail locations that host EVSE will attract customers that want to charge their vehicles while they shop, eat or engage in other activities. With one hour of dwell time, a PEV driver can add up to 20 miles of driving range.

## Financial Viability of Retail & Public Locations

The financial viability of EVSE at commercial sites largely depends on consumer use. The more a public charging station is utilized, the more revenue it generates. Other factors in a return on investment analysis are the user rate and installation and operation costs.[1] In addition, there are nonrevenue benefits, such as boosting a company's sustainability credentials and lessening environmental impacts. Ultimately, the financial return for charging equipment depends on user fees and frequency of use per day.

The California Center for Sustainable Energy (CCSE) has produced a draft report that provides insight into the value proposition for companies and institutions that install Level 2 charging infrastructure.[2] The report identifies the median willingness to pay (WTP) among PEV drivers for different charging scenarios.

| | WTP for Daily Charging | Average Dwell Time (approximation) |
|---|---|---|
| Median ($/hour) | $0.50 | $1.00 |
| Median ($/kWh) | $0.15 | $0.30 |

The study subsequently showed that the median WTP for occasional charging is sufficient to break even only with lower-cost Level 2 EVSE installations and that the median WTP for daily charging is not sufficient to break even with any currently available Level 2 EVSE.


1 From paying an electrical contractor to buying the charging equipment, the installation can cost about $4,000 for a Level 2 charger.

2 CCSE's Research and Analysis team presented the draft report *Providing a Place to Plug In: The Value Proposition of Hosting Level 2 Non-Residential Electric Vehicle Supply Equipment and Drivers' Willingness to Pay for PEV Charging* at the March 19, 2013, REVI meeting. A copy of the presentation can be found at: **http://energycenter.org/programs/pev-planning/san-diego**

San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness

# Charging Environments: Workplaces

## Background

Workplaces present a significant, and largely untapped, opportunity for plug-in electric vehicle (PEV) charging in the San Joaquin Valley. After home charging, workplaces are the second most common place to charge. Because vehicles are generally parked at workplaces for several hours, it is possible to completely recharge a PEV before the commute home and increase miles traveled on electricity for plug-in hybrid electric vehicles.

**Did you know?**

The San Joaquin Valley Air Pollution Control District office in Fresno hosts two Level 2 chargers for their employees and visitors. The installations were funded by the **California Energy Commission Reconnect Program**.

Commutes in the San Joaquin Valley can be longer than average, when considering rural transportation. Residents in San Joaquin County are known by the census bureau as "mega-commuters," traveling on average 61 miles to work (U.S. Census Bureau). Workers from rural areas drive an average of 47% more miles per day than those from urban areas, according to the 2009 National Household Travel Survey. Facing long commutes, workplace charging can ameliorate any potential fear of depleting a car battery before getting home. The ability to charge at work may also encourage PEV adoption among employees that have limited charging options at home.

Implementing workplace charging is less complicated when a business or organization is the owner of the parking area, building and electrical service. By owning the building and its facilities, the employer has more control over the location and type of charging equipment that is installed and in developing policies regarding charger use. If the employer is not the owner of the facility, it is recommended that the employer notify the property manager that they are interested in installing electric vehicle supply equipment (EVSE) and work together to develop an installation and cost-management plan.

## Cost of EVSE Installation

The cost of an EVSE installation can vary depending on the type of equipment being installed, the site's existing electrical capacity, and permitting costs and labor rates.

In some cases, installations may require an upgrade to the electrical panel, circuit breakers, trenching, and laying new conduit. Below are cost estimates for EVSE installations at a workplace provided by CALSTART's *Best Practices for Workplace Charging:*[1]

- 40A branch circuit: $10-$11/ft
- 200A feeder circuit: $17-$18/ft
- Concrete patch: $14-$15/ft$^2$
- Asphalt patch: $10-$11/ft$^2$

Overall, estimates show that commercial installation costs range from $500 to $15,000 per charger installation.[2]

1 CalSTART (n.d.). *Best Practices for Workplace Charging*. **http://www.calstart.org/Libraries/Publications/Best_Practices_for_Workplace_Charging.sflb.ashx**
2 Ibid.

### Levels of Charging and Cost of Equipment

| Type of Charging | Power Levels (installed circuit rating) | Miles of Range per Hour of Charge* | Average Cost of Equipment |
|---|---|---|---|
|  **Level 1** | 110/120 VAC at 15 or 20 Amps | ~4-6 miles/hour | $0-$500 |
|   **Level 2**<br>3.3 kW (low)<br>6.6 kW (medium)<br>9.6 kW (high)<br>19.2 kW (highest) | 208/240VAC at 30 Amps<br>208/240VAC at 40 Amps<br>208/240VAC at 50 Amps<br>208/240VAC at 100 Amps | 8-12 miles/hour<br>16-24 miles/hour<br>32-48 miles/hour<br>>60 miles/hour | $500-$1,500 (residential)<br>$2,000-$6,000 (commercial) |
|   **DC Fast Charging** | 440 or 480 VAC | ~80% in <30 min. | up to $55,000 |

* Refer to vehicle specifications for exact ratings.

*Source: Ready, Set, Charge California! A Guide to EV Ready Communities.* "Estimated Vehicle Charging Times and Charger Hardware and Installation Costs." Association of Bay Area Governments, Bay Area Climate Collaborative, EV Communities Alliance, Clean Fuel Connection, and LightMoves Consulting. **http://www.rmi.org/Content/Files/Readysetcharge.pdf**

## Cost of EVSE Operation and Maintenance

The cost of operating an EVSE is dependent upon a number of factors: the cost of electricity, charging network costs and maintenance costs.

- **Electricity Cost:** Workplaces will need to manage electricity costs if employees are charging during daytime peak hours. Employers should contact the local utility to discuss billing impacts of workplace charging and how to manage electricity costs.
- **Charging Network Cost:** If the installed EVSE is part of a charging network, then the charger owners will usually need to pay monthly or yearly subscription fees to use networking capabilities and specialized software. These costs vary from service provider to service provider.
- **Maintenance Cost:** Maintenance costs are generally low, averaging around $300 per year, excluding administration costs.[3]

Additional information on the costs and benefits of operating EVSE may be found in the UCLA Luskin Center's report, **Financial Viability of Non-Residential Electric Vehicle Charging Stations**.

**Uncertain about user fees?**

When offering charging options to employees, consider an 80/20 rule where 80% of charging equipment is Level 1 and 20% is Level 2. Provide free Level 1 charging and set a fee for Level 2 charging.

## Ownership Models for Workplace Charging

Many companies may wonder whether or not to own and operate EVSE. There are two options available:

- **Own and operate the EVSE**: When choosing to own and operate EVSE, employers will be responsible for the associated maintenance, operation and revenue collection. The benefit is the ability to charge employees a user fee, which can cover some of the up-front and operational costs.
- **Turnkey model**: When a company chooses a turnkey model, an EVSE service provider will install, operate and maintain the charging system and control revenue collection. Usually, the employer will only need to pay for hardware costs. The benefit is that employers are able to host chargers without the responsibilities associated with operating them.

3 UCLA Luskin Center (2012). Financial Viability of Non-Residential Electric Vehicle Charging Stations.

## Paying for Charging Equipment

### Current Programs in California

**NRG eVgo**: NRG eVgo is offering subsidized charging stations and installations for workplaces. Learn more at **www.evgonetwork.com/request-charging-station/**.

### Looking for Incentives?

**U.S. Department of Energy's Alternative Fuels Data Center**: Find a list of currently available incentives for electric vehicle charging infrastructure.

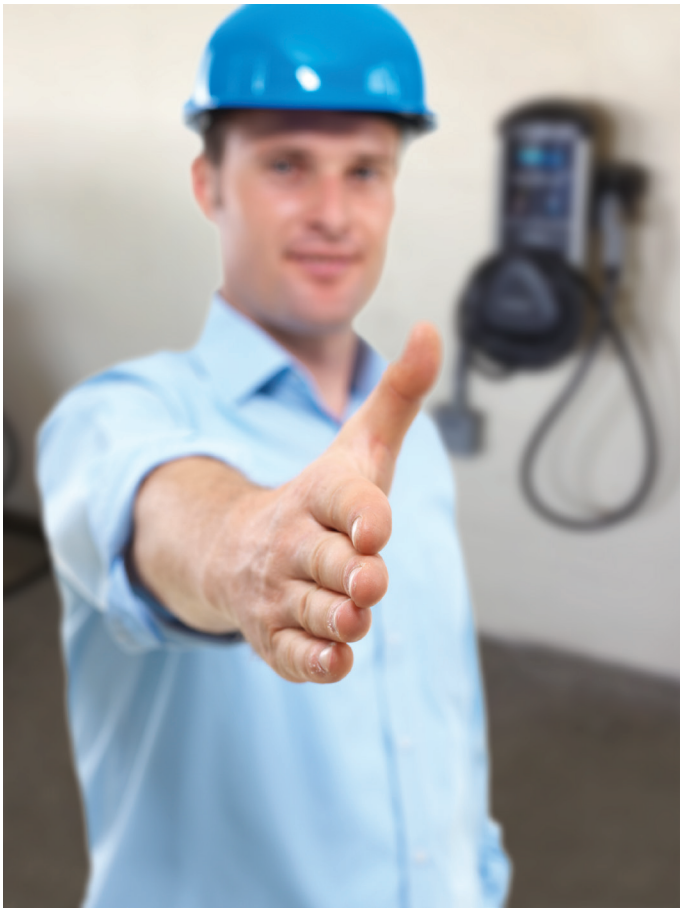
**San Joaquin Valley Air Pollution Control District** (SJVAPCD): The SJVAPCD anticipates developing incentive programs to fund the purchase and installation of electric vehicle charging infrastructure for Valley residents, business, and public agencies. Sign up on the SJVAPCD's email list to receive notices regarding upcoming funding opportunities.

San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness

# Homeowner's Guide for Permitting & Inspecting EV Chargers

## Introduction

Understanding how to charge your plug-in electric vehicle (PEV) at home may be overwhelming for new PEV drivers. This guideline will help you identify the most appropriate level of charging for your vehicle and navigate the permitting and inspection process for installing an EV charger at a single-family residence.



## How do I charge my plug-in electric vehicle at home?

The type of PEV you purchase will determine the ways you can charge your vehicle. Consult with your car dealership about your home charging options. There are two basic types of EV chargers for home use: Level 1 and Level 2. Chargers and related equipment are also known as electrical vehicle supply equipment, or EVSE.

Level 1 charging can be as easy as plugging directly into a standard 120-volt household outlet (three-pronged). PEVs come standard with a 120-volt charging cord that enables PEV owners to charge their vehicles with a conventional outlet.

Several manufacturers sell Level 2 EV chargers for home use that are capable of charging PEVs in half the time of Level 1 chargers. Level 2 EV chargers use a dedicated 240-volt circuit but typically require a permit and the installation of a dedicated circuit close to where your vehicle is parked (usually in the garage, carport or driveway). Visit **www.GoElectricDrive.com** for information on available chargers.

In order to obtain a permit, you (or your electrical contractor) will need to provide some basic information to show that your existing electrical service can handle the added load.

### Levels of Charging and Miles of Range

| Type of Charging | Power Levels (installed circuit rating) | Miles of Range per Hour of Charge* | Where to Charge |
|---|---|---|---|
| **Level 1** | 110/120 VAC at 15 or 20 Amps | ~4–6 miles/hour | Standard three-pronged outlet |
| **Level 2**<br>3.3 kW (low)<br>6.6 kW (medium)<br>9.6 kW (high)<br>19.2 kW (highest) | 208/240VAC at 30 Amps<br>208/240VAC at 40 Amps<br>208/240VAC at 50 Amps<br>208/240VAC at 100 Amps | 8-12 miles/hour<br>16-24 miles/hour<br>32-48 miles/hour<br>>60 miles/hour | At home, workplace or public charging station |

* Refer to vehicle specifications for exact ratings.

*Source:* Adapted from PEV Collaborative MUD Guidelines

## What information do I need to provide to obtain a permit?

In most cases, you (or your contractor) simply need to submit the permit application and associated documentation outlined below. Always check with the local jurisdiction's permitting department to make sure of what you need.

| Documentation | Description |
|---|---|
| **Permit Application** | Electrical permit or special permit for EV chargers |
| **EVSE Manufacturer's Information** | The manufacturer's installation instructions and EV charger specifications |
| **Site Plan** | Identify the complete layout of existing parking spaces and proposed location of EVSE parking space(s) with respect to existing building and structures |
| **Electrical Load Calculations** | Home electrical load calculation that estimates if an existing electrical service will handle the extra load from a residential EVSE and wiring methods based on the California Electrical Code (CEC) (Note that CEC Article 220 requires load calculations if the existing service panel is rated less than 200 amps) |
| **Electrical Plans** | Single line diagrams showing the system, point of connection to the power supply and the EVSE |

Documentation will be specific to each jurisdiction

## Verifying your contractor's licensure

PEV owners are encouraged to choose a licensed local electrical contractor to install EVSE. The electrician should have a C-10 license along with the expertise, tools and training for installing home EV chargers. You can verify your electrical contractor's license by visiting **www.CSLB.ca.gov** or by calling (800) 321-CSLB. The contractor should follow the installation instructions of the EVSE manufacturer and the requirements of California Electrical Code.

## Is an inspection required for my EV charger?

Yes, inspections are required for all EV charger installations before they are used. Upon completion of the installation, it is your responsibility (or your contractor's) to schedule a final inspection with the jurisdiction. In order to schedule an appointment, check with your local jurisdiction, usually the building department. Inspections are not required if you primarily use a portable charger (e.g., the standard 120-volt charger cord that comes with your vehicle).

## Contact your local utility before installing your EV charger

Though an individual Level 2 EV charger may have a negligible impact on the utility's electric system, it is still important to notify your local utility of any Level 2 charger installations to ensure that utility electrical system components will maintain reliable service in your neighborhood. By contacting your utility, you can also access information on special EV time-of-use (TOU) rates they may offer. These rates can provide you a significantly lower cost for electricity based on the time of day you charge your vehicle.

San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness

# Sample Zoning Code Provisions

## Introduction

Local jurisdictions need to standardize zoning code provisions for electric vehicle charging stations, also known as electric vehicle supply equipment (EVSE), to help support the plug-in electric vehicle (PEV) market. This document provides guidance for jurisdictions in choosing where to regulate, what type of equipment needs regulation and how many charging stations will be permitted in different land uses.


## Zoning Districts for PEV Infrastructure Use

When planning for PEV charger deployment in residential and nonresidential districts, local government officials must be aware of the various electrical levels for EVSE. The table below recommends the type of EVSE permitted and the permitting process for each zoning district.

| Sample Zoning Districts and Allowed Electric Vehicle Infrastructure Uses | | | |
|---|---|---|---|
| **Zoning District** | **AC Level 1 and 2 Charging Station** | **DC Level 2** (DC Fast Charging) Station** | **Battery Swap Station** |
| **Low-density Residential** | $P_1$*** | $P_1$ | |
| **High-density Residential** | $P_1$ | $P_1$, $P_2$**** | |
| **Mixed Use** | $P_1$ | $P_1$ or $P_2$ | |
| **Commercial** | P* | P | P |
| **Industrial** | P | P | P |
| **Institutional** | P | P | P |
| **Recreational** | $P_1$ | $P_1$ | |

* P = Permitted Use

** DC Level 2 is synonymous with DC fast charging.

*** $P_1$ allowed only as an accessory to a principal permitted use or as a conditional or special use

**** $P_2$ local jurisdictions may choose to allow DC Level 2 charging stations as a permitted use or to adopt development standards applicable to high-density residential, mixed-use residential or other zoning districts

# Local Utilities: Solutions and Programs for Plug-in Electric Vehicle Charging

## Southern California Edison (SCE)

**Secondary Metering** – SCE offers several electric vehicle rates. The Electric Vehicle Plan (TOU-EV-1) supplies a second meter, allowing customers to charge on a separate bill and take advantage of seasonal and time-of-use (TOU) rate changes without affecting their home energy bill.

| Electric Vehicle Plan (TOU-EV-1) | Summer | Winter |
|---|---|---|
| On-Peak: Noon – 9 p.m. Daily | 33¢/kWh | 23¢/kWh |
| Off-Peak: 9 p.m. – Noon Daily | 11¢/kWh | 11¢/kWh |

**Consumer Outreach Programs** – SCE has developed an extensive PEV website for consumers, businesses and local jurisdictions. It provides information on PEV and EVSE rebates, incentives and charging station equipment, PEV rates and installation procedures.

**Smart Grid Opportunities** – SCE has taken a leadership role in adopting smart grid technology. Within its territory, the utility has deployed smart meters to all customers and has conducted pilot projects for new distribution management systems, energy storage and neighborhood grid integration.[1]

**Renewable Energy Options** – Although SCE does not offer a separate renewable energy option, approximately 20% of its power was generated from renewable energy such as wind and solar in 2012.

**Multi-unit Dwellings (MUDs)** –Property owners may be eligible for residential rates designed for PEV charging. SCE encourages MUD customers to consider the various factors involved in installation, including the choice between dedicated-resident charging and common-area charging, before contacting an energy advisor for guidance in the installation process and rate structure.

## Pacific Gas & Electric (PG&E)

| | EV-A Time of Use Rate | EV-B Time of Use Rate |
|---|---|---|
| Rate Design | Single meter, home and PEV on time-of-use | Dual meter, PEV on time-of-use |
| Ideal For | Low energy usage, especially during peak hours | High energy usage or high residential usage during peak hours |
| Costs | None specific to rate; panel and/or service upgrade may be required | $100 per meter fee and second panel install; service upgrade may be required |

**Consumer Outreach Programs** –PG&E's dedicated website for PEVs (http://www.pge.com/electricvehicles/) offers an array of tools and PEV resources to help customers become PEV ready, such as a PEV rate calculator to estimate electricity costs for a variety of PEV models. It also has information for nonresidential customers interested in fleet or workplace charging.

**Smart Grid Opportunities** – The smart meter deployed by PG&E allows customers to intelligently monitor their energy use. Further, PG&E has an outage detection program and intelligent circuits to improve reliability.

**Renewable Energy Options** – As of April 2013, PG&E has proposed a "green option" pending California Public Utilities Commission approval. This program gives customers the option of purchasing 100% renewable energy produced by new and existing projects. Participants would pay the full cost of renewable energy projects built in response to their demand, but receive credits for avoiding generation.

**Multi-unit Dwellings (MUDs)** – PG&E's website provides a step-by-step guide to EVSE installations at MUDs.

## The City of Lodi Electric Utility

**Time-of-Use Rates** – PEV owners can take advantage of Lodi's Schedule EV rate to meet their charging needs. The rate recognizes two periods for time-of-use charges, incentivizing off-peak charging. It also requires a secondary meter.

| Period | Energy Cost (per kWh) | Time |
|---|---|---|
| EV charging period | $0.10427 | 10 p.m. – 6 a.m. |
| Non-EV charging period | $0.33000 | 6 a.m. – 10 p.m. |

**Consumer Outreach Programs** – PEV owners in Lodi can visit the utility's electric vehicle website to access information on the EV rate, a meter service application and electrical standards for EVSE installation.

Other local utilities may offer special electric vehicle programs and rates. Be sure to contact your local utility to make sure that you have the most up-to-date and accurate information.

1 https://www.sce.com/NR/rdonlyres/BFA28A07-8643-4670-BD4B-215451A80C05/0/SCE_SmartGrid_Strategy_and_Roadmap.pdf

San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness

# Local Government Action Plans: Best Practices for Plug-in Electric Vehicle Readiness

Plug-in electric vehicles (PEVs) can support local governments in achieving climate mitigations goals in many ways. Following are examples of how local governments have incorporated PEVs into their climate action plans, sustainability action plans and general plan updates.

## Climate Action Plans

### City of Oakdale (2011)

- **Strategy TLU.3.1: Reduce Traffic Speeds and Increase Safety in Sensitive Areas**
  Lower the speed limit to 35 mph in many streets to allow for the expanded use of neighborhood electric vehicles (p. 5-21)
- **Strategy TLU.4.1: Implement Preferred Parking Policy**
  Use parking policy to discourage driving and/or encourage the use of more fuel-efficient vehicles (p. 5-22)
- **General Plan Policy EV-2.8**
  Reduce emissions associated with transport of goods and services to municipal operations

### City of Merced (2012)

- **Strategy AR 4.2.1**
  The "Build a Green Fleet" program supports converting city fleet to cleaner vehicles (p. 43)
- **Strategy AR 4.2.8**
  Consider the use of neighborhood electric vehicles when appropriate
- **Strategy AR 4.4.9**
  Facilitate conversion to clean, heavy-duty fleets and expansion of necessary infrastructure

### Tulare County (2010, draft)

- Building energy efficiency/green building design strategy (p. 11)
- Convert fleet vehicles by replacing diesel engines with electric motors (p. 52)
- Provide the necessary facilities and infrastructure to encourage the use of low- or zero-emission vehicles (p. 260)

### City of Tulare (2011)

- **Measure VE 4.1**
  Continue and expand clean fuel vehicles in city fleet (p. 66)
- **Measure VE 4.2.1**
  Update codes to require electric vehicle charging equipment and parking for alternative fuel vehicles according to CALGreen (p. 111)
- **Measure VE 4.3**
  Facilitate conversion of medium- and heavy-duty vehicles to clean fuels by promoting fueling infrastructure and incentivizing fleet adoption (p. 113)

## Sustainability Action Plans

### City of Tracy (2011)

**Measure T 17**
Increased Use of Low Carbon Fueled Vehicles

Conduct the following to promote the use of low-carbon fueled vehicles:

- Use the zoning ordinance to allow no-/low-carbon fueling stations as part of the gas and service station land use category
- Amend the zoning ordinance or city standards to require new projects to provide parking spaces reserved for hybrid or electric vehicles and carpool or car share vehicles
- Require dedicated parking spots for alternative fuel, hybrid, carpool or car share vehicles in city parking lots and consider installing charging connections
- Encourage the use of hybrid and electric construction equipment and the use of alternative fuels for construction equipment
- Convert the municipal automotive fleet to cleaner fuels and lower emissions – convert the municipal nonautomotive fleet to cleaner fuels and lower emissions where possible

## General Plan Updates

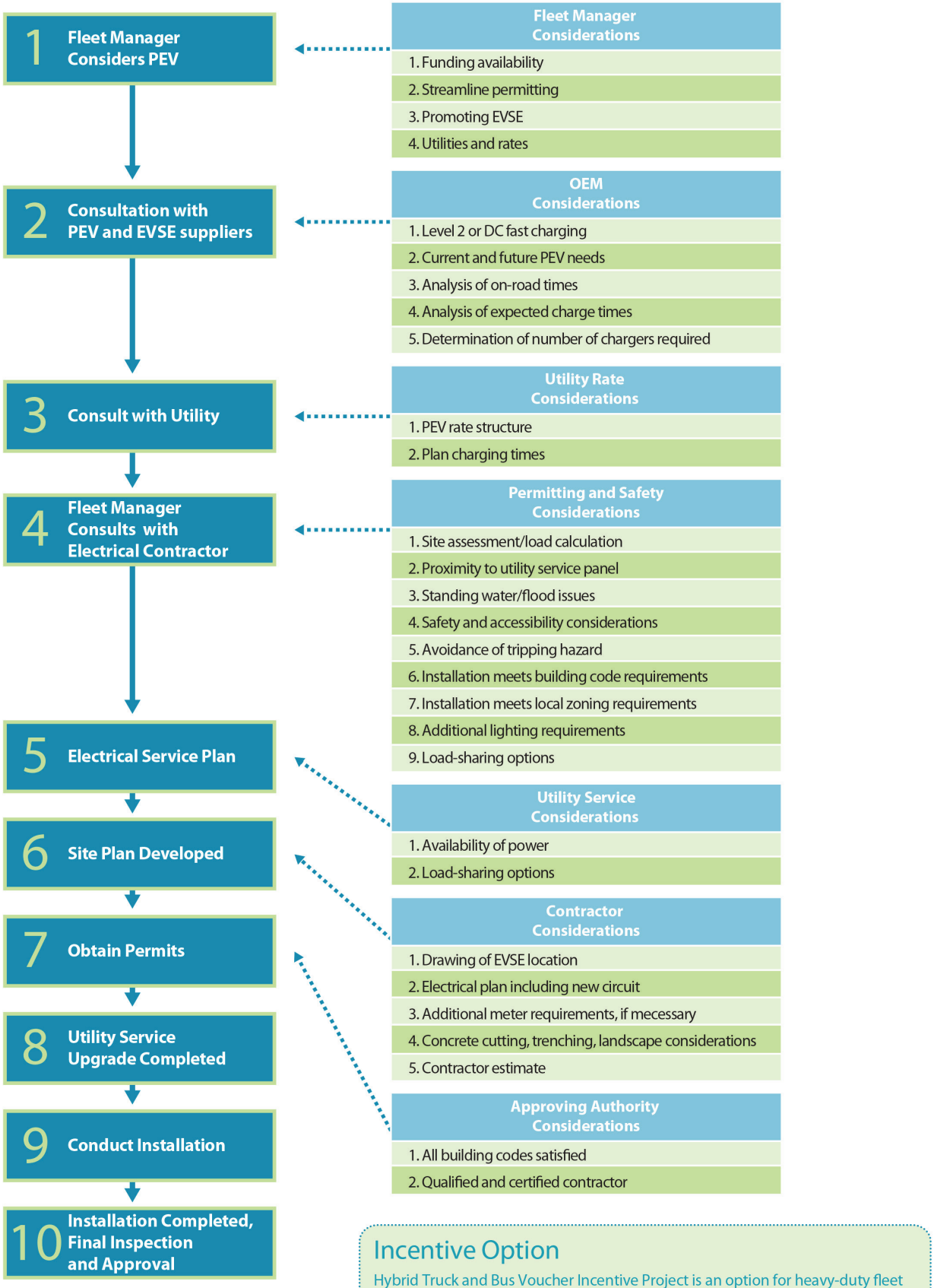
### City of Arvin (2012)

- **Conservation and Open Space Element**
  **Goal 7:** Improve air quality in the Arvin area by controlling emissions from stationary and mobile sources
- **Air Quality Element**
  **Goal 1:** To the greatest extent feasible, integrate air quality, land use and transportation planning and policy to reduce the emission of criteria pollutants and greenhouse gases from mobile sources
  **Goal 2:** Encourage the use of low-emission vehicles in city operations and in the larger community
- **Policy AQ-2.1:** Replace city fleet vehicles with low-emission technology vehicles wherever possible
- **Policy AQ-2.2:** Provide preference to contractors using reduced-emission equipment for city construction projects, as well as for city service contracts
- **Policy AQ-2.3:** Encourage developments and street systems that accommodate the use of neighborhood electric vehicles (NEVs) for local travel

### City of Patterson (2010)

- **Implementation Measure T-2:**
  City should maintain a street master plan that should be regularly updated to indicate the necessary right-of-way to be acquired or dedicated (applicable to on-street parking EVSE installations)
- **Implementation Measure T-9:**
  City shall implement the downtown physical design plan

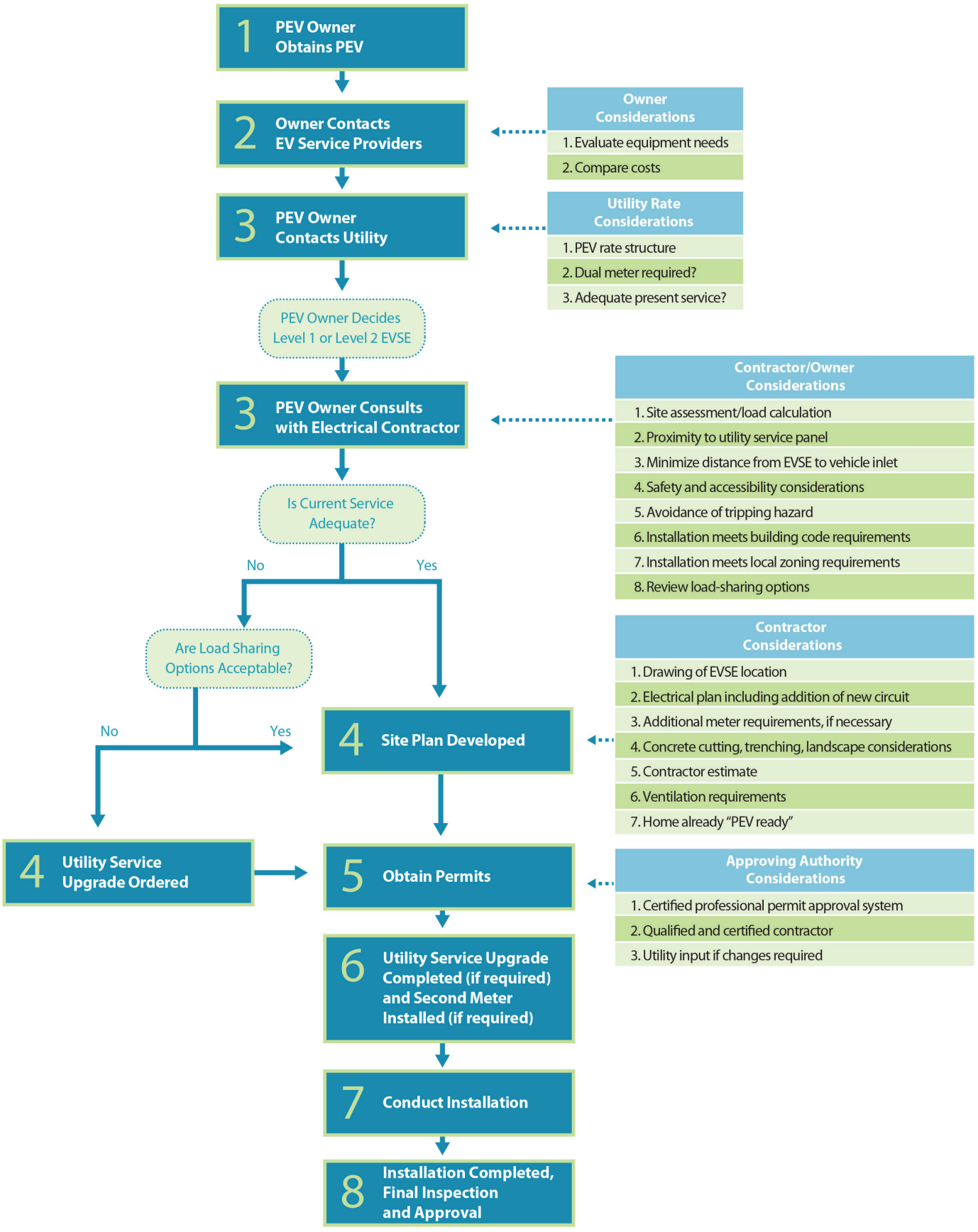
# Fleet EVSE Installation Guidelines



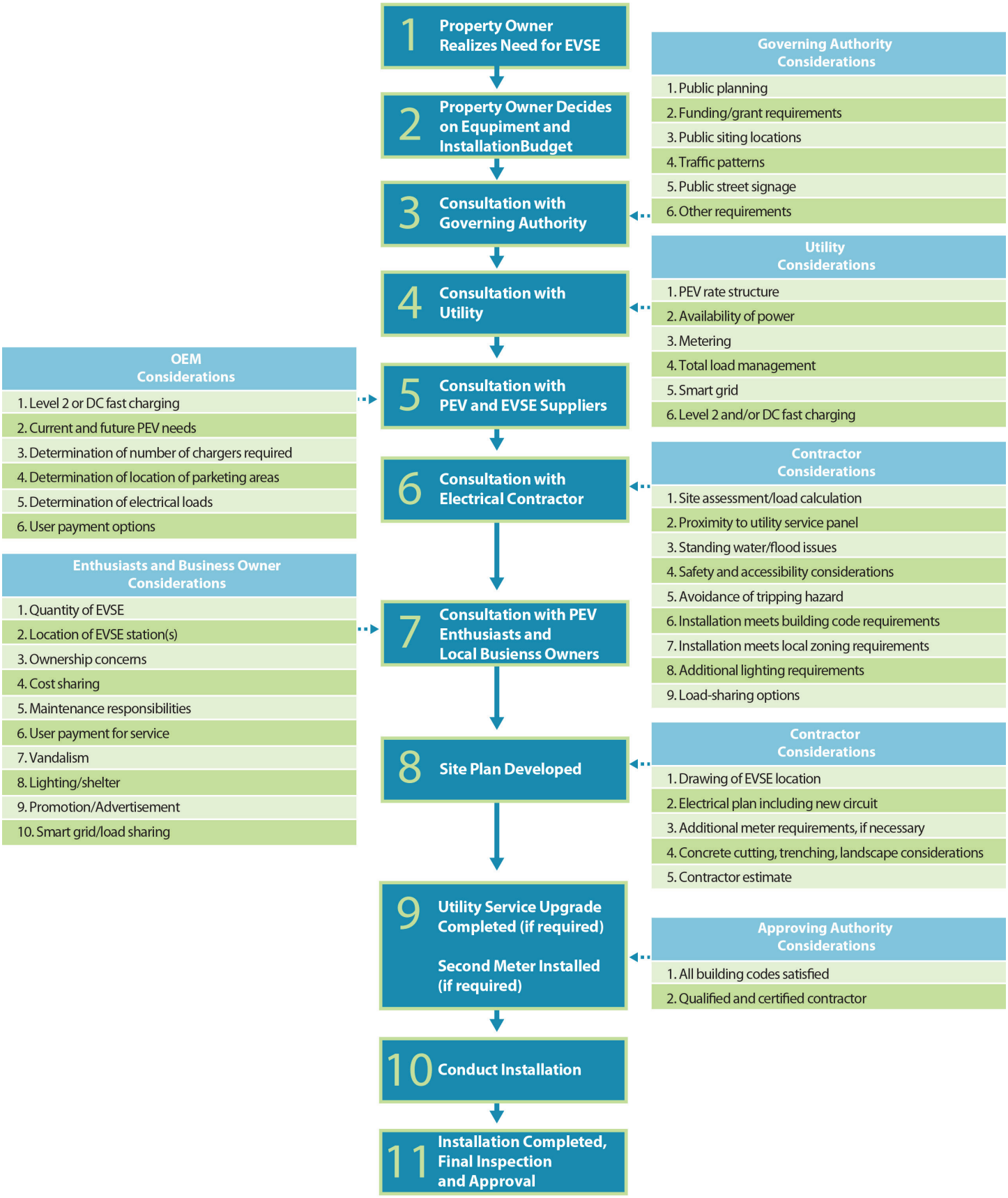

## Incentive Option

Hybrid Truck and Bus Voucher Incentive Project is an option for heavy-duty fleet vehicles with additional funding from the San Joaquin Valley's "Plus Up" program.

# Residential EVSE Installation Guidelines



# Nonresidential EVSE Installation Guidelines



San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness

# Considerations for Public Agencies that Provide Charging

## Background

Public agencies have various reasons for wanting to install charging stations, also known as electric vehicle supply equipment (EVSE). Public agencies may want to support greater plug-in electric vehicle (PEV) adoption in their community in order to meet climate goals, provide infrastructure to support their electric vehicle fleet or simply to offer an additional public benefit for their residents.

## Key Issues

Though public agencies often have these goals in mind, it can be difficult to navigate the diverse EVSE market. In addition, EVSE installations can be expensive, making it necessary to secure funding before pursuing an installation project.

There are some considerations for public agencies before pursuing an installation:

- How will the project installation, operation and maintenance be paid for?
- Will the chargers be available for public, government employee or fleet use?
- Will vehicle charging be free or for a fee?
- What information exists on local PEV adoption and the EVSE marketplace?
- Will the agency want to issue a request for proposal (RFP) to EVSE installations?
- Approximately how many chargers will the project consist of and where will they be located?

Generally, the impetus for installing charging infrastructure comes from Climate Action Plans (CAPs), which call for emission-reduction goals. This may guide the way the public agency will conduct the installations. For examples of how San Joaquin Valley public agencies have implemented clean vehicles into their CAPs, see the *Local Government Action Plans: Best Practices for Plug-in Electric Vehicle Readiness* fact sheet.

## Available Funding Sources

Public agencies that want to upgrade or install new charging infrastructure for public and employee use should visit federal, state and local solicitation websites for information about grant funds.

### San Joaquin Valley Air Pollution Control District

Public agencies can take advantage of the many grants and funding opportunities offered by the air district. Currently, funding is available for the procurement of PEVs and upcoming funding will be available for EVSE. Keep up-to-date on incentives on their website, **www.valleyair.org**.

### TIGER Grants

The US Department of Transportation (DOT) provides cities and public agencies with grant money for transportation projects that better environmental problems, such as the installation of electric vehicle charging stations. More information can be found on their website, **www.dot.gov/tiger**.

### Alternative and Renewable Fuel and Vehicle Technology Program

AB 118 (Núñez, Chapter 750, Statutes of 2007) created the Alternative and Renewable Fuel and Vehicle Technology Program and AB 8 (Pavley, Chapter 401, Statutes of 2013) authorized the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help the state achieve its climate change policies. Public agencies can pursue certain solicitations and receive funding for alternative fuel projects by visiting **www.energy.ca.gov/contracts/transportation.html**.

## Request for Proposals

To pursue large-scale EVSE installation projects, it can be useful for public agencies to release an RFP and let EVSE vendors competitively bid on the project.

The RFP should consist of the agency's list of requirements of the EVSE and may include a list of sites where the vendor will need to evaluate and install EVSE. An RFP may include a turnkey-style installation, wherein the vendor will complete the installation and be responsible for operation and maintenance of the equipment.

Usually these turnkey installations are not free. Because of high installation costs, vendors generally prefer the host (i.e., the public agency) to pay for some of these costs. However, having vendors bid on a project allows the public agency to choose the most price-competitive project.

When vendors bid for EVSE projects, they usually have a manufacturer, service provider and electrical contractor in mind to complete the project. Therefore, this lessens the amount of work for the public agency to find each participant individually.

There is a template public agencies can use to solicit EVSE installations called *Request for Proposal Template: Installation and Operation of Electric Vehicle Charging Stations.*

## San Joaquin Valley Example

The City of Lodi is at the forefront of electric vehicle charging in the Valley. Ten years ago, Lodi had installed two entry-level PEV chargers at City Hall and four chargers at their municipal service center.

Early in 2012, EVSE vendor Clipper Creek contacted the Lodi officials to promote a California Energy Commission grant in which they were serving as a contractor to provide replacement charging heads for old Level 2 legacy chargers.

At that time, the city was in the process of developing their CAP. Thanks to the timing of the Clipper Creek project, the city decided to install more stations around town in order to complement their CAP. Clipper Creek agreed and installed five more stations. The new charging stations were installed at the city's library, finance office, parking garage (transit center), community center, and animal shelter.

Currently, Lodi does not charge drivers a fee to use the public chargers. However, as of summer 2013, Clipper Creek was developing plans to add a card-swipe device to these chargers. The chargers will have a credit or debit capability and allow any user to access and pay for a charge. It is still uncertain what rate drivers will be charged. Further, the City passed an **ordinance** that allows towing of vehicles that are parked in EV-designated parking spaces.

## Recommendations

To expand the number of chargers deployed by public agencies, these recommendations should be followed:

1. Add PEV infrastructure development to their Climate Action Plan as a way to expand regional PEV adoption and achieve climate mitigation goals

2. Install turnkey-style EVSE that benefit both the EVSE vendor and the public agency

# Request for Proposal (RFP) Template

## Installation and Operation of Electric Vehicle Charging Stations

This request for proposal (RFP) template provides recommended headings and language to assist in the issuance of an RFP for electric vehicle charging stations. The outline provides a brief summary for each heading with information that should be customized for each individual RFP. This outline was created based on information gathered from RFPs created by the City of Chula Vista and the City of Long Beach.

**Disclosure:** *Proposals shall be kept confidential until a contract is awarded. The <insert jurisdiction> reserves the right to request clarification of any proposal term from prospective vendors. Selected vendor(s) will be notified in writing. Any award is contingent upon the successful negotiation of final contract terms. Negotiations shall be confidential and not subject to disclosure to competing vendors unless and until an agreement is reached. If contract negotiations cannot be concluded successfully, the <insert jurisdiction> reserves the right to negotiate a contract with another vendor or withdraw the RFP. Any contract resulting from this RFP shall not be effective unless and until approved by the <insert jurisdiction council>.*

### *1. Overview of the Project*

Requesting proposals from vendors to fully fund, design, install, operate, maintain, market and potentially remove electrical vehicle (EV) charging stations, also known as electric vehicle supply equipment (EVSE), on publically owned property for public use. This work will also include assisting the jurisdiction in identifying ideal site locations for the EVSE installations.

### *2. Acronyms/Definitions*

A glossary of the necessary acronyms and definitions used throughout the RFP (e.g., Vendor – organization/individual submitting a proposal in response to this RFP).

### *3. Scope of Project*

The scope of the project is as follows:

- Provide attractive and well-maintained EVSE.
- Cover all costs associated with installation, maintenance and electricity for the EVSE. The vendor may establish a service charge and method of payment collection to recoup these costs as well as any operating profit from EVSE users.
- Identify siting locations, including physical address, project site (landmark location), reasoning behind the location selection and accompanying notes.
- Provide proper EV parking signage and reconfiguration of any parking stalls for EV parking.
- Market the project as well as provide product advertisement.
- Offer options for EVSE when the agreement expires (e.g., charging unit removal, transfer of ownership, contract renewal options).
- The <insert jurisdiction> to provide the required parking spaces to accommodate the EVSE within the parking facilities at no cost to the vendor.
- Comply with all permitting, ADA and parking requirements.

### *4. Additional Considerations*

The vendor must agree to insurance and liability requirements (scope and coverages) set by the jurisdiction and state such in its proposal.

<Jurisdiction to insert summary of applicable insurance and liability requirements here and/or can attach full description to end of this template.>

<Jurisdiction can add any additional considerations here. For example, if city offers/restricts use of advertisements on or around EVSE.>

## *5. Submittal Instructions*

For questions regarding this RFP, submit all inquiries via email to <insert email address> by <insert due date>. Responses to the questions will be posted <insert where responses will be made available> no later than <insert date>. All proposers are recommended to visit the above mentioned <insert jurisdiction> website on a regular basis as responses will be posted when available.

***Proposal Evaluation Process Timeline***

| **TASK:** | **DATE/TIME:** |
|---|---|
| Deadline for submitting questions | <Insert date> |
| Answers to all questions submitted | <Insert date> |
| Deadline for submission of proposals | <Insert date> |
| Evaluation period | <Insert date> |
| Selection of vendor | <Insert date> |

***NOTE: These dates represent a tentative schedule of events. The <insert jurisdiction> reserves the right to modify these dates at any time, with appropriate notice to prospective vendors.***

Vendors shall submit one (1) original proposal marked "ORIGINAL" and four (4) identical copies to the following:

<Insert Jurisdiction Name>
<Insert Contact Name>
<Insert Address>

Proposals shall be clearly labeled in a sealed envelope or box as follows:

REQUEST FOR PROPOSAL NO.: <insert proposal number>

FOR: Electric Vehicle Charging Stations

**Disclosure:** *Proposals must be received by <insert date and time>. Proposals that do not arrive by the specified date and time WILL NOT BE ACCEPTED and will be returned unopened. Vendors may submit their proposal any time prior to the above stated deadline. Email or fax submissions will not be accepted.*

*At its sole discretion, the <insert jurisdiction> may reject incomplete proposal submittals if, in its judgment, the submittal lacks information needed to effectively evaluate the proposal. Nothing in this request for qualifications implies a contractual obligation with any firm, nor will the <insert jurisdiction> reimburse costs for submittal preparation.*

**Proposal Format:**

*Vendor Information:*

- The legal name of the vendor, address and telephone number.
- The structure of the organization (e.g., sole proprietorship, partnership, corporation, etc.) including state of formation.
- The name, address and telephone number of the person to whom correspondence should be directed.
- The year the company was established as currently being operated.
- A certified financial statement, including, but not limited to a Dun and Bradstreet rating.
- Employer ID number as well as a DUNS number.

*Vendor Background & Work Experience:*

- A list of all communities within the local utility (e.g., Pacific Gas and Electric, Southern California Edison) territory in which the vendor has provided and maintained publicly available EVSE during the last five years, if applicable. Please list communities with active EVSE and communities where EVSE have been removed. Also include the following information for each community:
  - Name of the organization that contracted with you for EVSE sites. Please include the name of a contact person and phone number.

- Was the contract/franchise exclusive or nonexclusive?
- Number of EVSE provided.
- Time period that the EVSE were installed.
- Reporting sales & usage (sample reports).

- A list with additional California communities and/or communities in United States in which the vendor has provided and maintained publicly available EVSE during the last five years, if applicable. Include all of the information identified in the previous bullet.
- A list of vendor's ten most recent projects with a short description of the scope of work.
- Please list any public agencies that have chosen to cancel or not renew EVSE contracts with your firm during the last five years. Show names of organizations and names and phone numbers of persons who can be contacted.
- Provide qualifications of the local contractors that will perform the EVSE installations. Demonstrate that the vendor is working with C-10 licensed electrical contractors employing California state-certified electricians to handle EVSE installations and maintenance.
  - List any EVSE-specific trainings or certifications that the vendor's electrical contractor and/or the contractor's electricians have completed, if applicable (e.g., Electric Vehicle Infrastructure Training Program (EVITP) or UL training).
  - Include the number of EVSE installations completed to date by the vendor's electrical contractor and/or the contractor's electricians.
- Demonstrate an understanding of <insert jurisdiction> processes, required permits, permit costs, licenses and applicable state and local codes specific to EVSE and procedures for this type of project.

*Scope of Work:*

- A written and pictorial description of the proposed EVSE design including:
  - Comprehensive specifications (make, manufacturer and model numbers of equipment).
  - Delivery and proposed installation schedule.
  - The submission of more than one type of charging station is permitted, however, if the selection of any particular design would result in a change to the proposed rate structure and method of collection, those changes must be noted.
- Metering configurations identifying how the vendor will provide the electricity to the EVSE end consumer at no cost to the jurisdiction.
  - Process and schedule for reimbursement to the jurisdiction for cost recovery of electricity provided to EVSE (if applicable).
- Proposed EVSE end-consumer rate structure (e.g., charging customers per kWh usage or plug time) and customer method of payment (e.g., credit card reader for universal usage or restricted access for only network users).
- Description of the proposed EVSE maintenance program including the location of maintenance facilities, number of staff that will be available for maintenance and anticipated response times.
- Description of ability and staff expertise to provide services including marketing, installation, monitoring and maintenance of EVSE.
  - Quality control/safety features.
  - Marketing plan details and available resources.
- Financial incentives to the <insert jurisdiction> (if applicable).
- Options for EVSE when the agreement expires (e.g., charging unit removal, transfer of ownership, contract renewal options) and responsible party for any costs incurred (if applicable). Highly preferred that the vendor cover any removal costs.

*Additional Items:*

- The proposal must be signed by the individual(s) legally authorized to bind the vendor.
- If complete responses cannot be provided without referencing supporting documentation, such documentation must be provided with the proposal and specific references made to the tab, page, section and/or paragraph where the supplemental information can be found.

## *6. Proposal Evaluation & Award Process*

Proposals will be evaluated based on the following criteria*:*

- Current and past vendor performance in similar contracts with other agencies.
- Financial stability of the proposer as reflected in a certified financial statement or other certified statement, including but not limited to a Dun and Bradstreet financial rating.
- EV customer rate structure and method of customer payment that will be used to charge customers.

- Description of metering configuration.
- Process and schedule to reimburse the jurisdiction in order to recoup cost of electricity used to provide EVSE (if applicable).
- Maximum public benefit (i.e., in terms of affordability and customer support).
- Strength, quality, durability, advanced technology, future flexibility and aesthetic appeal of proposed EVSE.
- Proposed maintenance, repair and replacement schedule including response times for malfunctioning EVSE (e.g., vendor's proximity to the <insert jurisdiction> and number of proposer's employees performing maintenance functions).
- Possible commitment to providing additional EVSE at other parking facilities owned by <insert jurisdiction> (desirable but not required).
- Vendor's specific marketing strategy that includes product advertising.
  - EVSE installation marketing plan.
  - Description of the vendor's available marketing resources.
- Proposed options for EVSE (e.g., system removal, transfer of ownership, contract renewal options) when the agreement expires and potential costs to the jurisdiction.
- Overall monetary return to the <insert jurisdiction> (if applicable).

*Suggestion for Jurisdiction: Create a scoring criterion that may include assignment of percentages and/or weighting each criterion listed above.*

### *7. Project Specifications*

- Provide installation site plans (if applicable [for reference, please see Exhibit A of the City of Long Beach RFP No. PW12-016]).

### *8. Subcontractor Information and Business License*

Does this proposal include the use of subcontractors?

Yes _____ No _____ Initials _____

If "Yes", vendor must:

- Identify specific subcontractors and the specific requirements of this RFP for which each proposed subcontractor will perform services.
- The <insert jurisdiction> requires that the awarded vendor provide proof of payment of any subcontractors used for this project. Proposals shall include a plan by which the <insert jurisdiction> will be notified of such payments.
- Primary contractor shall not allow any subcontractor to commence work until all insurance required of subcontractor is obtained.

**BUSINESS LICENSE**

<Insert Jurisdiction> requires all businesses operating in the <insert jurisdiction> to pay a business license tax. In some cases the <insert jurisdiction> may require a regulatory permit and/or evidence of a state or federal license. Prior to issuing a business license, certain business types will require the business license application and/or business location to be reviewed by the development services, fire, health and/or police departments.

### *9. Cost*

- N/A

### *10. Terms, Conditions and Exceptions*

<Insert project specific terms, conditions and exceptions>
To view an example, please reference section 9 of the City of Long Beach RFP No. PW12-016.
<Insert individual public liability and insurance requirements for your agency>

## UPS Electric Vehicle Deployment Case Study

UPS is a global package delivery company, handling some 16.3 million packages and documents daily. Among the 96,173 vehicles in its fleet, 2,745 are alternative fuel vehicles – the largest alternative fuel fleet in the country. [1]

With the help of Electric Vehicle International (EVI), an EV manufacturer based in Stockton, CA, UPS was able to deploy the largest EV fleet in the industry, consisting of 100 fully electric vehicles to deliver packages mainly in Sacramento, San Bernardino, Ceres, Fresno and Bakersfield, CA.

Before officially launching the fleet, UPS tested the EV delivery trucks in different environments and provided training for drivers on how to use the vehicles. After drivers finished the training, staff rode along with the drivers to ensure they used the vehicles in the most optimal way.

The UPS facilities charging these trucks are equipped with Level 2 charging stations with smart metering capabilities. The smart chargers are able to identify the best time to charge a vehicle based on its delivery schedule and battery needs. In addition, if there is charge left in the battery after a truck has completed its deliveries, the residual energy is fed back into the grid.


The UPS electric trucks will reduce their consumption of fuel by approximately 126,000 gallons per year, reducing over 1,100 metric tons of $CO_2$ emissions. This is equivalent to avoiding the greenhouse gas emissions of 233 passenger vehicles annually or the addition of 918 acres of U.S. forests in one year.[2]

1 **http://www.ups.com/content/us/en/bussol/browse/leadership-afvfleet.html?srch_pos=4&srch_phr=fuel**
2 These were calculated by the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator.
**http://www.epa.gov/cleanenergy/energy-resources/calculator.html**

## Manteca Unified School District Case Study

Manteca Unified School District (MUSD) has pursued a solar project that allows for electric vehicle charging. In September 2013, MUSD's $30 million solar energy project went online after a year of planning. The school district worked with IEC Power, who designed and installed the renewable energy system.

The project installed solar panels at 26 sites in the district and expects to produce 6,720 MWh (6.72 million kWh) per year, which will cover approximately half of the district's annual energy consumption. Even though it only covers half of the district's energy consumption, the savings are greater than 50%.[1] In all, the district expects to reduce their electricity bill by up to 65% and save over $25 million over the next 25 years.[2]

Students will track the energy savings and renewable energy usage, and classroom studies will emphasize the energy technologies.


Solar panels at the school district offices, as well as at the Regional Environmental Studies Center, will also power PEV charging equipment. Electric vehicle charging will be available directly from the solar power generated during on-peak daylight hours and at night, during off-peak hours, by energy stored on site.

The Regional Environmental Studies Center, pictured, which is a 150-year-old reclaimed barn, is the first zero net-energy building in San Joaquin County. Inside the center, there are digital kiosks that monitor the solar panels' energy output and will be used as not only a teaching tool for students, but also a space for the public to learn about green buildings and sustainability.[3]

Funding for this project came from an ultralow interest (less than 1%) Qualified Zone Academy Bond (QZAB).[4] With help of the QZAB loan to purchase the solar panels, the school district can also apply for California Solar Initiative rebates and modernization match funding from the state.

1 Manteca Unified School District. "Manteca Unified School District is Going Solar!" http://image.schoolspan.com/files/manteca/filestore/5IT6H548.pdf
2 Risso, Rose Albano. "Schools now solar-powered." Manteca Bulletin. September 27, 2013. http://www.mantecabulletin.com/archives/86526/.
3 Ibid.
4 "Manteca Unified School District is Going Solar!"

## Costs and Benefits of Switching to a Plug-in Electric Vehicle

The cost of driving an internal combustion engine (ICE) vehicle primarily depends what a driver pays at the pump. Based on the average cost of a gallon of regular gasoline and the average retail price per kilowatt hour (kWh) for all residential customers in the San Joaquin Valley in 2011, a plug-in electric vehicle (PEV) driver in the Valley will pay a third of the cost of a gallon of gasoline to travel the equivalent distance.

Considering that an average driver in the San Joaquin Valley drives about 13,000 miles a year,[1] there are savings available. Using the average gasoline price in California ($3.89), a Valley driver would spend about $1,800 on gas per year. With a PEV, the same amount of driving would only cost about $700 in electricity.[2]

The U.S. Energy Information Administration estimates that with a plug-in hybrid electric vehicle (PHEV), a driver will save $853 on fuel per year, and with a BEV, a driver will save $787 per year on fuel.[3]

## Retail Price of Electricity in the San Joaquin Valley

The following table displays the average retail price of electricity among utilities in the San Joaquin Valley in 2011.

| Utility | City of Lodi | Merced Irrigation District | Modesto Irrigation District | Pacific Gas & Electric | Turlock Irrigation District | Southern California Edison |
|---|---|---|---|---|---|---|
| Class of Ownership | Public | Public | Public | Investor Owned | Public | Investor Owned |
| # Consumers | 22,013 | 6,433 | 94,015 | 4,574,094 | 71,829 | 4,287,994 |
| Average Retail Price (cents/kWh) | 16.99 | 15.32 | 17.12 | 15.32 | 14.51 | 14.42 |

## Calculating the Savings

A PEV driver in the San Joaquin Valley will pay $1.54 to drive the same distance as an ICE driver on one gallon of regular gas. In California, the average cost of a regular gallon of gasoline is about $3.89. The cost to drive a PEV was calculated by multiplying the following variables: estimated efficiency of a new ICE vehicle (28.2 mile per gallon), the estimated fuel economy of a PEV (about 35kWh/100 miles) and the average retail price of electricity in the region ($0.15613 per kWh).[4, 5, 6]

$$28.2\ \textit{miles per gallon} \times \frac{35\textit{kWh}}{100}\ \textit{miles} \times \$0.15613\ \textit{per kWh} = \mathbf{\$1.54}$$

1 This is calculated based on EMFAC2011 inventory and for persons aged 18 and over.
2 (13,000 mi/28.2mpg) x $3.89/gallon of gas
3 EIA "Vehicle Choice Modeling and Projections for the Annual Energy Outlook" **http://www.eia.gov/forecasts/aeo/workinggroup/transportation/evworkshop/pdf/maples.pdf**
4 EPA Fuel Economy Trends Report. **http://www.epa.gov/oms/fetrends.htm#summary**
5 Model Year 2012 Fuel Economy Guide. **http://www.fueleconomy.gov/feg/pdfs/guides/FEG2012.pdf**
6 The average electricity price was calculated by summing the average retail price (cents/kWh) of six electric utilities in the Valley and dividing the total by six.

## Regional Residential Solar and Plug-in Electric Vehicle Adoption

*(Data as of April 2014)*

**Table 1** shows residential solar panel rebate applications in the San Joaquin Valley, with counties ranked according to the number of applications for the California Solar Initiative (CSI).

### Table 1: Residential Solar Panel Applications (by County)

| Amount of Rebates | County Name | % All Res. Applications | % All SJV Res. Applications | % County Households |
|---|---|---|---|---|
| 5,225 | Fresno | 3.82% | 31.92% | 1.83% |
| 4,407 | Kern | 3.22% | 26.93% | 1.76% |
| 2,867 | Tulare | 2.09% | 17.52% | 2.23% |
| 1,574 | San Joaquin | 1.15% | 9.62% | 0.74% |
| 729 | Madera | 0.53% | 4.45% | 1.73% |
| 550 | Merced | 0.40% | 3.36% | 0.74% |
| 715 | Kings | 0.52% | 4.37% | 1.76% |
| 300 | Stanislaus | 0.22% | 1.83% | 0.18% |

**Table 2** shows nonresidential solar panel rebate applications in the San Joaquin Valley, with counties ranked according to the number of applications for CSI.

### Table 2: Nonresidential Solar Panel Rebates (by County)

| Amount of Rebates | County | % All Nonres. Applications | % All SJV Nonres. Applications |
|---|---|---|---|
| 284 | Fresno | 3.77% | 24.13% |
| 230 | Kern | 3.05% | 19.54% |
| 200 | San Joaquin | 2.65% | 16.99% |
| 179 | Tulare | 2.38% | 15.21% |
| 84 | Merced | 1.12% | 7.14% |
| 79 | Kings | 1.05% | 6.71% |
| 74 | Madera | 0.98% | 6.29% |
| 47 | Stanislaus | 0.62% | 3.99% |

**Table 3** shows residential plug-in electric vehicle rebates in the San Joaquin Valley, with counties ranked according to the number of applications for the Clean Vehicle Rebate Project (CVRP). It also provides the percentage of residents who have received rebates in each county.

Table 3: Residential CVRP Rebates (by County)

| Amount of Rebates | County | % All Res. Applications | % All SJV Res. Applications | % County Households |
|---|---|---|---|---|
| 301 | Fresno | 1.12% | 72.88% | 0.11% |
| 241 | Kern | 0.90% | 58.35% | 0.10% |
| 236 | San Joaquin | 0.88% | 57.14% | 0.11% |
| 100 | Stanislaus | 0.37% | 24.21% | 0.06% |
| 47 | Tulare | 0.18% | 11.38% | 0.04% |
| 36 | Merced | 0.13% | 8.72% | 0.05% |
| 26 | Madera | 0.10% | 6.30% | 0.06% |
| 9 | Kings | 0.03% | 2.18% | 0.02% |

**Table 4** shows nonresidential PEV rebates in the San Joaquin Valley, with counties ranked according to the number of applications for CVRP.

Table 4: Nonresidential CVRP Rebates (by County)

| Amount of Rebates | County |
|---|---|
| 17 | Fresno |
| 9 | San Joaquin |
| 4 | Tulare |
| 2 | Stanislaus |
| 2 | Kern |
| 1 | Madera |
| 1 | Merced |

**Table 5** shows the number of solar panel applications by ZIP code in the San Joaquin Valley, ranked according to number of applications.

**Table 6** shows the number of CVRP rebates by ZIP code in the San Joaquin Valley, ranked according to number of rebates.

**Tables 5 and 6** also present the percentage of households that apply within the ZIP code.

Table 5: Residential Solar Panel Rebates (by ZIP code)

| Residential (by ZIP code) | | | |
|---|---|---|---|
| ZIP code | Amount | City | % Households in ZIP code |
| 93312 | 831 | Bakersfield | 4.79% |
| 93619 | 803 | Clovis | 8.48% |
| 93611 | 705 | Clovis | 5.48% |
| 93314 | 618 | Bakersfield | 9.25% |
| 93230 | 492 | Hanford | 2.38% |
| 93720 | 480 | Fresno | 2.76% |
| 93711 | 455 | Fresno | 2.95% |
| 93311 | 423 | Bakersfield | 3.29% |
| 93722 | 375 | Fresno | 1.63% |
| 93727 | 346 | Fresno | 1.67% |

Table 6: Residential CVRP Rebates (by ZIP code)

| Residential (by ZIP code) | | | |
|---|---|---|---|
| ZIP code | Amount | City | % Households in ZIP code |
| 95391 | 57 | Tracy | 2.20% |
| 93619 | 43 | Clovis | 0.45% |
| 93311 | 42 | Bakersfield | 0.33% |
| 93611 | 38 | Clovis | 0.30% |
| 93312 | 35 | Bakersfield | 0.20% |
| 93720 | 35 | Fresno | 0.20% |
| 93306 | 32 | Bakersfield | 0.16% |
| 95377 | 28 | Tracy | 0.35% |
| 93711 | 27 | Fresno | 0.18% |
| 93722 | 26 | Fresno | 0.11% |

**Table 7** presents the top cities that had both the highest PEV and solar rebates and applications in the San Joaquin Valley.

Though rebate and application numbers do not equal the real number of households with solar panels and/or PEVs, they are still highly correlated with the amount of solar and PEV ownership in the region.

Table 7: Cities with highest PEV and solar rebates and applications

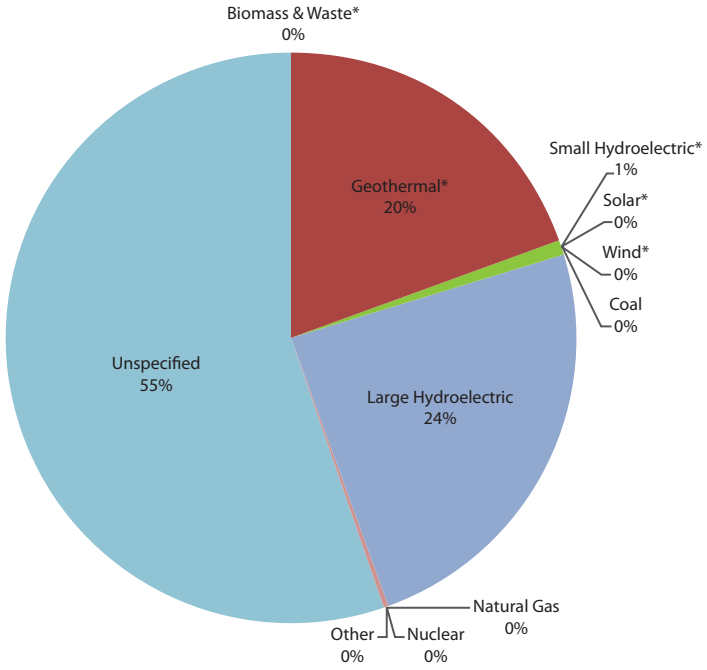
| Top Cities | % Households with Solar | & Households with PEVs |
|---|---|---|
| Clovis | 4.63% | 0.25% |
| Bakersfield | 1.75% | 0.10% |
| Fresno | 1.06% | 0.06% |

Note: 2010 U.S. Census data was used for all population analysis. The CVRP data was taken from the latest CVRP dataset from the week of July 15, 2013. The CSI data is from the **California Solar Initiative** website, but only provides information from applications administered by California Center for Sustainable Energy, Southern California Edison and Pacific Gas and Electric.

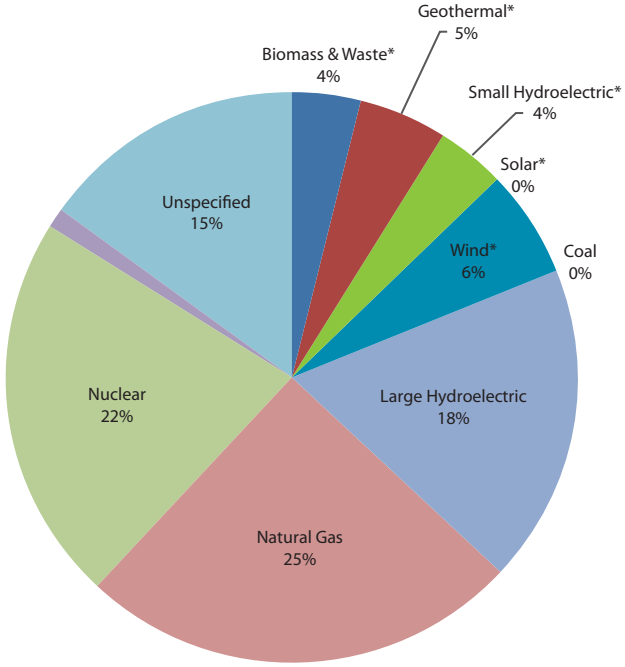
## San Joaquin Valley Utilities' Electricity Sources

The California Renewables Portfolio Standard (RPS) is one of the most ambitious renewable energy standards in the country. The RPS program requires investor-owned utilities, electric service providers and community choice aggregators to increase procurement from eligible renewable energy resources to 33% of total procurement by 2020. Below are the largest utilities in the San Joaquin Valley and their respective mixes of power. Resources that have an asterisk (*) indicate they have either zero GHG emissions and/or are renewable.

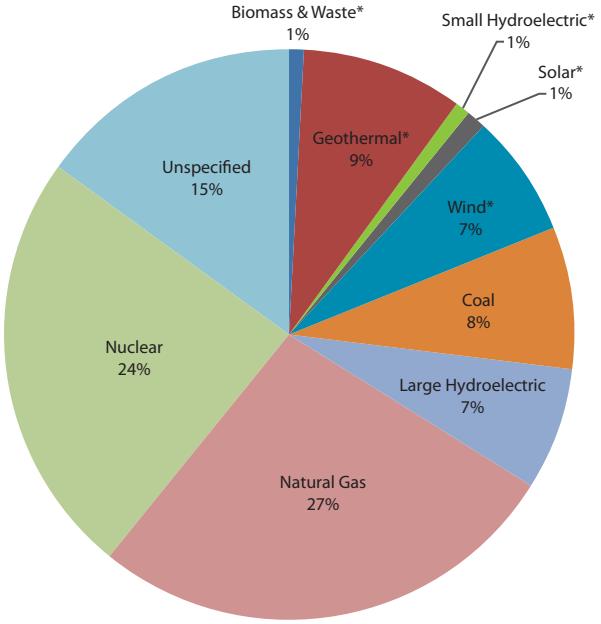
### Lodi Municipality Power Mix



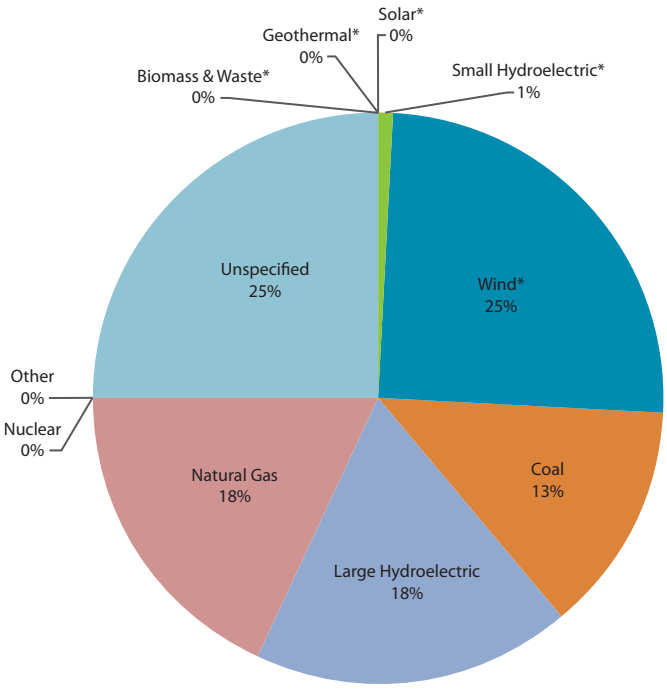

### Pacific Gas & Electric Power Mix



## Southern California Edison Power Mix




## Modesto Irrigation District Power Mix




Plugging into any of the above utilities' grids allows PEV drivers to benefit from charging with at least 20% renewable energy and zero oil.

Power mix data is from the California Energy Commission for 2011 (latest available data).

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## Compilation of Plan and Resource Hyperlinks

### Background

Executive Order B-16-2012, **http://gov.ca.gov/news.php?id=17472**

Executive Order B-18-2012, **http://gov.ca.gov/news.php?id=17508**

### Engaging Elected Officials

The Zero-Emission Vehicle Guidebook is available on the Governor's Office of Planning and Research website at **http://www.opr.ca.gov/ZEV**

### Parking and Signage

City of Sunnyvale Building Code: **http://sunnyvale.ca.gov/Portals/0/Sunnyvale/CDD/Residential/Electrical%20Car%20Chargers.pdf**

City of Los Angeles Building Code: **http://ladbs.org/LADBSWeb/LADBS_Forms/PlanCheck/2011LAAmendmentforGreenBuildingCode.pdf**

City of Lancaster Building Code: **https://library.municode.com/HTML/16042/level3/TIT17ZO_CH17.08REZO_ARTVSOWIALENUS.html#TIT17ZO_CH17.08REZO_ARTVSOWIALENUS_17.08.330ELVECHST**

Mountain House Building Code: **http://www.sjgov.org/commdev/cgi-bin/cdyn.exe/handouts-mtnhouse_MH_CH_TEN?grp=handouts-mtnhouse&obj=MH_CH_TEN**

Signage: **http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/13-01.pdf**

City of Lodi Parking Enforcement **http://publicdocs.lodi.gov/Docs/ORDINANCES/2013/ord1881.pdf**

City of Santa Monica Parking Enforcement **http://www.smgov.net/departments/council/agendas/2012/20120724/s2012072407-A-1.htm**

City of Laguna Beach Parking Enforcement **http://lagunabeachcity.granicus.com/MetaViewer.php?view_id=3&clip_id=299&meta_id=23343**

City of Knoxville, TN Parking Enforcement **http://knoxvillecitytn.iqm2.com/Citizens/FileOpen.aspx?Type=30&ID=1702**

State of Washington Parking Enforcement **http://apps.leg.wa.gov/billinfo/summary.aspx?bill=5849**

State of New York Parking Enforcement **http://open.nysenate.gov/legislation/bill/S5190-2013**

Accessibility Requirements, Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices. **http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf**

**Training for Electrical Contractors**

EVSE Codes and Standards: **http://www.afdc.energy.gov/afdc/codes_standards.html**

City of Irvine Load Calculation Worksheet: **http://www.cityofirvine.org/civica/filebank/blobdload.asp?BlobID=17661**

EVITP Website: **http://www.evitp.org/training-programs**

Fresno, Madera, Kings and Tulare JATC: **http://www.fresnojatc.org**

Alameda County Electrical JATC: **http://595jatc.org**

**Workplace Charging**

DOE's Workplace Charging Challenge: **http://www1.eere.energy.gov/vehiclesandfuels/electric_vehicles/workplace_charging.html**

DOE's Plug-in Electric Vehicle Handbook for Workplace Charging Hosts: **http://www.afdc.energy.gov/uploads/publication/pev_workplace_charging_hosts.pdf**

CALSTART Employer EV Initiative: **http://www.evworkplace.org**

**Building Codes for Plug-in Electric Vehicle Charging**

Advanced Energy Charging Station Installation Handbook: **http://www.advancedenergy.org/_files/pages/Charging-Station-Installation-Handbook-.pdf**

CALGreen Building Standards Code: **http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf**

Assembly Bill 1092: **http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB1092**

### Fleet Electrification

AFDC's Heavy-Duty Vehicle Search: **http://www.afdc.energy.gov/vehicles/search/heavy**

AFDC's Light-Duty Vehicle Search: **http://www.afdc.energy.gov/vehicles/search/light**

AFDC's Petroleum Reduction Planning Tool: **http://www.afdc.energy.gov/prep**

### Leveraging Renewable Energy

California Plug-in Electric Vehicle Driver Survey Results: **http://energycenter.org/clean-vehicle-rebate-project/vehicle-owner-survey/feb-2014-survey**

## Appendix

### The Basics: A Guide to Plug-in Electric Vehicles and Charging Infrastructure

Alternative Fuels Data Center (SFDC) website: **http://www.afdc.energy.gov/vehicles/search/heavy/**

AFDC's station locator: **http://www.afdc.energy.gov/locator/stations/**

PlugShare: **http://www.plugshare.com/**

### Charging Environments: Workplaces

Clipper Creek's Reconnect Program: **http://www.clippercreek.com/reconnect-ca-program.html**

DriveClean Resources for Businesses: **http://www.driveclean.ca.gov/pev/Resources_For_Businesses.php**

DriveClean Resources for Workplace Charging: **http://www.driveclean.ca.gov/pev/Charging/Public_and_Workplace_Charging.php**

DriveClean website: **http://www.driveclean.ca.gov**

San Joaquin Valley Air Pollution Control District: **http://www.valleyair.org/lists/list.htm**

Financial Viability of Non-Residential Electric Vehicle Charging Stations: **http://luskin.ucla.edu/sites/default/files/Non-Residential%20Charging%20Stations.pdf**

**Homeowner's Guide for Permitting & Inspecting EV Chargers**

GoElectricDrive.com: **http://www.GoElectricDrive.com**

Verify your contractor's license: **http://www.CSLB.ca.gov**

**Local Utilities: Solutions and Programs for Plug-in Electric Vehicle Charging**

Southern California Electric PEV Website: **https://www.sce.com/wps/portal/home/residential/electric-cars**

Southern California Electric Smart Grid Opportunities: **https://www.sce.com/NR/rdonlyres/BFA28A07-8643-4670-BD4B-215451A80C05/0/SCE_SmartGrid_Strategy_and_Roadmap.pdf**

Pacific Gas & Electric PEV website: **http://www.pge.com/electricvehicles/**

PG&E Renewable Energy Options: **http://www.pge.com/myhome/environment/pge/greenoption/**

PG&E Multi-Unit Dwellings Page: **http://www.pge.com/myhome/environment/whatyoucando/electricdrivevehicles/installationprocess/**

Lodi Electric's PEV website: **http://www.lodielectric.com/electricvehicles.html?page=r**

**Local Government Action Plans**

City of Oakdale: **http://www.ci.oakdale.ca.us/gp/Links/pdfs/oakdale-cap-20120720.pdf**

City of Merced: **http://www.cityofmerced.org/depts/cd/planning/climate_action_plan/default.asp**

Tulare County: **http://generalplan.co.tulare.ca.us/documents/GeneralPlan2010/ClimateActionPlan.pdf**

City of Tulare: **http://www.ci.tulare.ca.us/pdfs/departments/planning/City_of_Tulare_CAP_2011.04.11_complete.pdf**

City of Tracy: **http://www.ci.tracy.ca.us/documents/Sustainability_Action_Plan.pdf**

City of Arvin: **http://www.arvin.org/downloads_pdfs/Final-Arvin-GP-IS%20%28July-12-2012%29.pdf**

**Considerations for Public Agencies That Provide Charging**

San Joaquin Valley Air Pollution Control District: **http://www.valleyair.org**

TIGER Grants: **http://www.dot.gov/tiger**

Alternative and Renewable Fuel and Vehicle Technology Program: **http://www.energy.ca.gov/contracts/transportation.html**


electric drive

## Glossary of Terms, Abbreviations and Acronyms

| Term, Abbreviation or Acronym | Description |
|---|---|
| A | Amperes or amps. The International System of Units base unit of electric current. |
| AB | Assembly Bill |
| AC | Alternating current |
| ADA | Americans with Disabilities Act of 1990, which prohibits discrimination based on disability. |
| ATTE | Advanced Transportation Technology and Energy |
| BEV | Battery electric vehicle. It is a fully electric vehicle fueled only by the onboard battery. |
| CALGreen | California Green Building standards |
| CAP | Climate Action Plan |
| CARB (or ARB) | California Air Resources Board |
| CCR, Title 24 | California Code of Regulations, Title 24. Commonly known as the California Building Standards Code. |
| CEC (or Energy Commission) | California Energy Commission |
| CCSE | California Center for Sustainable Energy |
| Charger | A device designed to charge batteries or other energy storage options within electric vehicles. Chargers vary in electrical voltage. |
| Charging level | Standardized indicators of voltage at which an electric vehicle's battery is recharged. Commonly, these are Level 1 (120 VAC), Level 2 (208/240 VAC) and direct current (DC) fast charging. |
| Circuit breaker | A device that protects an electrical circuit from damage caused by overloaded electrical current by automatically interrupting the current flow. |
| CPUC | California Public Utilities Commission |
| CVRP | Clean Vehicle Rebate Project |
| DC | Direct current |

| | |
|---|---|
| DMV | Department of Motor Vehicles |
| DOE | U.S. Department of Energy |
| EPRI | Electric Power Research Institute |
| EVITP | Electric Vehicle Infrastructure Training Program |
| EVSE | Electric vehicle supply equipment. This includes all components required for the purpose of delivering energy to an electric vehicle, such as conductors, plugs, power outlets, wiring, ground connectors, etc. |
| EVSP | Electric vehicle service providers |
| GHG | Greenhouse gas. Any of the gases (e.g., carbon dioxide, methane, ozone and fluorocarbons) emitted that absorb solar radiation in the atmosphere, contributing to the greenhouse effect. |
| HEV | Hybrid electric vehicle. A motor vehicle powered by both an electric propulsion system with a conventional internal combustion propulsion system. A hybrid electric vehicle does not plug into an off-board electrical source. |
| HOA | Homeowners' association |
| HVIP | Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (California Air Resource Board) |
| HOV | High occupancy vehicle |
| ICC | International Code Council |
| ICE | Internal combustion engine. An engine that combusts petroleum-based fuel to deliver power to a vehicle. |
| IOU | Investor-owned utility |
| J1772 | Industrywide standard EV connector for Level 2 charging. |
| kW | Kilowatt. A unit of power equal to 1,000 watts. |
| kWh | Kilowatt-hour. A unit of energy commonly used for measuring the energy capacity of a battery. It is also the common billing unit used by electric utilities to provide energy to consumers. |
| MUD | Multi-unit dwelling |
| MOU | Municipally owned utility |
| MUTCD | Manual on Uniform Traffic Control Devices |
| NEC | National Electrical Code |
| NREL | National Renewable Energy Laboratory |

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| OEM | Original equipment manufacturer |
| PEV | Plug-in electric vehicle. Any motor vehicle for on-road use that is capable of operating only on the power of a rechargeable battery or battery pack (or other storage device that receives electricity from an external source, such as a charger). |
| PEVC | California Plug-in Electric Vehicle Collaborative |
| PG&E | Pacific Gas & Electric |
| PHEV | Plug-in hybrid electric vehicle. A vehicle fueled at least partially by an onboard battery charged from the electrical grid. There are two types of PEVs that are commercially available: battery electric vehicles and plug-in hybrid electric vehicles. |
| Plan | San Joaquin Valley Plug-in Electric Vehicle (PEV) Readiness Plan |
| Prewiring | Providing sufficient infrastructure, such as wiring, conduits, junction boxes, outlets and adequate electrical panel and circuitry capacity to meet anticipated future EVSE demand. |
| the Region | The San Joaquin Valley Air Pollution Control District jurisdiction |
| SAE | Society of Automotive Engineers |
| SCE | Southern California Edison |
| SJVAPCD | San Joaquin Valley Air Pollution Control District |
| SJVPEVCC | San Joaquin Valley Plug-in Electric Vehicle Coordinating Council |
| SCS | Sustainable Communities Strategy |
| TOU | Time-of-use. An electricity billing method with rates based upon the time of electricity usage during the day. |
| UL | Underwriters' Laboratory |
| VMT | Vehicle miles traveled |
| the Valley | The San Joaquin Valley Air Pollution Control District jurisdiction |
| ZEV | Zero-emission vehicle. A vehicle that emits no tailpipe pollutants |

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