Bay Area and Monterey Bay Regions Draft PEV Readiness Plan

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Bay Area Air Quality Management District

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Metropolitan Transportation Commission

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Executive Summary

The deployment of plug-in electric vehicles (PEVs) has the potential to reduce petroleum consumption drastically, minimize greenhouse gas (GHG) emissions, and increase energy independence through the utilization of locally-produced energy sources. The success of long-term transportation electrification will depend in part on the near-term deployment of charging infrastructure. The introduction of PEVs and the corresponding Electric Vehicle Supply Equipment (EVSE) infrastructure requires a broad range of stakeholders to prepare and plan for deployment. Automobile manufacturers have deployed a variety of PEVs, including plug-in hybrid electric vehicles (PHEVs) such as the Chevrolet Volt and Toyota Prius Plug-In, as well as battery electric vehicles (BEVs) such as the Nissan LEAF and the Ford Focus Electric. These PEVs are available and on the road today due to the commitment and interest of early adopters. Public agencies are well-positioned to help facilitate a transition towards electrification by coordinating the efforts of key stakeholders.

The Bay Area Air Quality Management District (BAAQMD) in partnership with the Metropolitan Transportation Commission (MTC), Association of Bay Area Governments (ABAG) and other stakeholders has developed this Draft Plug-in Electric Vehicle (PEV) Readiness Plan (the Plan) as part of a grant awarded by the United States Department of Energy (DOE) under a solicitation released in 2011 (DE-FOA-0000451). BAAQMD is also administering two (2) grants awarded by the California Energy Commission (CEC) for regional PEV readiness (PON-10-602); one for the Bay Area and the other for the Monterey Bay area.

This Draft Plan represents the initial results of research, analysis, and planning conducted to help the Bay Area and Monterey Bay Region (the Region) achieve the goal of being PEV Ready. The work builds on previous phases of the readiness planning effort, captured separately in a Planning Concepts Document and a Best Practices Document provided to local governments. These documents provided an introduction to the PEV ecosystem and helped identify the key planning elements that require further research, analysis, and planning to help the Region achieve the goal of being PEV Ready. Both documents are available online at www.bayareapevready.org and www.baaqmd.gov/evready.

The BAAQMD is currently accepting comments on the Draft Plan. Input received will be used to develop the final PEV Readiness Plan for the Bay Area and Monterey Bay regions. The BAAQMD will also host six identical informational sessions throughout the region to facilitate public access and participation in the planning process. At each of these sessions, BAAQMD staff will present an overview of the Draft Plan and solicit questions, comments and input from the public. Feedback from the sessions and comments that are provided via online before the deadline of Monday, October 22, 2012 will be incorporated into the final Plan.

These informational sessions are open to all interested parties. Due to limited seating capacity, pre-registration is required. To register for the sessions, and for further information, please visit http://www.PEVreadinessPlan.eventbrite.com.

This Plan focuses on actionable steps for local and regional governments to help them move towards PEV readiness. These include identifying key locations for siting public PEV

charging infrastructure; creating guidelines for installing chargers at challenging locations such as parking garages and multi-unit dwellings; and changing permitting processes, zoning ordinances, and building codes in order to remove key barriers to PEV deployment.

This Plan and others produced as part of the Region's initial planning efforts are not focused on aspects of PEV adoption and deployment which are largely outside of the control of local and regional agencies. The most prominent example of this is vehicle price: The upfront cost (i.e., the purchase price) of PEVs is higher than conventional vehicles. Although this is perhaps the most significant barrier to mass adoption of PEVs, it is not the focus of readiness planning efforts because local and regional agencies have limited capacity to affect significant change. This Plan provides background on this and other key market-related issues, but focuses on identifying solutions to existing barriers to PEV and EVSE deployment at local jurisdictions.

This document is presented with 11 sections, which can be characterized as follows:

- The first four (4) sections of the document provide an introduction to the Region, including: an outline of key stakeholders and the partnerships that have developed via the readiness planning process and other initiatives in the Region; a review of why this Plan is needed and how it fits within existing initiatives; a review of PEV and EVSE deployment in the Region to date; and the draft version of a regional siting analysis.
- The next seven (7) sections of the document provide in-depth analysis and recommendations related to each aspect of the PEV readiness planning process including: building codes; construction permitting and inspection processes; zoning, parking, and local ordinances; stakeholder training and education; consumer education and outreach; and minimize grid and utility impacts.
- The final section reviews specific implementation actions with a focus on actions for local governments to implement readiness efforts and an assessment of the potential costs and sources of funding for local jurisdiction readiness planning.

In each of the core sections of the PEV readiness planning process – Sections 5 through 10 – are discussions on significant gaps and deficiencies in the Region with respect to key issues, and the recommendations to close the gaps and correct those deficiencies. Furthermore, best practices and mechanisms to share lessons learned between local governments are also identified.

Although the responsibility for implementing the solutions to many of the issues identified in this document is outside the jurisdiction of local and regional governments, this document focuses on creating informational resources and on identifying solutions that may be addressed through the CEC grant or in collaborations with utilities and other stakeholders. Table ES 1 summarizes the sections in this report.

Table ES 1. Summary of PEV Readiness Planning Elements

Section	Area of Focus	Summary
1	Stakeholders and Partnerships	• The readiness planning is bolstered by the Bay Area EV Strategic Council, which has worked closely with state- and national-level organizations such as the California Plug-in Electric Vehicle Collaborative (PEVC), the CEC, and the DOE. • Readiness planning efforts are complemented by an array existing efforts in the Region, such as the Monterey Bay Electric Vehicle Alliance (MBEVA). • The Region is coordinating closely with industry, particularly automobile manufacturers and electric vehicle service providers (EVSPs) • Regional stakeholders will maintain engagement through the implementation of this plan via the California PEVC, commitment to the CEC regarding readiness planning, involvement with the development of the Region's Sustainable Community Strategy (SCS; per SB 375), deploying incentives to help local jurisdictions become PEV ready, ongoing involvement with regional Clean Cities Coalitions, and via the *Go EV Campaign.*
2	Need for PEV Readiness Plan	• The results of a survey conducted by BAAQMD of local jurisdictions reveal that the Region is in vastly different states of readiness. • An analysis of the survey shows that the top five cities in terms of readiness in our Region are Santa Rosa, San Francisco, Palo Alto, Novato, and Rio Vista. • However, even in the cities that scored well in the analysis of the survey, there are still many steps that can and need to be taken to improve PEV readiness across the Region.
3	Current Deployment: Vehicles and EVSE	• Current demand for PEVs in the Region is strong based on industry-reported data and Clean Vehicle Rebate Project (CVRP); likely more than 4,000 PEVs are on the road today in the Region. • There are nearly 4,000 residential Level 2 EVSE deployed or planned for deployment; nearly 2,600 nonresidential Level 2 EVSE deployed or planned for deployment; about 90 DC fast chargers being deployed; and 4 battery switch stations. • Initial review of driver and charging behavior in the Region; limited to BEVs because there are not data for PHEVs available in the Region at this time. • Most vehicles are being charged at night, largely due to the deployment of so-called smart chargers – vehicles are plugged in for much longer than they are being charged (i.e., when the vehicle is drawing power from the EVSE).

4	Regional Siting Analysis	• Review of prioritized sites for EVSE deployment that will support local and regional travel, including:
		  • Market segmentation of PEV adopters in the Region to estimate likely deployment of PEVs, particularly residential EVSE
		  • Identification of priority areas for workplace charging, including L1 and L2 EVSE.
		  • Identification of priority areas for publicly available charging including L2 and DC fast chargers.
		• Review of prioritized sites to facilitate travel along corridors and to other regions

Section	Area of Focus	Gaps and deficiencies	Recommendations	Implementation Actions
5	Building Codes	• Limited adoption by local governments of PEV readiness building codes	• Adopt standards for EVSE into the building code • Adopt requirements for pre-wiring EVSE into the building code	• BAAQMD and local stakeholders to develop Sample Ordinances and Best Practices document resources • Convene Summit of local elected officials to champion PEV readiness in the Region • Utilize existing county and local government forums to share best practices across jurisdictions • Consider possibility of linking incentives to adoption of PEV readiness plans
6	Construction Permitting & Inspection	• Limited Guidelines Outside of Residential (Single-Family Dwelling) Charging • Cumbersome, lengthy and/or relatively high cost to obtain permits in certain municipalities • Limited coordination between all portions of the PEV infrastructure chain (vehicle dealer, vehicle purchaser, utility, local jurisdiction)	• Encourage local governments to adopt streamlined and expedited permitting processes – Evaluate potential of target to issue permits within 24 to 48 hours at a cost of no more than $250 – Consider staffing permitting counters with technical staff – *Alternative:* Issue expedited permits for projects that involve only Level 1 chargers in single-family residences – *Alternative:* Issue expedited permits to certified contractors • Train permitting and inspection officials on EVSE installation • Improve coordination between local government and utilities to create a notification protocol for new EVSE through the permitting process – *Alternative:* Conduct outreach encouraging contractors to notify utilities of new EVSE installations • Create a permitting checklist for PEV owners and contractors • Create cross-jurisdictional opportunities for sharing lessons learned	• BAAQMD, along with PEVC and other stakeholders to develop inspection and permitting checklist templates and materials to help facilitate EV installation in MDUs and workplaces. • Convene Summit of local elected officials to champion PEV readiness in the Region. • Utilize existing county and local forums to share best practices across jurisdictions. • Consider possibility of linking incentives to adoption of PEV readiness plans. • Consider strategies such as making receipt of air quality and transportation grant funding conditional on vehicle dealers, EVSE vendors and property owners using common checklist contained in BAAQMD "local best practices document"

Section	Area of Focus	Gaps and deficiencies	Recommendations	Implementation Actions
7	Zoning, Parking, and Local Ordinances	• Potentially onerous zoning ordinances or inconsistent parking requirements that make it more difficult to install EVSE in certain places • Little available data regarding readiness from local agencies regarding this aspect of the PEV ecosystem. About 80% of surveyed local agencies are not involved in creating zoning and parking ordinances	• Encourage local agencies to adopt a climate action plan, general plan element, or stand-alone plan that encourages deployment of PEVs and EVSE • Encourage local agencies to adopt regulations and enforcement policies for PEV parking spaces • Encourage local agencies to consider specific design guidelines for PEV parking spaces that include requirements such as allowing PEV parking spaces to count toward minimum parking requirements • Encourage local agencies to adopt minimum requirements for PEV parking	• Convene Summit of local elected officials to champion PEV readiness in the Region • Utilize county and regional forums to share best practices across jurisdictions • Continue to work with the PEVC and via grants programs to increase guidance on PEV-friendly zoning and parking requirements • Provide additional guidance that helps to eliminate the barriers associated with EV installation in multi-unit dwellings • Consider possibility of linking incentives to adoption of PEV readiness plans
8	Stakeholder Training & Education	• Lack of knowledge in many local jurisdictions regarding PEV infrastructure • Lack of knowledge at the local automotive dealer level regarding PEV infrastructure, notifications and permitting	• Develop schedule for and conduct Stakeholder Training and Outreach	• Seek additional AB 118 funding from CEC to fund training based on assessment • Coordinate local funding from cities and counties and regional agencies to provide training • Convene summit of local elected officials to champion PEV readiness in the Region • Partner with Clean Cities Coalitions and city and county associations to provide information to local jurisdictions on available training • BAAQMD to promote existing available training and education provided via PEV advocacy groups and related organizations

Section	Area of Focus	Gaps and deficiencies	Recommendations	Implementation Actions
9	Consumer Education and Outreach for PEVs	• Lack of a centralized Region-specific PEV information resource for consumers	• Provide a centralized Region-specific PEV information resource for consumers, local government, fleets, and employers	• MTC to develop Go EV campaign for Bay Area • CEC funding to be used to prepare outreach materials in Monterey Area • BAAQMD to collaborate with PEVC to develop materials at the statewide level that are not already available via existing PEV advocacy organizations and other stakeholders • Work through the EV Strategic Council, MBEVA, and the PEVC to interface with private sector efforts to promote information distribution on PEV
10	Minimizing Grid & Utility Impacts	• Potential for local grid impacts caused by PEV clusters • High rates of adoption of PEV could impact the grid at peak levels • Some municipal utilities have yet to adopt time of use (TOU) rates and few have notification systems; these make the grid vulnerable to both clustering and peak impacts	• Further evaluate utility rate structures related to PEVs • Create utility notification protocol • Upgrade distribution infrastructure • Implement consumer outreach programs • Evaluate Smart Grid opportunities • Provide renewable energy options for PEV drivers	• Encourage utilities to consider amending existing tiered rate tariffs to include PEV-friendly programs and to conduct further analysis of Time of Use (TOU) Rates and options for secondary meter • Convene summit of local elected officials to champion PEV readiness in the Region • Create utility notification protocol for local government and EVSE hosts(including residents) • Use Go EV campaign to provide consumers with information on TOU rates and renewable energy options for PEV drivers

Section 11 of the document highlights the specific aspects of Implementation Actions identified in the right-most column for Section 5 through Section 10 in the table above.

1. Stakeholders and Partnerships

The Bay Area and Monterey Bay Region (the Region) has been proactive and successful in its efforts to deploy plug-in electric vehicles (PEVs) and the supporting electric vehicle supply equipment (EVSE) as a result of engaged stakeholders and strong partnerships. The development of this Regional PEV Readiness Plan serves as an illustrative example: The Bay Area Air Quality Management District (BAAQMD) is the lead agency for this effort and has partnered with two other Bay Area regional agencies, the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) to develop this Plan. These three organizations are all members of the Joint Policy Committee, which coordinates the agencies efforts on growth in the Bay Area. BAAQMD also partnered with the Bay Area EV Strategic Council (EV Council), a public-private partnership of relevant stakeholders, to assist with the development of the Plan and with the EV Council's counterpart, the Monterey Bay Electric Vehicle Alliance (MBEVA) for the development of this plan for that area of the Region. In addition, BAAQMD partnered with regional Clean Cities Coalitions (CCC) – including the East Bay (EB), San Francisco (SF), and Silicon Valley (SV) Clean Cities Coalitions – to conduct significant outreach and arrange public meetings in the Region.

This Plan represents both a statewide and regional effort co-sponsored by the United States Department of Energy (DOE) and the California Energy Commission (CEC) that seeks to identify the systems and resources that are needed to support accelerated PEV adoption. The Plan covers the following 12 counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma, Monterey, Santa Cruz, and San Benito.

As part of the grant provided by the DOE, the BAAQMD is a significant part of a statewide partnership that includes several state and local agencies actively engaged in identifying mechanisms to reduce the barriers to PEV and EVSE deployment in California. These include the CEC, California Public Utilities Commission (CPUC), California Building Standard Commission (CBSC), California Air Resources Board (CARB), the California PEV Collaborative, South Coast Air Quality Management District (SCAQMD), and other Clean Cities Coalitions throughout the state. These groups comprise the California PEV Coordinating Council (CalPEVCC). The CalPEVCC has provided oversight in the development of PEV readiness guidelines, six regional deployment plans, and a compiled statewide PEV deployment plan for California (Statewide Plan). This Plan constitutes one of six regional deployment plans that will be folded into the Statewide Plan.

Here in the Region, even during these early stages of PEV and EVSE deployment, partnership includes a broad and diverse group of Bay Area and Monterey Bay stakeholders that are pursuing numerous avenues to support deployment including:

- **Regional PEV readiness planning**: BAAQMD, MTC, ABAG, Bay Area EV Strategic Council, MBEVAEB, SF and SV Clean Cities Coalitions and local cities and counties.
- **Infrastructure Providers**: Coulomb, ECOtality, Better Place, 350 Green, Clipper Creek NRG, AeroVironment, GE, Schnieder, SPX and Greenlots
- **Vehicle Manufacturers**: Nissan, Toyota, GM, BMW, Mercedes

- **Guideline and permitting process development**: BAAQMD, ABAG, Tri-Chapter Uniform Code Committee (TUCC), and local cities and counties
- **Technical innovation**: Tesla, Coulomb, Better Place, Google, Intel, UC Berkeley, and Electric Power and Research (EPRI)
- **Advocacy**: Clean Cities Coalitions, Plug-In America, Electric Auto Association (EAA; Bay Area EAA Chapters include the Golden Gate Electric Vehicle Association, Silicon Valley EAA, San Jose EAA, East (SF) Bay EAA, and North (SF) Bay EAA), SF BayLEAFs, CALSTART, City CarShare, American Lung Association, Natural Resource Defense Council, Bay Area Climate Collaborative; MBEVA and Ecology Action
- **Training and Outreach**: US DOE, Clean Cities Coalitions, PEV Collaborative, community colleges, and the Electric Vehicle Infrastructure Training Program (EVITP)
- **Grid Issues**: CPUC, EPRI, Pacific Gas and Electric (PG&E), and municipal electricity providers
- **Funding Agencies**: BAAQMD, MTC, CEC, DOE, California Air Resources Board (CARB)

To help foster cooperation and coordination on the local PEV deployment efforts, the Bay Area EV Strategic Council was formed. The Council is a voluntary public-private partnership that was created in early 2011 with a mission to establish the greater San Francisco Bay Area as the “EV Capital of the United States” – as measured by the proportion of EVs deployed in the region. To advance this mission, the Council focuses on the 2011-2013 timeframe as a critical ”tipping point” in the regions’ transition to electrified transportation. Table 1 is a list of partners, making up the Bay Area EV Strategic Council. The Council has various levels of participation via the following four (4) committees, each of which provides vetting and steering for planning documents developed as part of the DOE grant:

- The Steering Committee is the core executive-level voting group that sets policy and strategy for the Council;
- The Executive Committee sets the agenda and budget for the Council;
- The Planning Committee supports all aspects of the planning process for the Council; and
- The Technical Committee is an advisory committee of technical experts.
- An overview of the EV Council, its members, roles and responsibilities is presented below in Table 1.

Table 1. Bay Area EV Strategic Council Members

Stakeholder	Role and Responsibilities
Regional and State Agencies	
Association of Bay Area Governments	Lead on EV Corridor Project ($4M EVSE project supported by CEC, BAAQMD, and local partners) Co-lead on SB 375 sustainable communities strategy
Bay Area Air Quality Management District	Lead on the DOE and CEC -funded regional PEV readiness plan Invested $6M+ in EV infrastructure in 2010-12
California Energy Commission	Provides $20 million annually in AB 118 program funds for PEV infrastructure Establishes energy policy and planning for California
Metropolitan Transportation Commission	Invested $15M+ in EV projects as part of Climate Initiatives grant Co-lead on SB 375 sustainable communities strategy
Monterey Bay Unified Air Pollution Control District	Coordinate efforts in Monterey Bay with MBEVA and Ecology Action on the DOE-funded regional PEV readiness plan
Congestion Management Agencies	
San Francisco County Transportation Authority	Establishes transportation policy and funding for the county; required to meet SB 375 greenhouse gas emissions targets
Transportation Authority of Marin	Establishes transportation policy and funding for the county; required to meet SB 375 greenhouse gas emissions targets
Sonoma County Transportation & Climate Protection Authority	Establishes transportation policy and funding for the county; required to meet SB 375 greenhouse gas emissions targets
Local Jurisdictions	
City and County of San Francisco	Regional leader in investing in EV infrastructure, including chargers, EV taxis, EV fleets, EV car share
City of San Jose	Placed EV as a centerpiece of the Green Plan, and invested in EV chargers and fleets
City of Oakland	Developed Climate Action Plan that features EV fleet and charging initiatives
City of Berkeley	Embraced EVs in municipal fleet and EV car sharing integration with municipal fleet
Marin County	Leader in low-carbon electricity supplied by the Marin Energy Authority, and allocated local transportation funding for EV chargers
Industry	
Kleiner Perkins Caulfield Byers	Lead venture fund in Silicon Valley and sponsored a large portfolio of EV related companies

Stakeholder	Role and Responsibilities
Pacific, Gas, & Electric	Developed a robust PEV and clean fuel vehicle program and is preparing to integrate PEVs on the smart grid Assess impact of PEVs on the electric grid and develop strategies to reduce or mitigate these impacts
Itron	Global leader in smart grid infrastructure and services, including PEV-related metering and software
Better Place	Developing a $20M pilot switch station demo project in the Bay Area focused on taxis and shuttles, with BAAQMD, MTC, City of San Jose, and City and County of San Francisco
Coulomb Technologies	Deployed 5,000 chargers globally including the ChargePoint America program in California and beyond
ECOtality	Lead on the $100M DOE-funded EV Project, now in San Francisco Bay Area, San Diego, and Los Angeles
Tesla Motors	BEV factory in Fremont for Tesla Model S and drivetrain for Toyota vehicles
CODA Electric	Original equipment manufacturer
Non-Governmental Organizations	
EB, SF and SV Clean Cities Coalitions	Actively driving PEV adoption in fleets region-wide
Bay Area Climate Collaborative	Project manager for *Ready, Set, Charge* EV Guidelines Project manager for $2.8M MTC-funded PEV fleet demonstration project
City CarShare	Developing $1.7M EV car share project with MTC funding
EV Communities Alliance	Lead facilitator for ABAG's EV Corridor Project Developed *Ready, Set, Charge* EV Guidelines
Plug-In America	Publishes leading resources on PEV products Advocates for EV-friendly legislation and policy
Silicon Valley Leadership Group	Co-sponsored annual PEV conferences, an executive PEV demonstration program, and the developed Bay Area Climate Collaborative to help drive the low-carbon transition

Stakeholder engagement in the Monterey Bay has taken shape largely through the Monterey Bay Electric Vehicle Alliance (MBEVA). MBEVA formed in March 2009 with initial support from the Monterey College of Law in Seaside and since then has held regular meetings to advance PEV goals related to: funding, policy improvement, public outreach, economic development/workforce development, and infrastructure development for the Monterey Bay area. MBEVA's Steering Committee is comprised of representatives from business, higher education, labor, local government agencies, and non-profit organizations. MBEVA is the only tri-county body in the Monterey area dedicated to accelerated adoption of PEVs in support of the region's implementation of state legislation to reduce GHG emissions. Most recently, MBEVA became a project under the umbrella of Ecology Action, a nonprofit consultancy in Santa Cruz. MBEVA's primary goals are:

- Increasing funding for, and installation of, publicly-available EV charging stations;
- Ensuring local governments adopt supportive policies, including streamlined EV charging station permit processing and increased number of EVs in their fleets;
- Increasing public awareness about electric and plug-in hybrid electric vehicles; and
- Increasing training of local workforce for green jobs related to the EV industry, and attracting electric vehicle businesses to the region.

An overview of MBEVA, its members, roles and responsibilities are presented below in Table 2.

Table 2. Monterey Bay Electric Vehicle Alliance

Stakeholder	Role and Responsibilities
Regional and State Agencies	
Association of Monterey Area Governments	Providing planning support related to PEVs and EVSE deployment in Monterey Bay Started with a $50,000 grant to help pay for 4 charging stations and produce report published in Jan 2012
Monterey Bay Unified Air Pollution Control District	Liaison to EV Council Funded several smaller grants for several deployment projects, including 7 Level 2 EVSE, 1 DC fast charger, and 4 BLINK stations installed Member of Steering Committee of MBEVA Helping fund upcoming National Plug-In Day for Monterey Region via $1,000 contribution
Local Governments	
Transportation Agency of Monterey County	Engaged with MBEVA steering committee ; applicant on behalf of MBEVA to deploy 7 Level 2 EVSE
City of Salinas	Member of Steering Committee of MBEVA
City of Santa Cruz	Member of Steering Committee of MBEVA
Santa Cruz County Regional Transportation Commission	Applicant on behalf of MBEVA to deploy 1 DC fast charger
Labor	
International Brotherhood of Electrical Workers (IBEW) Local 234	Member of Steering Committee of MBEVA Serves as on-the-ground implementer for EVSE in the Monterey Bay Region; have provided event space to host meetings as a central location for engaged stakeholders
Education	
California State University Monterey Bay	Member of Steering Committee of MBEVA Providing support on CEQA-related issues
Non-Governmental Organizations	
Ecology Action	Recently became official host of MBEVA; serve as point agency for readiness grant and the EVSE deployment grant from CEC Member of Steering Committee of MBEVA
Industry	
Green Fuse Energy	Providing technical and organizational support to MBEVA, on a volunteer basis Helps coordinate on the ground action for EVSE deployment Working with IBEW and other EVSE installation contractors Previous experience on EV1 development team at GM
Envirocentives	Member of Steering Committee of MBEVA Provided grant writing support
Chevrolet of Watsonville Nissan, Santa Cruz Nissan, Seaside	Active automotive dealerships in the Region that have supported event planning and local/regional efforts.

Stakeholder Engagement throughout the implementation of the Plan

As is evidenced by the robust framework described above, there is substantial coordination between PEV stakeholders throughout the Region. It is anticipated that these partnerships will continue throughout the implementation of this plan (through 2014) due to a number of factors. These are as follows:

- *Commitments to the California Energy Commission (CEC):* Both the Bay Area and Monterey regions have received funding from the CEC to do further work on PEV readiness in the Region. The BAAQMD is the fiscal agent for both grants (which run through 2014) and as a requirement of these grants, local PEV coordinating councils must be maintained and used as a mechanism to vet and receive input on the content of regional readiness plans that will be submitted to CEC. BAAQMD will gauge the need to continue these stakeholder groups at the end of that period and is willing to assume the role of coordinator for the Bay Area to continue stakeholder engagement, if necessary at that time. BAAQMD will also seek to engage its regional agency partners and partners in Monterey to support this effort and to support a similar continuation of regional engagement if necessary in the Monterey area.
- *The California Plug-In Electric Vehicle Collaborative:* This statewide organization is a multi-stakeholder private-public partnership working to ensure a strong and enduring transition to PEV in California. BAAQMD is the regional lead for this organization which discusses strategy, tactics, policy, incentives and market expansion for PEV with all of the major automotive manufacturers, electric utilities, electric vehicle supply equipment (EVSE) manufacturers, state agencies, non-governmental and other stakeholder. This organization is slated to continue its work through 2014 and will allow the Region to engage directly with major stakeholders regarding the implementation actions which lie outside the purview of regional and local government as part of this plan.
- *Sustainable Communities Strategy (SCS):* A significant emissions reduction strategy that underlines the Bay Area's SCS (as outlined by ABAG and MTC) relies on the mass adoption, deployment and use of PEV. The time frames in that particular strategy run through the year 2035 and target a 15% per capita reduction in greenhouse gas emissions (GHG). Due to these targets, it will be necessary for regional agencies to engage with local governments to make sure that PEV can be easily deployed throughout the Region and to ensure that local governments are ready to deal with the increased numbers of PEV projected in the SCS. This provides a conduit to engage major municipal fleet owners and local governments throughout the timeframe of this plan.
- *Incentives:* As part of SCS efforts to reduce GHG and efforts by BAAQMD to reduce air pollution, significant grant funding will be available during the time period for implementation of the plan (see Section 11 Implementation Actions). This funding provides the ability for regional agencies to engage directly with major fleets to encourage electrification of taxis, municipal operations and delivery vehicles. The BAAQMD has extensive history stretching back to the 1990s in terms of providing grant funding for the deployment of electric vehicles and its associated infrastructure. Additionally, BAAQMD and MUAPCD have extensive connections with major fleets in the region due to diesel emissions reductions programs that have replaced thousands of vehicles through incentives programs over the past 20 years.

MTC, as the conduit for transportation funding in the region also has extensive experience and pre-existing connections with local transit agencies and their associated fleets. This provides the region with multiple avenues to engage stakeholders outside of the coordinating councils listed above and to catalyze their adoption of electric vehicles.

- *DOE Clean Cites Coalitions (CCC):* CCC's have been a valuable resource for the region in terms of the engagement of stakeholders. Especially in terms of the engagement of major fleet operators. Their ability to provide education and real world experience to those considering the use of alt fuels has provided the region with the major advantage in terms of the adoption of PEV. More recently, Bay Area CCC have been co-funded by BAAQMD to increase their outreach to local and regional fleets. Based on the success of that program, BAAQMD will continue to utilize the CCC as a conduit to engage stakeholders throughout the development of this plan.
- *Education:* In addition to the efforts listed above, the BAAQMD and MTC plan to undertake a major education campaign which will focus on providing information to the public and stakeholders on the benefits of PEV use. It is anticipated that this will also provide a major conduit to maintain stakeholder engagements throughout the timeframe of this plan.

2. Need for a Regional Plan

2.1. Introduction

The Bay Area and Monterey Bay Region is currently one of the leading markets for plug-in electric vehicles (PEVs) in the country. The most recent estimates from the Clean Vehicle Rebate Project (CVRP) indicate that more than 3,300 PEVs are on the road in the Region today, with more than 700 publicly available charging spots in the ground, and at least another 1,500 charging spots planned over the next 2 years. The first retail DC fast charger in California was opened in April 2012 at the Stanford Shopping Center, which is the first of about 50 that will ultimately be deployed in the Region as part of BAAQMD's DC Fast Charger Program. Beyond these efforts to deploy publicly available charging stations, PEV owners are likely installing electric vehicle supply equipment (EVSE) to charge their vehicles at home.

These are exciting developments for the Region because PEVs are a critical path towards reducing air pollution in our communities and harmful emissions that cause climate change. PEVs can also help consumers save money over the life of their vehicle, while reducing our Region's dependence on petroleum.

What the vehicle and EVSE deployment numbers do not tell us is: Are we PEV ready? In other words, as a Region, are local governments and other stakeholders prepared to support consumers in our Region that are thinking of buying a PEV and/or installing EVSE at their home. The simplicity of plugging in an electric vehicle belies the complexity of what that entails – from both a planning and technical perspective. And although the PEV driving experience is comparable to or better than conventional vehicles – which are paramount to their success in the market place – there are few other similarities between the ownership experience of PEVs and conventional vehicles. Some of the key aspects of the PEV ecosystem that require coordination and planning include answering questions such as:

- How do I get EVSE installed?

This is an important question, particularly because the refueling experience in a PEV is so different from a conventional vehicle. The opportunity to refuel at home is convenient; however, getting equipment installed at home is a different aspect of the vehicle ownership experience. In many cases, consumers will need to install equipment which requires permits and inspections – it is important that the fees and timing for these processes are minimized and streamlined while ensuring consumer safety. For potential PEV buyers in multi-unit dwellings, the answer to this question is more complicated today; however, with planning and education of stakeholders, the process will eventually be comparable to the ease of installing EVSE at a single family home. For new developments, local governments can adopt building codes that require developers to make a building PEV-ready, which is a much more cost-effective investment for EVSE than trying to retrofit the building later.

- Where can I charge?

Although most charging will likely occur at home (>80%), it will be important to provide charging opportunities at locations such as workplaces, retail centers, and public transit connections.

Getting EVSE deployed at these places requires consideration of zoning and parking rules at the local level. And as noted previously, local governments can adopt building codes for new construction, and offer incentives to developers that go beyond the minimum requirements.

- Where can I get more information?

PEVs are a new technology and will require education for all parties involved in the PEV ecosystem, including potential vehicle buyers, dealers, inspectors and other local government staff, electrical contractors, emergency response teams, and utilities. Much of this education is already starting to take place; however, more will be needed.

- Will there be any problems when I plug in?

In the near-term future, utilities and analysts have demonstrated that it is highly unlikely that PEVs will lead to negative impacts on the grid. However, in the mid- to long-term future, utilities will need to devise infrastructure maintenance plans that account for PEV adoption, while also providing PEV owners incentives to charge off-peak. Although Pacific Gas & Electric (PG&E) provides electrical service to the majority of residents in the Region, there are five (5) municipally owned utilities and a community choice aggregator operating in the Region that will also have to consider how to manage increased PEV adoption. Although the utility will bear the sole burden of managing its services, setting rates, and encouraging PEV adoption, other stakeholders have a role to play by helping utilities understand where vehicles and EVSE are being deployed.

The PEV Readiness Plan provides stakeholders in the PEV ecosystem with specific guidance, emphasized by best practices from communities in the Region and around the country, to improve and streamline the process of purchasing a PEV, installing EVSE, and charging the PEV at home and in public. The progress made in the Region to date has been exemplary; however, there are many critical areas for improvement.

2.2. Readiness: Where Are We Today?

BAAQMD conducted a survey of local governments to understand the current level of readiness in the Region. Many local governments are engaged in the process of becoming PEV ready, so the results of the survey should be understood as a snapshot in time during a dynamic process. The survey sought to answer questions across the key areas of PEV readiness, including the following areas, with an introduction to each PEV readiness element below:

• Building Codes	• Stakeholder Training and Education
• Construction Permitting and Inspection	• Consumer Education and Outreach
• Zoning, Parking, and Local Ordinances	• Incentives for Charging: MUDs, Workplace, and Public

Building Codes. The integration of charging infrastructure into buildings will require the development of building codes. Modifications to building codes can help send the right policy signals and communicate to stakeholders such as developers, electricians, and permitting

inspectors that the deployment of PEV and charging infrastructure requires careful consideration.

Construction Permitting and Inspection. With an initial focus on deploying charging infrastructure at homes, it is essential that the installation process – including construction permitting and inspection – be streamlined to the extent possible without jeopardizing public safety. An expedited installation process will help ease the transition to PEVs and improve the overall consumer experience. With many areas throughout the Bay Area and Monterey Bay Region deploying EVSE, it will be important to share the lessons learned throughout the Region.

Zoning, Parking Rules, and Local Ordinances. The deployment of an effective and properly incentivized charging infrastructure will require local agencies to update zoning, parking rules, and ordinances. These three areas have many impacts on the deployment of PEVs, most notably the location and siting of publicly available infrastructure. Zoning, parking rules, and ordinances help address details such as accessibility, time restrictions, signage, and enforcement.

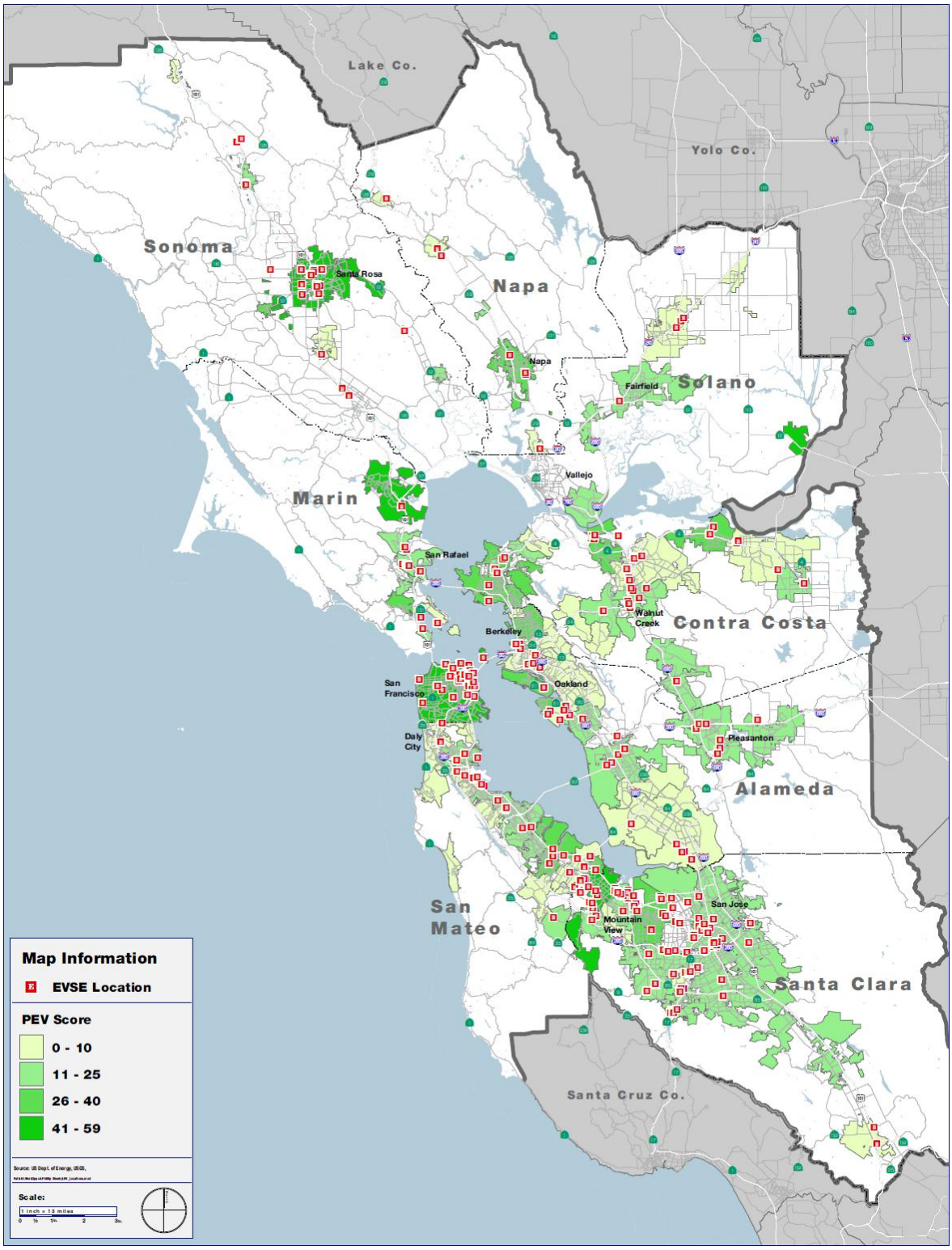
Stakeholder Training and Education. PEVs and the supporting charging infrastructure are new technologies. With any new technology, it is important for stakeholders such as electricians, permitting agencies, building inspectors, and first responders to receive the training and education required to ensure public safety and minimize the barriers to widespread adoption. Training and education are low-cost, high-reward investments that local and regional agencies can make to help support the deployment of PEVs and EVSE.

Consumer Education and Outreach. Federal, state, and local governments are doing their part to support the deployment of PEVs via financial and non-financial incentives. While many consumers may be aware of these incentives, it is important that these same agencies work together with the private sector to communicate the benefits of PEVs to a broader audience and share the initial lessons learned from deployment.

Minimizing Grid and Utility Impacts of PEVs. The economic and environmental benefits of using electricity to displace gasoline in the transportation sector are dependent on a reliable and clean electrical grid. Research by academic institutions, federal agencies, and utilities indicates that the electrical grid will be able to meet the demand for electricity from the deployment of PEVs over the next several years. However, the accelerated adoption of PEVs may cause challenges in some areas and will require careful planning by utilities. For instance, it will be important to identify pricing and control signals that will enable consumers to charge their vehicles in a cost-effective manner while minimizing the impacts on the grid. Furthermore, as the adoption of PEVs gain traction, it will be important to plan for next-generation issues such as the integration of renewable energy with PEVs or the potential for vehicle-to-grid applications.

The map in Figure 1 below is an overlay of our assessment of readiness with the current deployment of EVSE in the Region. Note that the top PEV readiness score is 100 and the jurisdiction would be shaded a dark green. The top tier of local governments in our Region scored between 50 and 59 on the readiness scale.

Figure 1. PEV Readiness in the Region[1]



[1] Note that this version of the map only includes the Bay Area; the Final Plan will include results from Monterey Bay.

The readiness survey of local governments reveals that the Region is in vastly different states of readiness. An analysis of the survey shows that the top five cities in terms of readiness in our Region are Santa Rosa, San Francisco (City & County), Palo Alto, Novato, and Rio Vista. Even in the cities that scored well in our analysis of the survey, however, there are still many steps that can and need to be taken to improve PEV readiness across the Region. At the same time, these cities can provide guidance and best practices to other cities and local governments. Some of the highlighted survey results that reflect the need for a Regional Plan include the following:

- Only 1 in 6 of the local governments surveyed have adopted EVSE requirements for permitting; although about 1 in 3 of the respondents are in the process of or considering the adoption of EVSE-specific requirements for permitting, the other half of respondents are seeking additional information or have not started to look at how to adapt requirements to EVSE.
- Permitting processes, including time to issue permits and permitting fees, are generally close to meeting the goal of 24-48 hour permitting at a cost of less than $250; however, there are still a significant number of local governments (>25%) that take longer than 6 days to issue permits and others that are charging more than $250 (>20% across all installation types). It is also important to note that the survey is self-reported information, and anecdotal evidence indicates that permitting processes may be longer than what is self-reported by local government staff.
- The level of readiness regarding zoning and parking ordinances is difficult to ascertain because more than half of the survey respondents are not involved in these issues, and in many cases two thirds of the respondents left the question blank. Even of the local governments that responded, however, only 5% have adopted zoning and parking ordinances related to EVSE.
- Only 1 in 10 local governments have adopted building codes for EVSE.
- Less than 20 local governments in the Region have been involved in workshops related to education and outreach of local and regional stakeholders across issues including PEVs, permitting and inspection, building code requirements, or first responder training.
- 1 in 2 respondents has not started to develop education materials related to PEVs and EVSE.
- The majority of respondents (>70% in each case) have not started looking at best practices or providing incentives related to charging at MUDs, workplace charging, or public charging.

[Note: more detailed results of the survey will be available as an appendix in the Final PEV Readiness Plan]

3. Current Deployment in the Region

Consumer demand for PEVs in the Region has been strong to date. Research from Nissan indicates that the San Francisco Bay Area has the highest rate of LEAF adoption in the country on a per household basis. As noted previously, the California Air Resources Board's Clean Vehicle Rebate Project (CVRP) issued more than 3,300 PEV rebates in the Region to date, representing 34% of the PHEV and 42% of the BEV rebates issued statewide.

3.1. Vehicle Deployment

Based on data from the CVRP, at least 3,200 PEVs[2] have been deployed in the Region (see Table 3 below). Although these data likely represent the majority of vehicles deployed in the region (estimated at greater than 75%), there are a couple of limitations to these data that contribute to underreporting of PEVs in the Region:

- The most significant limitation is that the first generation of the Chevrolet Volt was not eligible for the rebate. There were approximately 7,600 Volts sold nationwide in 2011; about 30% of those were sold in California. Considering that the Region accounts for approximately 40% of the California market for PEVs to date, there may be up to 1,000 more Volts (a PHEV) on the road in our Region than what is reported in Table 3 below.
- Not all PEV purchasers opt for the California rebate incentive. Although more than likely, most consumers will take advantage of the rebate.
- There are some PEVs that were likely purchased before the rebate was available to California consumers; the data available extend back to April 2010.

Table 3. Rebates for PEVs issued in the Region

County	PHEV	BEV	Total
Alameda	205	480	685
Contra Costa	91	157	248
Marin	36	126	162
Monterey	7	15	22
Napa	14	44	58
San Benito	10	9	19
San Francisco	56	204	260
San Mateo	96	341	437
Santa Clara	293	873	1166
Santa Cruz	13	45	58
Solano	16	35	51
Sonoma	13	48	61
Total	**850**	**2377**	**3227**

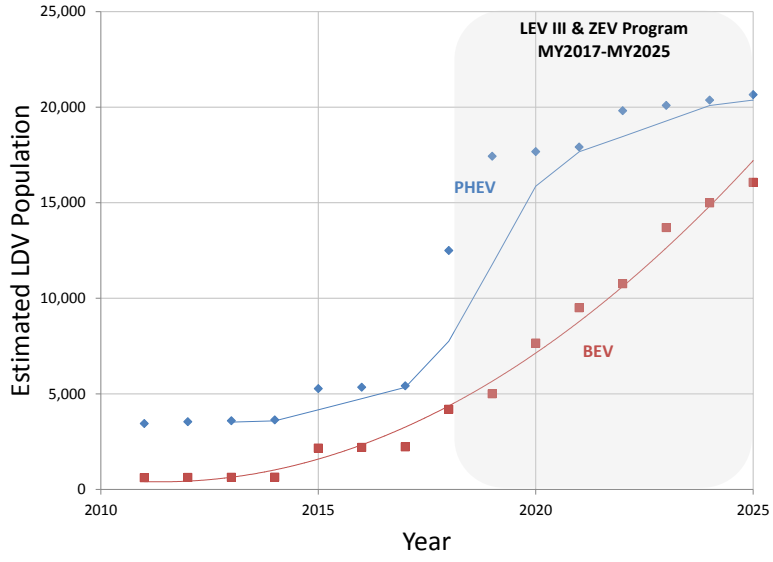
Source: CVRP, Air Resources Board, August 2012

[2] This number is less than the 3,300 cited previously because rebates are issued for commercial ZEVs, neighborhood electric vehicles (NEVs), and electric motorcycles are eligible. After excluding these from consideration, more than 3,200 of the rebates are issued for PHEVs and BEVs.

One of the more surprising results is the balance of PHEVs and BEVs to date; initial forecasts predicted higher sales in PHEVs than BEVs. However, CVRP data shows more BEV sales than PHEVs, which may be a result of two factors: the relatively high costs of PHEVs (e.g., the Volt) compared to BEVs (e.g., LEAF); and the fact that neither CVRP rebates nor the California High Occupancy Vehicle (HOV lane access) stickers were available for the early PHEV model. As noted previously, however, there are approximately 1,000 PHEVs in the Region that are not accounted for in these estimates. Furthermore, additional data show that the Volt and Toyota Prius Plug-In have been recently out-selling the Nissan LEAF. Based on existing sales data and the numbers provided via the CVRP, ICF forecasts that there may be two times as many PHEVs on the road than BEVs within the next 12 months. From a vehicle deployment perspective, the split between PHEVs and BEVs on the road is not particularly important; however, from a policy perspective, the focus of local and regional efforts can shift significantly depending on the vehicle architecture. Where appropriate, these issues are highlighted throughout the Plan. For the most part, the focus on readiness for this Plan is independent of vehicle architecture.

Moving forward, ICF projects strong continued growth in the PEV market in the Region over the long-term future, with moderate growth of PEV sales over the next several years. However, as regulatory drivers such as the Zero Emission Vehicle (ZEV) Program and Low Emission Vehicle (LEV) III Program – both part of California's Advanced Clean Cars Program – become more important during the release of model year (MY) 2017 vehicles, ICF anticipates a significant increase in PHEV deployment. Furthermore, ICF estimates that battery costs – the most significant driver for PEV costs – will decrease by about 30% by 2020, making PEVs more affordable and accessible to a larger demographic of car buyers.

Figure 2. Forecasted Baseline PHEV and BEV Populations (in the light-duty sector) for the Region



ICF developed the penetration scenarios in Figure 2 based on the following inputs and assumptions:

- ICF accounted for PEVs that would be deployed to meet the requirements of the ZEV Program, which requires automobile manufacturers to introduce zero tailpipe emission vehicles in volumes that increase over time. The program is implemented using credits, which vary depending on factors such as emission control technology and vehicle range. ICF used what ARB documentation describes as "*the most likely compliance scenario",*[3] a mix of transitional zero emission vehicles (TZEVs), BEV, and hydrogen fuel cell vehicles (FCVs). To develop the baseline, ICF assumed that TZEVs would all be PHEVs.[4]
- Based on EMFAC and sales data from the California New Car Dealers Association (CNCDA), we estimated that the Bay Area accounts for approximately 21% of vehicle sales in California.
- ICF also used internal analyses of other national- and state-level forecasts of PEV populations, and trends in hybrid-electric vehicle penetration in California and the Bay Area.

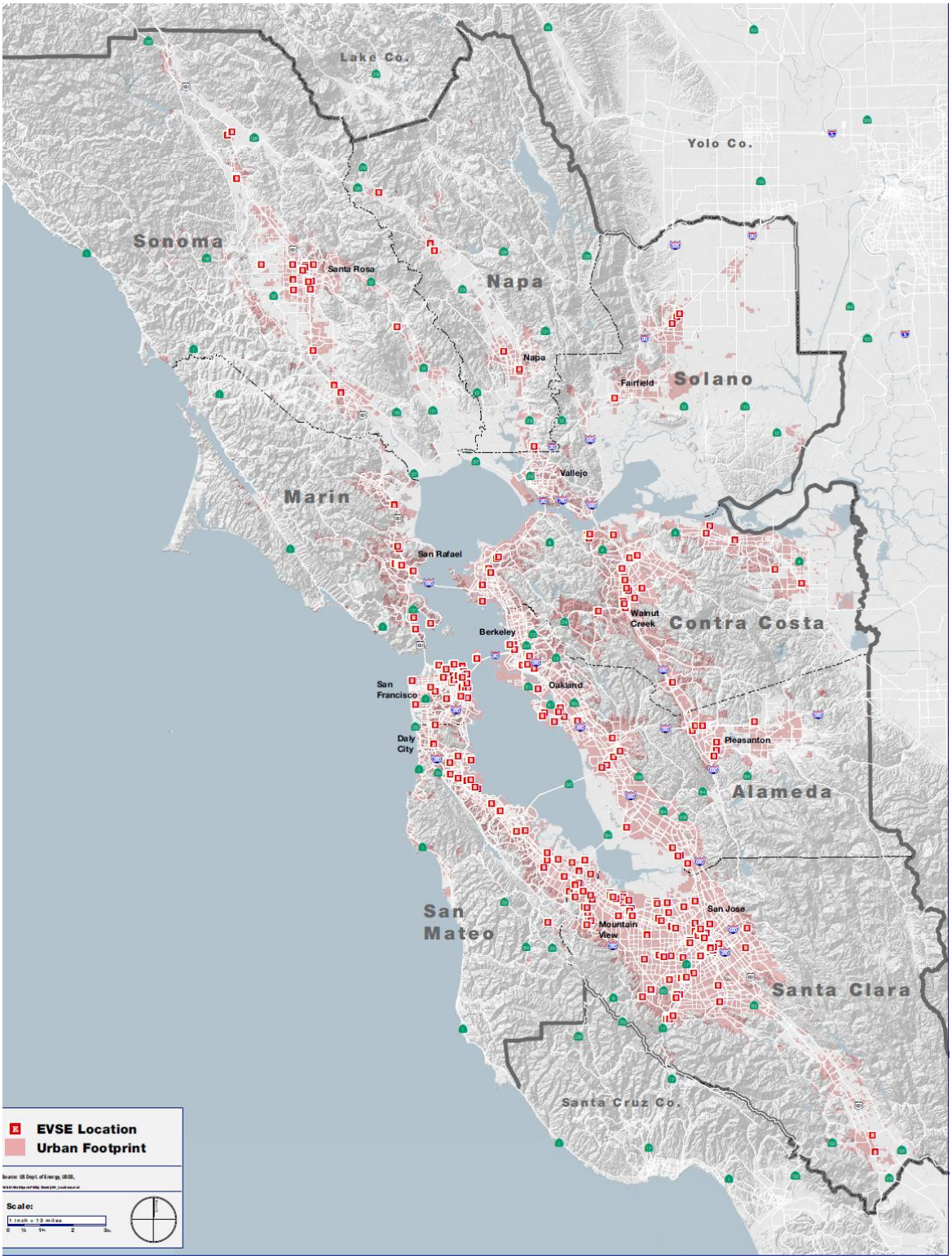
3.2. EVSE Deployment

As a result of consumer interest, regional agencies and electric vehicle service providers (EVSPs) have responded to the need for public infrastructure with a variety of deployment projects, as highlighted in Table 4 below. The current map of EVSE in the region is also shown in Figure 3 below.

[3] Appendix B, Draft Environmental Analysis for the Advanced Clean Cars Program, CARB, December 2011. We also drew from an ARB Staff Presentation dated November 16, 2010 entitled "ZEV Regulation 2010, Staff Proposal", available online at: http://www.arb.ca.gov/msprog/zevprog/2011zevreg/11_16_10pres.pdf

[4] Appendix B, Draft Environmental Analysis for the Advanced Clean Cars Program, CARB, December 2011. We also drew from an ARB Staff Presentation dated November 16, 2010 entitled "ZEV Regulation 2010, Staff Proposal", available online at: http://www.arb.ca.gov/msprog/zevprog/2011zevreg/11_16_10pres.pdf

Figure 3. Overview of EVSE Deployed to date



Source: MTC GIS Unit; data retrieved from AFDC

Table 4. Overview of EVSE Deployment Projects in the Region

Project Title	Lead & Support Agencies	Local Incentive Funding		Chargers		
		Source	Amount	Residential Level 2	Nonresidential Level 2	DC Fast
EVSE Home Charger Rebate Program	ECOtality, Coulomb, AeroVironment	BAAQMD	$2.5	3,000		
DC Fast Charger Program	ECOtality, AeroVironment	BAAQMD	$.75			50
ChargePoint America	Coulomb Technologies	DOE	n/a		1,100	--
Bay Area and Monterey Bay EV Corridor Project	EV Communities Alliance. ABAG, BAAQMD Local Cities/Counties	CEC	$1.49		212	18
		BAAQMD	$0.40			
Update Existing EV Infrastructure	Clipper Creek	CEC	$2.30		230	--
Local Government EV Projects	Multiple	BAAQMD	$0.15		50	--
		MTC	$2.80			
eFleet: Car Sharing Electrified	City CarShare SFCTA	MTC	$1.70		24	
		BAAQMD	$0.53			
Bay Area Electric Vehicle Taxi Corridor Program Better Place, SFMTA		MTC	$7.0	*4 battery switch stations*		
		BAAQMD	$.43			
Tribal Community Sustainable Transportation	Kashia Band of Pomo Indians	MTC	$0.37		6	--
Businesses Deploying EV Infrastructure	Best Buy, McDonald's, Etc.	BAAQMD	$0.34		178	--
Electric Vehicle Charging Station Project	NRG (settlement w/ CPUC)	NRG		1,650* (minimum)		55
			Total (maximum)	**3,990**	**2,583**	**91**

CEC – California Energy Commission; DOE – U.S. Department of Energy; SFCTA – San Francisco County Transportation Authority; SFMTA – San Francisco Municipal Transportation Agency

* For the purposes of our estimates, we assume that 60% of the Make Readies (see below for more information) to be deployed by NRG will ultimately be residential Level 2 EVSE and the other 40% will be nonresidential Level 2 EVSE.

The EV Project: The EV Project, managed nationwide by ECOtality, was funded by the US DOE as part of the American Recovery and Reinvestment Act (ARRA), receiving a total of $115 million. The EV Project is also co-funded by the BAAQMD for deployment in the Bay Area region. ECOtality is managing the installation of 15,000 commercial and residential charging stations in more than 15 regions across the United States. Through March 2012, ECOtality reports[5] that 891 residential Level 2 chargers and 12 publicly available Level 2 chargers have been installed in the San Francisco Bay Area with 1,210 Nissan Leafs enrolled to date. To date the program has focused on residential installations; however, there are plans to deploy more publicly available chargers in the near future for the San Francisco Bay Area.

BAAQMD EVSE Deployment Programs: The BAAQMD is a key local funding source that has since 2009, allocated more than $6 million to support investments in EVSE deployment in the Bay Area. This funding has been deployed in two phases: Phase 1 is a $1.3 million project that provides funding for the deployment of publicly accessible EVSE charging stations which include over 200 Level 2 and 6 DC fast charge EVSE and one battery switch station.

Phase 2 provides an additional $5 million to install 3,000 residential Level 2 and 50 DC fast charge EVSE. EVSE providers participating in BAAQMD's Phase 2 *EVSE Home Charger Rebate Program* include ECOtality (1,500 Blink home chargers), AeroVironment (500 residential chargers), and Coulomb Technologies (500 residential chargers). Through July 2012, more than 800 EVSE have been installed through this program.[6] AeroVironment and ECOtality were also selected by the BAAQMD to support the DC Fast Charger Program and will install 30-50 DC fast chargers in the Bay Area region by December 2013. Recommendations for the allocation of the remaining funds from Phase 2 are pending upon the completion of this Plan.

ChargePoint America: This is a $37 million project, with $15 million from ARRA funds, administered by Coulomb Technologies focusing on the deployment of infrastructure in 10 regions throughout the United States, including the San Francisco Bay Area. As part of the program, the City of San Francisco has installed 80 Level 2 chargers in municipally-owned garages throughout the city. The ChargePoint America program has also sponsored the deployment of chargers at locations such as the Oakland International Airport, where 8 Level 2 chargers are deployed in the Premier Parking Lot. The Monterey Bay Region also received five Level 2 EVSE as part of ChargePoint America, with the infrastructure deployed in the cities of Scotts Valley, Capitola, Aptos, and Santa Cruz.

California Energy Commission: Has funded two projects that are focusing on the deployment of EVSE in the Bay Area. The first is called the **Bay Area EV Corridor Project** and is being implemented by the Association of Bay Area Governments and EV Communities Alliance. This project also includes deployment of EVSE in the Monterey Bay Region, with an estimated 44 dual outlet EVSE deployed in the Monterey Bay Region, managed in coordination with the Monterey Bay Electric Vehicle Alliance (MBEVA) and Ecology Action. The second project is a

[5] The EV Project Q1 2012 Summary
[6] Not all of the EVSE deployed as part of ECOtality's EV Project in the Bay Area are part of the Air District's Home Charger Rebate Program, hence the difference in number of EVSE installed.

statewide effort managed by Clipper Creek to **update the infrastructure** that was in place from the initial deployment of PEVs from the late 1990s.

Metropolitan Transportation Commission (MTC): Has also assumed a proactive role in the deployment of PEVs and charging infrastructure as part of the **Climate Initiatives Program**. MTC awarded nearly $12 million to four projects:

- San Francisco's Municipal Transportation Agency (SFMTA) partnered with the City of San Jose and Better Place for the **Bay Area EV Taxi Corridor Program**, a zero emission electric taxi project to demonstrate 61 electric taxis with battery switch capabilities, 25 electric neighborhood taxis, and four battery switching stations. The project received about $7 million in funds. Better Place has advanced its project and has the first two sites identified and is nearing the finalization of the permitting process for each site – one in the North Beach neighborhood of San Francisco (near the intersection of Davis St and Broadway) and the other at San Francisco International Airport. This project is also co-funded by the BAAQMD.
- The **Local Government EV Fleet Project** is administered by eight local governments (led by Alameda County) that are in the process of procuring 90 PEVs for municipal fleets and 90 Level 2 chargers accessible to both the government fleets and, in some cases, the public. The local government agencies plan to deploy 78 light-duty PHEVs and BEVs and 12 vans or shuttles. The project received $2.8 million. As of March 2012, the project partners were on the verge of issuing a bid for procurement of the first round of vehicles and charging stations.
- City CarShare is leading a **Car Sharing Electrified Project** to deploy 29 PEVs, which will be a mix of PHEVs and BEVs, and install 24 Level 2 chargers. The project received $1.7 million from MTC and an additional $0.53 million in funding from the BAAQMD. City CarShare has also established itself as a leader in the Bay Area with regard to EVSE deployment in a carshare fleet. Through its **eFleet Program,** they currently have more than 7 PEVs in their fleet with plans to expand to 30 PEVs over the next 24 months, and achieve 50% penetration of alternative fuel vehicles by 2015. With a total fleet of about 400 vehicles, they have the potential to deploy 200 PEVs in the Bay Area. For each PEV currently deployed they have at least one dedicated EVSE; and in several cases, they have installed two EVSE (for two vehicles), with the second charging station available for public use.
- The Kashia Band Pomo Tribal Government of the Stewarts Point Rancheria received about $370,000 to deploy four PEVs – two sedans and two vans – and six charging stations.

Monterey Bay Unified Pollution Control District (MBUPCD): The MBUPCD has played an active role in deploying EVSE in the Monterey Bay Region. They have funded projects such as the following:

- A grant to the Association of Monterey Bay Association of Governments (AMBAG) to install four ECOtality Blink stations. This grant also includes funding for public outreach and policy analysis.

- A grant to the Transportation Agency of Monterey County to install seven Level 2 EVSE in the tri-county Monterey Bay Region.
- A grant to the Santa Cruz County Regional Transportation Commission to install one DC fast charging station.
- A grant to the City of Santa Cruz to install EVSE in public parking garages in downtown Santa Cruz, providing a total of about 10 Level 2 EVSE.

NRG Settlement: The most recent development related to the deployment of charging infrastructure that will affect the San Francisco Bay Area is the settlement between NRG Energy Inc. and the California Public Utilities Commission (CPUC) stemming from the California energy crisis in 2000 and 2001. Of the $122.5 million settlement, NRG will spend $102.5 million to fund the installation of EVSE throughout California over a period of four years. More specifically, the settlement will fund:

- 200 **Freedom Stations** to be deployed statewide, with 55 of these deployed in the Bay Area. Each Freedom Station will consist of at least one DC fast charger and one Level 2 EVSE.[7] On top of the $50.5 million earmarked for stations, another $3 million is earmarked for the fixed operating costs of these stations e.g., electricity demand charges, meter charges, and maintenance, over a five-year period.
- 10,000 Make-Ready Stubs and 1,000 Make-Ready Arrays,[8] collectively referred to as **Make-Readies**, are to be deployed statewide at a cost of $40 million; unlike the Freedom Stations, Make-Readies are not intended to be available to the general public. At least 1,650 of these Make Ready Stubs will be deployed in the Bay Area, with an additional 4,000 stubs to be deployed at NRG's discretion. The bulk of this money will go towards wiring homes, and preparing workplaces, multi-family dwelling units (MDUs), hospitals, and schools for EVSEs. It is anticipated that NRG will target Bay Area with more than the minimum number of installations, since the area has a high proportion of residents living in MDUs. NRG will not own this equipment, the property owners will, but the company will have exclusive rights for 18 months to sell the equipment and related services to the property owners. After 18 months, the locations are open to competition.
- The **Technology Demonstration Program** with $5 million, with potential projects focusing on: stationary battery storage systems to reduce peak electricity demand from Freedom Stations, the installation of Extreme Freedom Stations (i.e., Level 3 DC public chargers exceeding 80 kW), smart charging technology, or a vehicle-to-grid demonstration project.
- The **EV Opportunity Program** with $4 million for projects that enhance social benefits of PEVs and create opportunities for residents of under-served communities. The eligible projects include the deployment of EVSE for PEV carsharing projects, a PEV job training program, or other projects that will help under-served communities.

[7] Per the terms of the settlement, NRG also has the option of deploying two DC fast chargers at Freedom Stations.
[8] Note that an array can have no more than 10 stubs, which means that there must be at least 1,000 unique locations across the state.

To address equity concerns, both the Freedom Station and Make-Readies deployment have provisions regarding the siting of infrastructure in low- and middle-income areas. For instance, 20% of the Freedom Stations must be installed in an area in which the median income is in the lowest third. It is also anticipated that significant coordination on the siting of this infrastructure will occur between NRG and BAAQMD as part of this planning effort.

Sustainable Community Strategy (SCS): Regional agencies in the Bay Area have also demonstrated their long-term commitment to supporting the electrification of the transportation sector as a critical strategy to meet the region's climate change goals. Most notably, on May 18, MTC and ABAG approved the Plan Bay Area Preferred Land Use and Transportation Investment Strategy[9], which outlines the Bay Area's strategy to meet the per capita GHG reduction targets of SB 375, with spending upwards of $275 billion out to 2035. While most of these investments are transit-oriented or for the expansion of roads and bridges; however, there are two key aspects of the Plan Bay Area that will promote the deployment of PEVs and EVSE out to 2040:

- **Regional Public Charger Network:** With PHEVs likely to be deployed in significant numbers in the Bay Area, this strategy makes targeted investments to help increase the opportunity to increase the number of pure electric miles for PHEVs. The initial plan is to dedicate approximately $240 million over the span of 15 years to support this program.
- **Vehicle Buyback & PEV Incentives Program:** This program couples fleet turnover with the deployment of PEVs. The vehicle buyback program is designed as a trade-in for older vehicles that are below a certain fuel economy threshold, with the eligibility restricted to consumers purchasing a PHEV or BEV. The incentive amount varies with the fuel economy of the vehicle being traded in (measured in mpg) as well as the vehicle type being purchased (i.e., PHEV or BEV). The initial plan allocates $180 million for this strategy over the span of 15 years.

3.3. PEV Driver Behavior: Charging and Trips

Overview of Data

Charging and trip data from ECOtality, as part of the EV Project engagement in the Bay Area, were analyzed for the Plan. There are many data which are not included in this analysis; however, this is generally a result of aggregation performed by ECOtality, in part to protect consumer privacy. The data, corresponding description, and some limitations are highlighted in Table 5.

[9] Preferred Land Use and Transportation Investment Strategy for Plan Bay Area, May 2012, available online at: www.onebayarea.org

Table 5. Overview of EVSE and Vehicle Data Elements

Parameter	Description and Limitations
No. of Level 2 EVSE	Monthly data, and total to date
Percent of time w/ EVSE connected	Monthly data, and total to date Data are only reported when >10 EVSE in zip code
Percent of time vehicle drawing power from EVSE	Monthly data, and total to date Data are only reported when >10 EVSE in zip code
Total electricity consumed by EVSE (AC kWh)	Monthly data, and total to date Data are only reported when >10 EVSE in zip code
No. of vehicles	Data reported by city Data are only reported when >10 vehicles in zip code
Sum of all miles	Data reported by city Data are only reported when >10 vehicles in zip code
Vehicle Id	Vehicles identified by zip code and city; no usage metrics are reported, only vehicle counts
Charging Events	Monthly data and total to date Data are only reported when >10 EVSE in zip code or city These are plug-in events, not charging events Data cannot be linked to individual vehicle
Time of Day Demand (AC kW)	Min and Max Charging Demand, hourly Data are only reported when >10 EVSE in zip code or city

Apart from the limitations listed above, it is also important to note that the EV Project in the Bay Area is only available to Nissan LEAF drivers and there is currently no plans by ECOtality to extend eligibility to other vehicle types; as a result, charging data for PHEVs e.g., the Chevrolet Volt is not available. At the time that this draft is being released, additional analysis of the data is being conducted and further refinements to these findings will be included along with the Final Plan. The data limitations are highlighted in Table 6 below – this information should be read as: For the data reported regarding the number of Level 2 EVSE, the dataset includes EVSE in 108 zip codes and 59 cities.

Table 6. Limitations of Key Parameters for PEV and EVSE Usage in the Region

Parameter	Geographic	
	Zip Codes	Cities
Communities with 10 or more participating Level 2 EVSE installed	108	59
Percent of time w/ EVSE connected	6	6
Percent of time vehicle drawing power from EVSE	6	6
Total electricity consumed (AC kWh)	6	6
No. of vehicles	108	59
Charging Events	22	20
Time of Day Demand	--	14

The summary results of the data include the following:

- There were 735 EVSE serving 668 vehicles in the Region, with San Jose alone accounting for nearly 20% of the vehicles in the Program (see Table 7 below for a distribution across the top 5 cities, representing about 40% of all vehicles in the program)
- These 668 vehicles have driven about 4.8 million all electric miles, and consumed 1.1 million kWh of electricity.
- Participating vehicles spend about 29% of the time plugged in and about 7% of the time charging (i.e., when the vehicle is drawing power from the EVSE).
- The number of plug-in events (not a charging event) and number of vehicles is a linear relationship, with little variation between cities (see Figure 4).
- Based on the maximum demand profiles for charging events, there are some small differences between charging behavior on the weekend vs. during the week (see Figure 5).
- There are small variations in weekday maximum charging demand between cities, with the most noticeable differences around the so-called shoulder of peak demand, post 6pm (see Figure 6).

Table 7. Vehicle Counts in the EV Projection for the Region

Rank	City	Vehicle Count
1	San Jose	130
2	Fremont	46
3	Oakland	38
4	Palo Alto	28
5	San Francisco	28

Figure 4.Plug-in Events and Number of Vehicles, by City

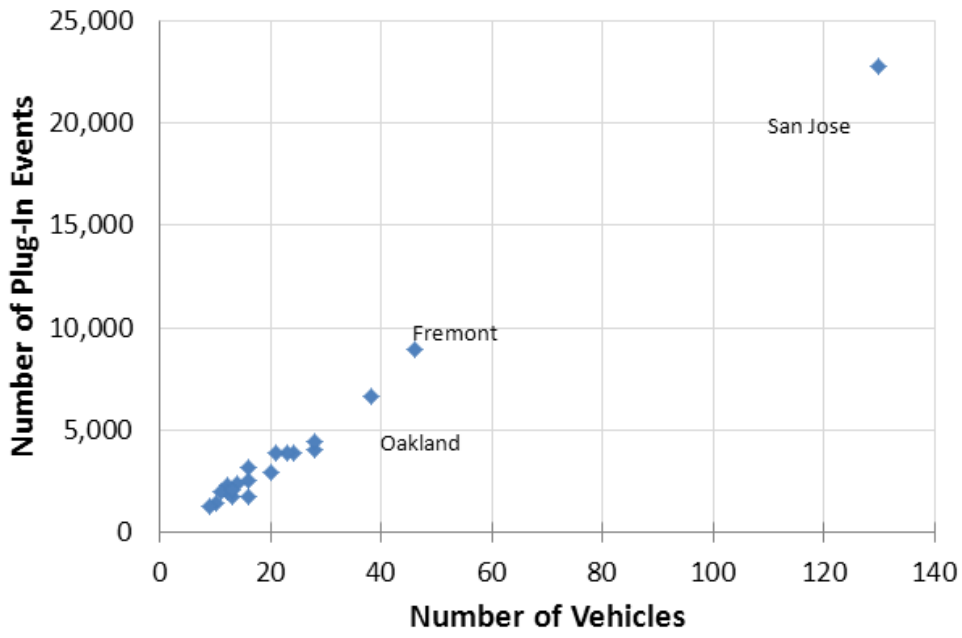


Figure 5. Maximum Aggregated Demand for the Region, by weekday and weekend

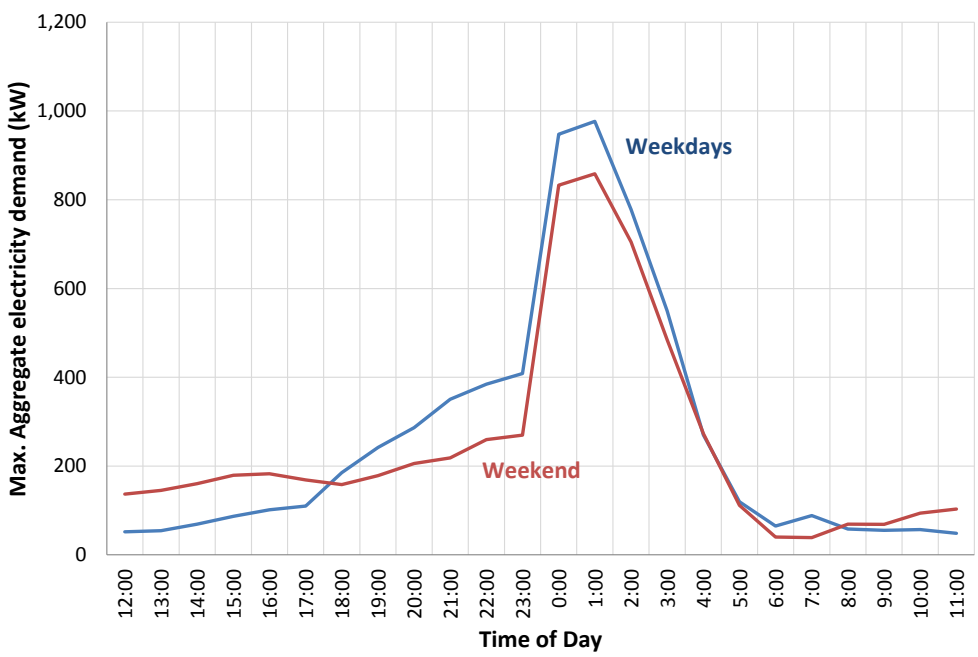
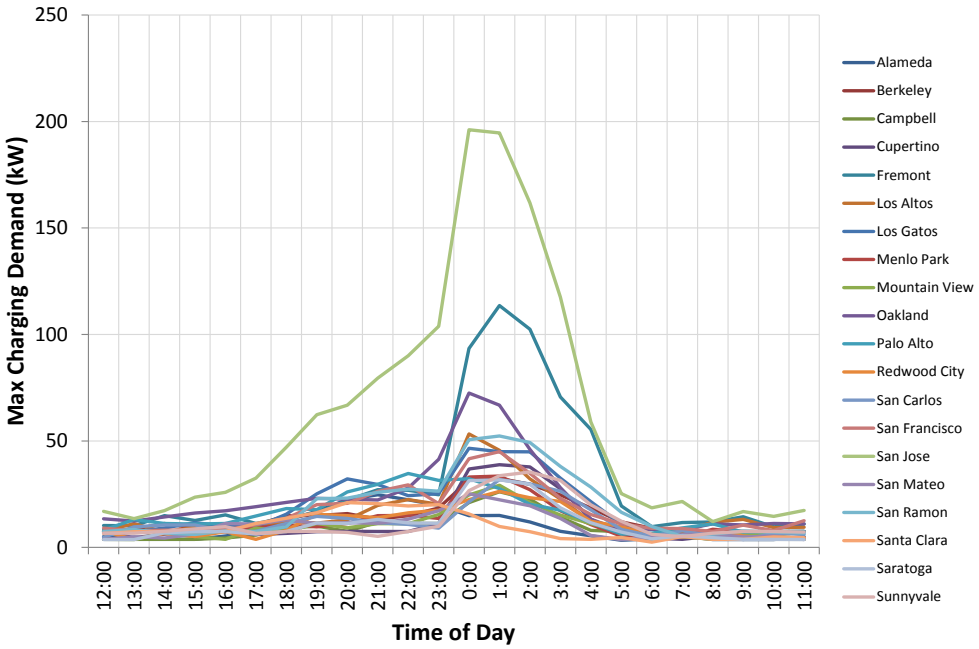


Figure 6. Maximum Charging Demand (kW) for the Region, by City



4. Regional Siting Plan

4.1. Introduction

PEVs rely on charging to extend their range (PHEVs and BEVs) and as their main source of propulsion energy (BEVs). Charging infrastructure is a key component of PEV deployment and is a source of constant debate regarding:

- Location: Where should chargers be located? Options are generally characterized as in the home, at the workplace, and public versus private.
- Quantity: How many are needed to support PEV drivers?
- Level of charging: What voltage and power levels are necessary for useful PEV charging at the various locations – Level 1, Level 2, or DC fast charging?
- Investment: Who pays for and maintains public and private infrastructure?
- Payment: How much should individuals pay for "a charge"?

To answer some of these questions, this section provides an overview of the current makeup and state of the charging infrastructure in the region.

With a strong consumer market for vehicles, regional readiness planning should focus much of its efforts on ensuring that the infrastructure is in place to support PEV deployment. To date, the Region has properly focused on ensuring that early adopters have a positive experience for charging vehicles at home. EPRI has prepared a convenient graphic to illustrate the priorities for likely charging scenarios, as shown in the so-called charging pyramid in Figure 7. Residential charging is the most important aspect of EVSE deployment; however, as the Region advances in its PEV readiness planning, workplace or retail charging and publicly accessible charging should also be addressed systematically. It is also important to note that over a third of housing units in the Region are multi-family dwelling units (MDUs), and face a similar set of barriers to those associated with workplace and public charging. Fortunately, regional agencies and stakeholders have initiated the deployment of nonresidential charging and are also examining paths to installing EVSE in MDUs, and these efforts will yield valuable lessons learned over the next several years.

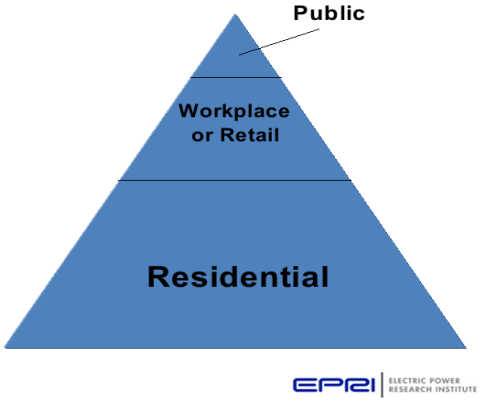


Figure 7. The EPRI Charging Pyramid

4.2. Need for a Regional Siting Plan

As noted previously in Section 3, there are many deployment activities in the region in the near-term, with additional funding from MTC as part of its regional transportation plan for EVSE deployment activities in the mid-term future. The goal of a siting plan is to help guide and coordinate siting efforts; it should not be confused with a prescriptive determination of where EVSE needs to go. The siting analysis combines various parameters such as characteristics of PEV ownership,

PEV usage, EVSE usage, land use, and regional travel patterns to identify the most likely areas to:

- Support PEVs in the Region to maximize all-electric miles and provide ample opportunities for charging while minimize the risk of stranded assets; and
- Extend the range of PEVs for intra- and inter-regional travel along various corridors.

Market Segmentation

The first step of the siting plan is to segment areas based on the likelihood of PEV adoption. Based on existing research, parameters such as income and hybrid electric vehicle (HEV) ownership, the potential for PEV adoption for specific catchment areas in the Region are characterized. The assessment will distinguish between EVSE deployment at residences and MDUs to the extent possible and feasible.

Residential EVSE

A major focus of infrastructure deployment to date has been residential EVSE. For instance, The EV Project to date has deployed about half (or 4,600) of its target residential Level 2 EVSE and only a third (or 1,500) of its target publicly available units.[10] As of August 2012, 95% of the "charging events" recorded as part of The EV Project have occurred at residential Level 2 EVSE; in the Bay Area, this percentage jumps to nearly 100%. The focus on residential deployment of EVSE is unsurprising – stakeholders, particularly OEMs, have been particularly vocal about emphasizing the need ensure that the home charging experience is positive. Additionally, guidelines and best practices are readily available for all parties (vehicle owner, utility, dealer, installers and local governments) relating to the installation of EVSE in single family residences (California Plug in Electric Vehicle Collaborative guidelines, etc.).

Multi-family Dwelling Unit EVSE

The population density in the Bay Area requires the consideration of deploying EVSE in MDUs. The San Francisco Department of Environment recently initiated MultiCharge SF in partnership with Coulomb Technologies to bring charging infrastructure to multi-family buildings in San Francisco, where two thirds of residences reside in MDUs (see Table 8 below). The project will help develop a knowledge base and best practices for EVSE deployment in MDUs by covering the costs of charging equipment and subsidizing the costs of installation significantly.

[10] Conversation with Steve Schey, ECOtality, April 11, 2012.

Table 8. Population and MDU Residents in Bay Area Counties

County	Population	% Population in MDUs
Alameda	1,500,000	38%
Contra Costa	1,100,000	24%
Santa Clara	1,800,000	32%
San Francisco	**900,000**	**67%**
San Mateo	750,000	33%

The MultiCharge SF project will help address some of the issues associated with deploying EVSE at MDUs. However, other jurisdictions outside of San Francisco will likely have to deal with the challenges of deploying EVSE at MDUs (see Table 9 below for a list of common challenges). The deployment of PEVs today will require many jurisdictions in the Region to grapple with these challenges before the lessons learned from the MultiCharge SF project are fully understood.

Table 9. Common Factors that Impact EVSE Installation at MDUs

Physical Challenges	• Availability of capacity in the electrical panel • Availability of space for additional meters in the meter rooms • Distances between utility meters, parking spaces, and unit electrical panels
Cost of Installation and Operation	• Restrictive facility configurations (master meter, remote parking, etc.) • Cost allocation to residents (based on usage, equipment, parking, shared service areas) • Inability to take advantage of off-peaking charging rates • HOA fee structures
Codes, Covenants, and Legalities	• Differences in ownership • Differences between actors who make the investment versus those that reap benefit • Agreements between property owners and residents / renters • Deeded parking spaces assigned to individual residents

Workplace Charging

Although initial data confirms the general view that most (light-duty PEVs) will be charged at home, it will be important to expand charging infrastructure beyond residences to achieve widespread adoption of PEVs. Furthermore, opportunities to charge outside of the residence will help increase the so-called “all-electric” miles for PHEVs and mitigate potential range limitations for BEVs. Workplace charging has garnered particular interest from stakeholders to fill the gap which will increase the all-electric range for PHEVs or extend the range for BEVs because of the amount of time that a vehicle will likely spend parked at a place of work. Furthermore, due to the time vehicles spend parked at workplaces, Level 1 EVSE may be a viable and lower-cost solution that also decreases load impacts. It is also important to note that there is a strong interest in the integration of renewable energy technologies (e.g., solar) with workplace installation to defray the costs of electricity (especially during peak hours).

Publicly Accessible Charging

Similar to workplace charging, publicly accessible charging will be an important part of the supporting infrastructure for PEVs as they reach increased levels of penetration. In the Bay Area, the City and County of San Francisco has established itself as a leader of deploying EVSE in municipally owned parking garages. However, beyond this jurisdiction's expedited deployment, there are still many barriers that prevent the deployment of publicly accessible EVSE. Many of these barriers are addressed in the current guidance being produced as patents planning effort, however, mechanisms and incentives for implementation still need to be determined.

4.3. Siting Plan

[Note: This section is a work-in-progress and is currently being developed in coordination with MTC using the regional transportation demand model for the Bay Area; however, this model does not cover the Monterey Bay. BAAQMD is working with its regional partners, including ABAG, MTC, and other stakeholders as needed to align the methodology used for each region to maximize compatibility.] The siting plan for suitable locations for EVSE is driven by the parameters such as those listed in Table 10.

Table 10. Parameters to Consider in the Identification of Suitable Locations for EVSE

Category	Parameter	Brief Explanation
Vehicle Characteristics	Vehicle range	Informs trip distance and vehicle type; as well as level of charging that is appropriate
	Charging time	Together with trip characteristics, will help characterize potential for opportunity charging; and provide estimate of level of charging needed (e.g., long charging times are not practical in some cases; fast charging is impractical in others)
PEV Demand	Vehicle type	Distinguishing between demand for PHEVs and BEVs is difficult; however, it would prove useful in the estimate of types of charging required (and cost, by association)
	Trip characteristics	Understanding where people are going and how far; a common output of travel demand models
	Home charging capability	Accessibility to a garage will help indicate the likelihood of a driver charging at home, where the vehicle spends a considerable amount of time. Increased home charging puts downward pressure on the need for public charging
Parking Characteristics	Lot types	The type of lot availability will help us understand, at a first pass at least, the range of costs for deploying EVSE.
	Ownership status	Will enable us to identify barriers associated with gaining access to some lots, targeting incentives, etc.
	Accessibility for installation	Improves cost estimate of EVSE installation; proximity to appropriate wiring/circuitry is useful, otherwise installation can be expensive

Market Segmentation

A scoring system was developed to evaluate the potential for a given catchment area to adopt electric vehicles. The scoring was based on the following criteria: income, hybrid electric vehicle ownership, property ownership, dwelling type, and household vehicles.

Income

Market research suggests that households with higher incomes are more likely to purchase an EV. A typical Focus Electric buyer has a household income $120-140k per year.[11] Because PEVs have higher upfront costs, income can also be a limiting factor. In some cases, we would filter out low income households entirely; however, for the purposes of this analysis, lower income households have simply been given a lower rating to indicate a lower probability of PEV adoption in the near-term future.

HEV Ownership

Households that value non-economic benefits are more likely to purchase PEVs. HEV owners show a willingness to pay to reduce gasoline use that goes beyond the economic benefits of using an HEV. A Ford Motors representative noted that typical Ford Focus Electric buyers have purchased HEVs in the past.[12] Research from UC-Davis supports this assumption: 68 percent of PEV owners surveyed either own or have owned an HEV and locations of HEV owners correlate with locations of PEV owners.[13]

Property Ownership

Households who own their property are more likely to adopt a PEV than those who rent, according to market research by Nissan and Chevrolet and surveys by UC Davis. Home ownership reduces both financial and non-financial barriers to EVSE deployment.

Dwelling Type

Dwelling type (e.g., single-family detached, single-family attached, or MDUs) can indicate PEV ownership. We assume that consumers with a single-family detached home generally have fewer barriers to EVSE deployment. Consumers living in MDUs are more likely to encounter barriers to EVSE deployment (e.g., limited space, HOA restrictions, installation costs for trenching, additional metering requirements, power availability).[14] There is work under way in the Region and in California to minimize the barriers to EVSE installation at MDUs; however, in the near-term, we assume that there will still be fewer barriers to EVSE installation at single-family (detached or attached) homes.

Total Household Vehicles

Based on research from the UC Davis, PEV purchasers in California tend to live in households that have purchased two new vehicles. With that in mind, we assume that households with two or more cars are more likely to purchase a PEV. Furthermore, we assume that households likely

[11] Mike Tinsky, Associate Director, Sustainability and Vehicle Environmental Matters, Vehicle Electrification and Infrastructure, Ford Motor Company. Phone interview, April 9, 2012.

[12] Mike Tinsky, Associate Director, Sustainability and Vehicle Environmental Matters, Vehicle Electrification and Infrastructure, Ford Motor Company. Phone interview, April 9, 2012.

[13] *Plug-In Vehicles in the San-Diego Region: A Spatial Analysis of the Demand for Plug-In Vehicles*. Gil Tal, Michael Nicholas, Justin Woodjack, Daniel Scrivano, Tom Turrentine. Plug-in Hybrid and Electric Vehicle Research Center of the Institute of Transportation Studies, University of California, Davis. Presented by Gil Tal, May 9, 2012 at EVS 26, Los Angeles, CA.

[14] Graham, R.L., J. Lieb, J. Sarnecki, R. Almazan, B. Neaman. 2012. Wise Investment in Electric Vehicle Charging Infrastructure through Regional Planning. EVS26 International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium.

to purchase a PEV will likely have at least one other vehicle in the household that could compensate for the range limitations of PEVs.

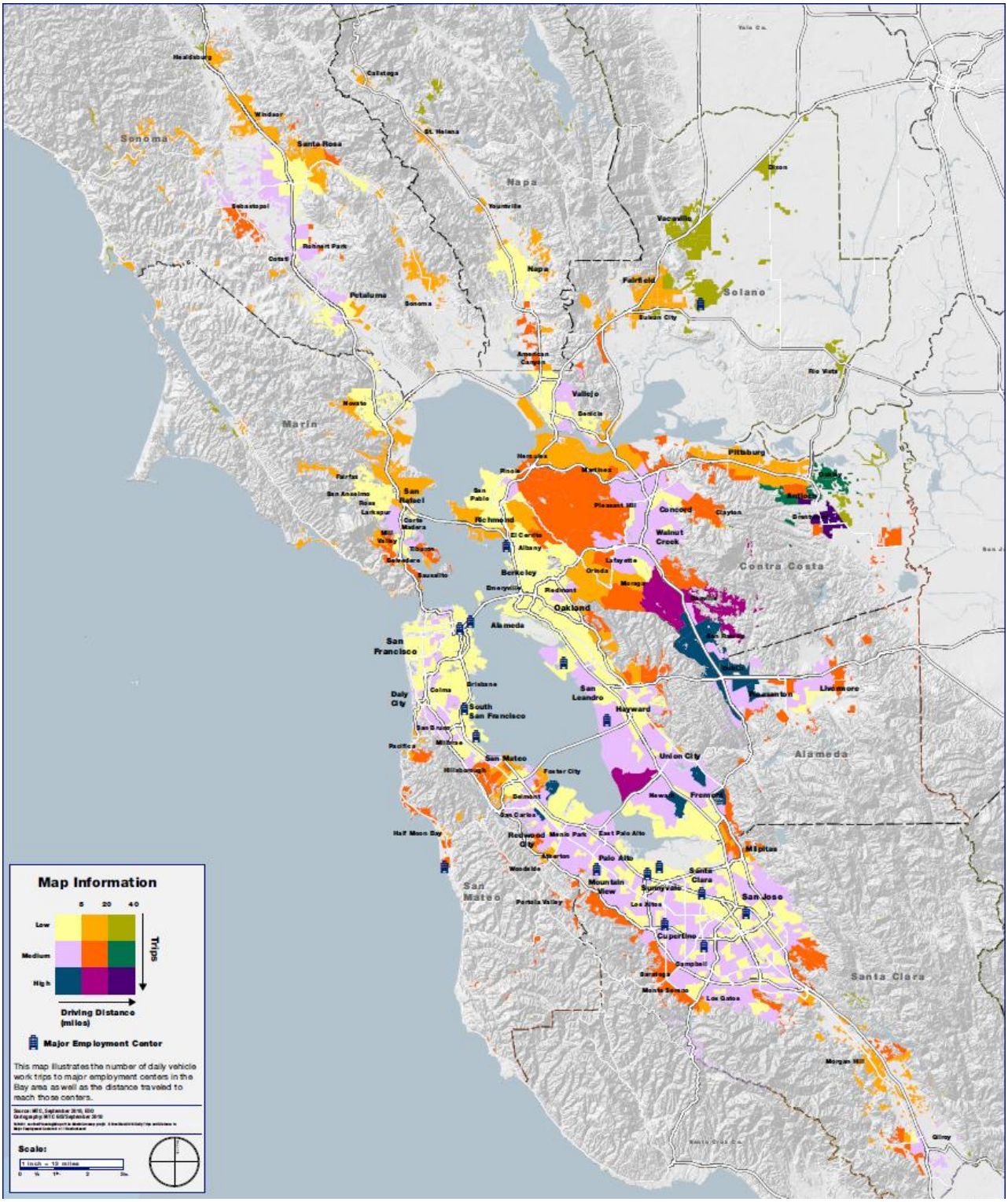
Workplace Charging

Based on market segmentation (see previous subsection), we are reviewing regional travel demand as it corresponds to the likelihood of PEV adoption. This analysis is also incorporating information from a survey conducted by BAAQMD of employers and fleets in the Region. Prioritization criteria are being developed based on information such as number of trips to an employment center and the distance traveled to that employment center. For instance, the map in Figure 8 shows various employment centers as a function of trips and distance of those trips. Workplace charging deployment will be prioritized in areas that can increase electric miles driven based on the capacity of typical PHEVs and BEVs.

Publicly Accessible Charging

We are working with MTC to consider parameters such as land use, travel demand modeling, corridor planning, links to transit trips, off-street parking availability and accessibility, and surveys of PEV drivers to identify publicly accessible charging. This section will be completed for the final version of the PEV Readiness Plan.

Figure 8. Daily Trips and Distance Traveled to Major Employment Centers



Source: MTC, GIS Unit and Research & Demographic Unit

5. Building Codes

5.1. Introduction

Agencies can adopt PEV-friendly building codes as an effective mechanism to facilitate the installation of EVSE, particularly for new construction. For instance, at the state level, the Department of Fair Housing and Community Development adopted the California Green Building Standards (CALGreen) modifications to require all new construction of single family and multi-unit dwellings to pre-install a dedicated branch circuit for Level 2 EVSE.[15]

The *Ready, Set, Charge* Document highlights two recommendations regarding the implementation of building codes. The first is related to accommodating the space requirements of EVSE and PEVs:

- Require sufficient area and electrical infrastructure for charging PEVs. Properly size all electric vehicle supply equipment, the electrical room wall, and floor area to accommodate the charging of PEVs.

In new multi-unit, commercial or industrial developments, local agencies may choose to require that the electrical room to be appropriately sized to accommodate future electrical equipment necessary for electric vehicle charging stations. As an example, Vancouver BC, Canada has adopted the following building by-law:[16]

> Part 13.2.1.1, Electrical Room: The electrical room in a multi-family building, or in the multi-family component of a mixed use building that in either case includes three or more dwelling units, must include sufficient space for the future installation of electrical equipment necessary to provide a receptacle to accommodate use by electric charging equipment for 100% of the parking stalls that are for use by owners or occupiers of the building or of the residential component of the building.

The second recommendation is focused on preparing new residential construction to accommodate PEVs in the future:

- Encourage single-family residential chargers and PEV “pre-wiring” readiness. Local agencies may wish to include basic infrastructure, such as conduits, junction boxes, wall space, electrical panel and circuitry capacity to accommodate future upgrades for solar systems and PEV charging.

For the purposes of this report, the emphasis is on PEV charging, rather than integration with solar systems. The importance of preparing new residential construction for PEV charging is that most charging will likely occur at homes at night when vehicles are parked for long periods of time and when time-of-use (TOU) rates offer favorable pricing (see Section 10 for more information on TOU rates).). Some local agencies have already adopted requirements that new

[15] Department of Housing and Community Development, “Final Express Terms for Proposed Building Standards of the Department of Housing and Community Development,” *State of California*, January 2010, http://www.hcd.ca.gov/codes/shl/ET_CALGreen_FINAL_REV%207-20-11.pdf.

[16] EV Infrastructure Requirements for Multi-Family Buildings: http://vancouver.ca/sustainability/EVcharging.htm; Bulletin available at http://vancouver.ca/commsvcs/licandinsp/bulletins/2011/2011-002.pdf

residential developments contain basic infrastructure to capture roof top solar power. Producing renewable energy during peak use periods and charging during off-peak periods is an ideal way to power PEVs.

California's Building Code and Electrical Code both contain specifications related to EVSE that local governments can adopt wholesale into their own codes. In addition, The CALGreen includes two tier levels of voluntary standards in addition to the base-level, mandatory standards that add a further set of green building measures. The voluntary Tier 1 code includes the following requirements to accommodate Level 2 EVSE:[17]

> CALGreen, Tier 1 (Voluntary), Electric vehicle charging: One-and two-family dwellings. Install a listed raceway to accommodate a dedicated branch circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure. Raceways are required to be continuous at enclosed or concealed areas and spaces. A raceway may terminate in an attic or other approved location when it can be demonstrated that the area is accessible and no removal of materials is necessary to complete the final installation.

Some cities in the Bay Area have adopted ordinances that modify the building code to require or regulate PEVs and charging infrastructure. For instance,

- The **City of Sunnyvale** adopted Ordinance 2964-11[18] in 2011 to amend Chapter 16.43 (Green Building Code) of Title 16 (Building and Construction) of the Sunnyvale Municipal Code, by requiring pre-wiring for EVSE in new construction to accommodate Level 2 charging stations in all garages or carports attached to single family residential units, and 12.5% of the total required parking spaces in residential developments with common shared parking.
- The **City of Milpitas** has also adopted detailed specifications for residential and non-residential EVSE into its building code based on the California Energy Code and on Underwriters Laboratory guidelines for charging stations.[19]

5.2. Gaps and Deficiencies

Survey Results: Review of Readiness in the Bay Area

During March – August 2012, BAAQMD conducted a comprehensive survey of Bay Area and Monterey Bay region cities and counties to assess their PEV readiness. 115 jurisdictions out of 131 responded, an 88% response rate. Of the agencies that responded to this survey, about one third (34%) indicated that they are involved in creating building codes, 41% indicated that they have not started or have only just started to look at how to adapt building code

[17] CalGreen, "California Green Building Standards Code," *California Building Standards Commission*, 2010, http://www.documents.dgs.ca.gov/bsc/calgreen/2010_ca_green_bldg.pdf
[18] City of Sunnyvale, "Ordinance No. 2964-11," accessed on April 19, 2012, http://qcode.us/codes/sunnyvale/revisions/2964-11.pdf.
[19] City of Milpitas Building Safety Department, "Electric Vehicle Charging System in Single Family Residence Plan Review and Permitting Requirements," 2011, available at: http://www.ci.milpitas.ca.gov/_pdfs/bld_electric_vehicle_charging_system.pdf, and "Commercial or Multi-Family Electric Vehicle (EV) Charging Station," 2011, available at: http://www.ci.milpitas.ca.gov/_pdfs/bld_policy_constructrion_BLG17.pdf

requirements for EVSE. Only 10% indicated that they have already adopted best practice requirements for EVSE, 19% have adopted building codes for EVSE, and only three out of the responding agencies have adopted unique building code requirements for new construction.

Table 11. Progress of Building Codes

Response	Count	Percent
Adopted best practice EVSE requirements	13	14%
In the process of adopting EVSE requirements	3	3%
Looking at other agency's EVSE requirements	17	19%
Requires further information on EVSE requirements	5	5%
Started to consider EVSE requirements	13	14%
Not started to look EVSE requirements	40	44%
Total Respondents	91	100%

31% of reporting agencies indicated that they have not yet adopted EVSE-specific requirements; however, some agencies are in the process of developing requirements via their staff (14%), in consultation with other agencies (9%), and by looking at other city or agency requirements (14%). Although more than 91% of respondents indicated that they would find best practice references and examples helpful, only 31% stated that they are willing to share their own best practice documents at this time.

5.3. Recommendations

Building codes contain detailed technical requirements for new construction. They are the appropriate place for local governments to specify the technical requirements for EVSE, as well as to require installation or pre-wiring for EVSE in new construction. This section contains two recommendations:

- Adopt standards for EVSE into the building code.
- Adopt requirements for pre-wiring EVSE into the building code.

Adopt standards for EVSE into the building code.

The first step in accommodating PEVs through local building codes is to adopt standards for EVSE into these codes. This is relatively straightforward, since in most cases, standards can be adopted from the California Building Standards Code; relevant sections are listed below. PEV-related building code standards should, at a minimum, address the following issues:

- Location of EVSE, including acceptable EVSE sites on a typical property and recommended locations of EVSE relative to vehicles and electrical panels.
- Electrical and technical standards for EVSE, including construction of equipment, wiring methods, and safety protection. Relevant standards can be found in the California Electrical Code and the Underwriters Laboratories (UL) guidance on EVSE.

- Signage and marking requirements.
- Ventilation requirements.
- Permitting and inspection requirements. This is the only building code element that is not addressed by state codes. Section 6 of this Plan discusses permitting and inspection requirements in more depth. It is important to note that these requirements may vary according to the type of building (residential or non-residential), the type of charging equipment (Level 1 or Level 2), and whether the building's existing electrical capacity is sufficient to power EVSE.

In order to make the process of complying with local building and permitting requirements easier for residents, it is recommended that local governments make available both online and in hard copy at the planning department a stand-alone guidance document that summarizes local building code and permitting requirements related to EVSE installations.

Sample standards and best practices

- Section 406.7 of the **California Building Code** includes electrical requirements, ventilation requirements, and labeling and signage requirements related to EVSE
- Article 625 of the **California Electrical Code** contains in-depth electrical requirements for EVSE, including requirements for wiring methods, equipment construction, control and protections, and locations.
- **UL Standard 2202** contains in-depth technical specifications for EVSE, including requirements for construction, injury protection, performance, ratings, and markings.

Adopt requirements for pre-wiring EVSE into the building code.

In addition to establishing specifications for EVSE, local governments should amend their building codes to require EV parking spaces. Adopting standards enables the installation of PEV parking, whereas requirements ensure that new construction will be pre-wired for EVSE.

Issues to Consider

Consistency with Minimum PEV Parking Requirements in the Zoning Code

These amendments are similar to the recommended minimum PEV parking requirements for inclusion in the zoning ordinance discussed in Section 7. They can either compliment or act as an alternative to zoning code parking requirements, depending upon the type of building to which they apply:

- For **residential properties**, the building code should be amended to require pre-wiring for EV charging stations in all single-family residences and for a certain percentage of parking spaces in multi-family buildings. These requirements should be consistent with any PEV parking requirements adopted through the zoning ordinance.
- For **non-residential properties**, existing building codes typically require that a certain proportion of parking spaces contain PEV charging stations. Zoning ordinance minimum requirements, which typically adjust the number of PEV parking spaces according to

anticipated demand at different land uses, are preferable to the uniform standards found in building codes, because they allow local governments to account for the fact that there is likely to be more demand for charging at certain locations, such as large retail centers or workplaces. However, the uniform non-residential PEV parking requirements typically found in building codes can serve as an interim measure while a jurisdiction is developing more in-depth parking requirements for inclusion in its zoning ordinance.

Sample standards and Best Practices

The **California Green Building Code (CalGREEN)** includes voluntary requirements for the number of designated PEV charging spaces at nonresidential locations. They require one PEV space for lots of up to 50 spaces, two spaces for lots of up to 200 spaces, and four spaces for lots with over 200 spaces. In order to be counted toward these requirements, spaces must be pre-wired for both Level 1 and Level 2 charging. Buildings must meet these requirements in order to achieve CALGreen Tier 1 or Tier 2.

CalGREEN also contains requirements for the number of parking spaces that area designated for fuel efficient vehicles (which includes low-emitting, fuel efficient, and carpool/van pool vehicles, as well as PEVs) and signage requirements for these spaces. Eight percent at all parking spaces at nonresidential buildings must be designated for fuel efficient vehicles, with voluntary requirements of ten and 12 percent for Tier 1 and Tier 2, respectively.

The **City of Los Angeles' Green Building Code** requires one outlet capable of accommodating a Level 2 charger in all single-family residences and townhomes, and that five percent of parking spaces in multifamily buildings contain Level 2 outlets. (§99.04.106.6)

The **City of Sunnyvale's Building Division** requires that all garages and carports attached to single-family buildings be pre-wired for Level 2 chargers, and that 12.5% of parking spaces in shared facilities at multi-family buildings be pre-wired.

Costs

Based on this analysis it appears that there are significant resources available to local jurisdictions in terms of sample building code documents. Therefore, the costs of making the investments necessary to achieve PEV readiness in the Region are principally associated with the education of local government staff and for staff time necessary to update local building codes. These costs are estimated to be in the $10,000-$20,000 range per jurisdiction. For the discussion of how to cover these costs, see implementation actions highlighted in Section 11.

Implementation Actions

The analysis above identifies key elements that need to be implemented in the Region to achieve PEV readiness for local governments in the area of building codes. In order to implement these plan elements a number of actions and strategies need to be considered. These may include policy and leadership actions, education initiatives, incentives and legislation. As these implementation actions are part of common solutions to all of the PEV readiness elements associated with this plan, the reader is encouraged to review the implementation actions in Section 11, which comprises the cost estimates for each of the

recommended actions and outlines a roadmap on how each element can be achieved using a number of different solutions.

6. Permitting and Inspection

6.1. Introduction and Overview

The installation of EVSE is a critical aspect of the PEV Ecosystem – it requires the consideration of construction, permitting, and inspection processes. The following subsections highlight the industry's approach to the installation of EVSE, outlining the key steps by participants such as consumers, electricians, permitting agencies, EVSE providers, and utilities. One of the key objectives of becoming PEV-Ready is outlining a process that expedites the installation of EVSE at various locations, while maintaining the safety of consumers and the public. This requires a permitting process with a quick turnaround time (ideally 24-48 hours), low fees (between $100 and $250), and supplementary guidance to help PEV owners through the process.

A number of California cities and counties have emerged as leaders in the field of Permitting and Inspection. At the municipal level, are readiness activities undertaken by leading government agencies that can serve as models for other cities and counties:

- The **City and County of San Francisco** has taken an active role in the deployment of EVSE, most notably through the Department of Environment.[20] They have provided information for residential installations for EVSE, including a step-by-step guide for individuals seeking to install EVSE at single family homes, public charging, and charging for business and fleets.
- The **City of Milpitas** does not require that single-family homeowners looking to install EVSE submit site plans for review prior to a building inspection. Instead, these homeowners simply schedule an inspection, during which they provide the following information to the inspector:
  - The type and UL (or other approved testing laboratory) listing of the EVSE.
  - The panel rating of the existing electrical service, the load of the existing system, and the EVSE load and circuit size.
  - Whether a second electric meter installation is required due to special electric utility rates available for EV charging.
  - The proposed location of the EV charging system.

  Milpitas has issued guidance to assist homeowners with preparing for an inspection, and this guidance includes diagrams illustrating typical configurations of EVSE in different garage types in order to assist homeowners with determining the proposed location of the charging system.[21]

[20] For more information, go to: http://sfenvironment.org/transportation/clean-fuels-vehicles/electric-vehicles-sf-electric-drive
[21] City of Milpitas, "Electric Vehicle Charging System in Single Family Residence Plan Review and Permitting Requirements," 2011, available at: http://www.ci.milpitas.ca.gov/_pdfs/bld_electric_vehicle_charging_system.pdf

- The **City of Sunnyvale** allows homeowners in single-family residential districts to obtain permits for charging stations online provided that the station will be located within a garage and can be connected to existing electrical panels. The City has also issued guidance for EV charging stations, including a permitting checklist.[22]
- In the **City of Los Angeles**, the Department of Building and Safety handles EVSE permitting. As of late 2011, the Department of Water and Power initiated a stakeholder group to discuss ways to adapt local codes and standards that encourage deployment of electric vehicles. The city also recently approved a new online application for Electric Vehicle Charger to process permits within 24 hours.[23]
- The **City of Riverside** developed installation guidelines[24] to assist homeowners and contractors in streamlining the permitting and installation process for home EVSE. The Riverside Public Utilities provides electricity to residents.

Additionally, in Region, the cities of **Gonzales** and **Morgan Hill** also offer express or over-the-counter permits for EVSE, and **Berkeley**,[25] **Los Altos**,[26] and **Sebastopol** have issued guidance on installing EV charging stations to help guide PEV owners through the permitting process. Sebastopol's guidance applies both to single-family residences and to MDUs and commercial developments.[27]

At the county level, the **County of Sonoma** has issued guidelines for the installation of EVSE in that region as part of a concerted effort to install EVSE in locations that aligns with the goals of the Climate Protection Action Plan.[28] Those guidelines highlight similar issues to the ones contained in this document and other PEV readiness planning documents, including: a review of their PEV charging station program with a siting analysis, signage, installation guidelines, the permitting process, and public outreach plans.

Residential Installations

Before the delivery of a PEV, consumers looking to install Level 2 chargers will likely seek out certified contractors (or coordinate through vehicle dealership program providers) to install EVSE at their residences and ensure the residences have adequate electrical capacity. There are a variety of permitting processes across jurisdictions; some are in-person while others are

[22] City of Sunnyvale, "Electric Vehicle Chargers: Building Division Requirements," 2012, available at: http://sunnyvale.ca.gov/Portals/0/Sunnyvale/CDD/Residential/Electrical%20Car%20Chargers.pdf

[23] Department of Building and Safety, "Application for Electrical Permit," *City of Los Angeles*, accessed on April 19, 2012, http://ladbs.org/LADBSWeb/LADBS_Forms/Permits/ElectricalFax.pdf.

[24] Building and Safety Division, "Electric Vehicle Charger Installation Guidelines," *City of Riverside*, accessed on April 19, 2012, http://www.riversideca.gov/building/pdf/handouts/EV-Charger-Guidelines.pdf.

[25] City of Berkeley, "Plug-In Electric Vehicle (PEV) Residential Charging Systems Guide," 2012, available at: http://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/PEV%20guide.pdf

[26] City of Los Altos, "Electric Vehicle (EV) Charging System for Single Family Residence," 2010, http://www.ci.los-altos.ca.us/commdev/building/documents/ELECTRICVEHICLECHARGER.pdf

[27] City of Sebastopol, "Electric Vehicle (EV) Charging System in Single Family Residence (SFR)," 2012, available at: http://ci.sebastopol.ca.us/sites/default/files/sbd/electric_vehicle_charging_system_in_single_family_residence_0.pdf, and "Commercial or Multi-family Electric Vehicle Charging Station," 2012, available at: http://ci.sebastopol.ca.us/sites/default/files/sbd/commercial_or_multi-family_electric_vehicle_ev_charging_station_0.pdf

[28] Electric Vehicle Charging Station Program and Installation Guidelines, Sonoma County, July 2011, http://www.sonoma-county.org/prmd/docs/misc/ev_prog_guidelines.pdf

via mail or online. Sometimes the PEV owner or electrical contractor must then obtain a permit for completion of work by a certified electrician. Nationally, EVSE target deployment markets have begun identifying ways to streamline the permitting process.

Multiple entities, including PG&E, a utility provider in northern California, have developed a step-by-step installation process to help new buyers of PEVs understand the requirements to charge their new vehicles. Checklists, such as the one outlined below, help residential and commercial consumers understand how to get the EVSE installation process started. The outline of the PG&E checklist is as follows:

- Contact an electrician to assess your home – the electrician can help determine if an upgrade is needed to your electrical service and what permits might be required
- Contact PG&E to start your application for a differential charging rate for your PEV – PG&E will help consumers complete their application online or over the phone. After the application is complete and the PEV delivered, the consumer must contact PG&E to make the rate change effective
- A qualified electrician will install your charging station – depending on the panel upgrade that is required, as determined by an electrician, then permits and installation are completed
- PG&E identifies service upgrade requirements and associated cost – in the case of Level 2 charging, the additional load may warrant a service or system upgrade

Multiple Dwelling Unit (MDU) Installations

Consumers living in apartment buildings and other MDUs will face more significant barriers in the process of installing EVSE. The barriers arise from questions about EVSE ownership and the potential cost implications. With regard to ownership, there are multiple considerations. In many areas across the country, consumers must first determine if a charger can even be installed, which depends on policies established by the homeowner's association (HOA) or other associations making managerial decisions for the property. HOAs and property managers will be may have additional questions regarding potential costs for the EVSE, how to manage payment for use, or how to establish dedicated compliant PEV parking spaces.

In California, the recent passage of Senate Bill 880 (SB 880, Corbett, Statues of 2012)[29] voids any policies or provisions that prohibit or restrict the installation or use of EVSE in a common interest development. Although this legislation will work to remove some of the barriers that are unique to MDUs, additional targeted outreach and education to consumers living in MDUUs, property managers and HOAs will be required in successfully support adoption of PEVS by MDU-dwelling consumers.

[29] Senate Bill 880 (Corbett), Common interest developments: electric vehicle charging stations. Available online at: http://leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_880_bill_20120229_chaptered.pdf

6.2. Gaps and Deficiencies

Guidelines Outside of Residential (Single Family-Dwelling) Charging

In the Region, there is a considerable amount of information available to stakeholders regarding the basics of residential EVSE installations at single-family dwellings. On the other hand, apart from the guidance issued by the cities of Milpitas and Sebastopol discussed above, there is limited information available regarding the construction, permitting, and inspection processes for MDUs, workplace charging, fleet and private charging, and charging at multi-use buildings.

The California Plug-In Electric Vehicle (PEV) Collaborative is a multi-stakeholder public-private partnership that collaborates on efforts to ensure a strong and enduring transition to a plug-in electric vehicle market in California. Through its member-driven process, the Collaborative members are working over the next year on developing recommendations and guidelines that will provide additional information and resources to stakeholders that wish to deploy EVSE in workplaces and in MDUs.

Speed and Coordination

The emphasis on streamlined permitting and coordination has been well placed; however, it will be important for agencies to understand what the processes and steps are needed to streamline the process for construction, permitting, and inspection. A key challenge here will be identifying ways to streamline these processes while considering the significant resource constraints under which local and regional agencies are operating.

Survey Results: Review of Readiness in the Bay Area and Monterey Bay Region[30]

In a survey of Bay Area jurisdictions, including cities, counties, and regional government, there were 113 responses (see Table 12 below). Of those respondents, about 40% of the jurisdictions are in the initial stages of looking into or adopting EVSE permitting and inspection requirements, while 18% have already adopted requirements and a third have not started looking into requirements. To date, only two jurisdictions (<2%) require a unique PEV infrastructure permit. However, 50% of jurisdictions responding require an additional permit to trench, cut, or replace concrete and 48% require a permit for ADA compliance.

[30] Note that the survey results presented in this document are preliminary and are in draft form. The results presented will be modified in subsequent documents to reflect additional analysis and additional responses received from participants.

Table 12. Progress of Permitting and Inspection in the Bay Area

Response	Count	Percent
Adopted best practice EVSE requirements	20	16%
In the process of adopting EVSE requirements	8	6%
Started to consider EVSE requirements	19	15%
Looking at other agency's EVSE requirements	20	16%
Requires further information on EVSE requirements	9	7%
Not started to look EVSE requirements	37	29%
Total Permitting & Inspection Respondents	113	

In terms of the permitting process, many of the jurisdictions do not offer a streamlined online process. Only 9% of jurisdictions responding provide online permitting applications. The most common way to provide permits is over-the-counter (78%), while 28% provide permits through a mail-in application. The primary way applicants can check the status of their applications is over the phone (77%), but some jurisdictions do provide updates online (25%) and by mail (23%). The permit application requirements vary greatly by jurisdiction. Most jurisdictions require plans/blueprints (70%) and load calculations (55%), while some also require the applicant to notify the utility (31%). Once the EVSE has been installed, applicants can request an inspection over the phone in 76% of the jurisdictions and in person in 50% of the jurisdictions. Only 16% of the jurisdictions offer inspection requests online. The typical response to an inspection request is 2-5 days (71%), but a significant percentage (29%) of jurisdictions do offer same day inspections.

A third of the responding jurisdictions have not developed requirements for EVSE and 77% do not have an EVSE-specific inspector checklist. However, many jurisdictions are in the process of developing requirements via their staff (19%), in consultation with other agencies (17%), and by looking at other city or agency requirements (14%). The vast majority of jurisdictions responding (89%) would find permitting and inspection best practice references and examples helpful, but only 45% are willing to share their own best practice documents.

The type of, cost of, and time to issue the permits depends on the category of the permit – which are distinguished here as single family permits, commercial permits, parking lot permits, and on-street parking permits:

- For single family permits, 28% of the responding jurisdictions' permits cost less than $100, 52% cost $101-$250, and 16% cost $251-$500, with 3 agencies reporting a cost greater than $500. The time to issue single family permits is generally the same day (53%) with less than 21 jurisdictions (21%) taking 2-5 days. The majority (52%) of the permits required are electrical with some jurisdictions requiring both an electrical and building permit (36%). A single post-inspection is the most common requirement among jurisdictions (43%), but 29% required an intermediate and post-inspection and 21% require a pre- and post-inspection.
- For commercial permits, 16% of the jurisdictions' permits cost less than $100, 38% cost $101-$250, and 38% cost $251-$500, and 9% cost more than $500. The time to issue

commercial permits is generally 2-5 days (33%) with 26% of jurisdictions issuing same day permits and a similar percent (23%) of jurisdictions taking 6-10 days. About the same number of jurisdictions require an electrical permit (39%) as those that require both an electrical and building permit (44%). An intermediate and post-inspection is the most common requirement among jurisdictions (37%), while 30% require a single post-inspection, and 24% require a pre- and post-inspection. A handful of jurisdictions require more than one pre-inspection (7%) and 2 agencies report requiring a plan check only.

- For parking lot permits, 16% of the jurisdiction permits cost less than $100, 37% cost $101-$250, and 36% cost $251-$500, and 10% report a cost of more than $500. The time to issue parking lot permits is a mix of same day permitting (24%), 2-5 days (31%), and 30% of permits take 6-10 days to be issued. The majority (70%) of the jurisdictions report either requiring only an electrical permit (38%) or both an electrical and building permit (42%). An intermediate and post-inspection is the most common requirement among jurisdictions (24%), while 26% require a single post-inspection and 29% required a pre- and post-inspection.
- For on-street parking permits, 13% of the jurisdiction permits cost less than $100, 48% cost $101-$250, and 30% cost $251-$500, and 9% cost more than $500. The time to issue on-street parking permits varies widely from same day (23%) to 2-5 days (32%) to 6-10 days (29%), but only 14% take 3-5 weeks. The majority (41%) of jurisdictions require electrical permits with some jurisdictions requiring both an electrical and building permit (32%) and a smaller percentage (21%) requiring planning entitlement. The inspection requirements for on-street parking permits among jurisdictions varied between a single post-inspection requirement (22%), an intermediate and post-inspection (38%), and a pre- and post-inspection (29%).

Table 13. Estimated Fees for Various EVSE Permits

Permit fee	Residential		Commercial / MDU		Open parking lot		On-street parking	
<$100	26	28%	14	16%	14	16%	9	13%
$101-$250	48	52%	33	38%	32	37%	33	48%
$251-$500	15	16%	33	38%	31	36%	21	30%
$501+	3	3%	8	9%	9	10%	6	9%
total	92		88		86		69	

Table 14. Time to Issue Permits for EVSE

Time	Residential		Commercial / MDU		Open parking lot		On-street parking	
Same day	53	53%	25	26%	23	24%	18	23%
2-5 days	21	21%	32	33%	29	31%	25	32%
6-10 days	18	18%	22	23%	28	30%	23	29%
3-5 weeks	8	8%	15	16%	12	13%	11	14%
>5 weeks	0	0%	2	2%	2	2%	2	3%
Total Respondents	100		96		94		79	

Table 15. Inspections Required for EVSE Installations

Time	Residential		Commercial / MDU		Open parking lot		On-street parking	
Intermediate & post-inspection	28	29%	34	37%	31	34%	30	38%
More than 1 pre-inspection	4	4%	6	7%	8	9%	7	9%
Plan check only	2	2%	2	2%	2	2%	1	1%
Post-inspection	41	43%	28	30%	23	26%	17	22%
Pre- & post-inspection	20	21%	22	24%	26	29%	23	29%
Total	95		92		90		78	

6.3. Recommendations

In order to streamline EVSE installations, the DOE and BAAQMD recommend that local governments consider the feasibility of issuing permits within 24 to 48 hours. In a survey of local governments in the Region, many agencies report that they are either meeting or exceeding this guidance, at least with respect to single-family residences. According to the survey results in Section 6.2, 53 percent of local governments in the Bay Area issue same-day permits for EVSE in single-family residences, and 80 percent charge under $250 for these permits. The speed with which local governments issue permits can have an even greater effect on installation costs than the fees that they charge. A same-day permit means that electrical contractors do not pass on the travel costs associated with multiple visits to the permitting office to PEV owners.

As local governments expedite the permitting process for PEV charging stations, they must balance convenience with quality control. These can be competing objectives. Making permits available over the counter or online, minimizing the amount of information that applicants must provide, and reducing fees keep installation costs low and serve as a signal to perspective PEV owners and contractors that a city is PEV ready. However, EV charging stations, particularly Level 2 chargers, consume more electricity than other residential appliances—often as much as all other uses in the house combined—and require careful attention to safety and potential grid impacts, which can drive up the costs and time associated with permitting.

The recommendations in this section are focused on helping local governments balance these competing objectives, and removing barriers to installing EVSE without sacrificing safety and quality control.

Staff the permitting counter with electrical permitting experts

In order for a local government to institute over-the-counter or another form of express permitting, it should have sufficient staff at the counter to process permits quickly. In addition, the staff working the permit counter should be adequately familiar with the technical aspects of EVSE to evaluate applications with minimum delay before issuing permits. This may require a change in permitting practices, since many local governments staff the counter with employees who are focused on helping applicants navigate the permitting *process* in general, not with their technical staff.

This recommendation is particularly important for local governments looking to minimize grid impacts. Whereas most appliances and motors consume electricity intermittently, while in use, EVSE consumes electricity continuously, which means that clustering from multiple charging events on the same transmission lines can overload the grid. In order to avoid overloading the grid, local governments should require that EVSE permit applications, particularly applications for Level 2 permits, contain load calculations. Expert permitting staff is needed to verify applicants' load calculations so that local governments can pass accurate information on to utility service providers that will enable utilities to analyze the strain that new EVSE will place on electricity infrastructure.

Obviously due to many competing priorities and the financial strain that many local jurisdictions are experiencing the implementation of the latter recommendation may be extremely difficult, especially in the near term. A range of alternatives are offered below as strategies to help local jurisdictions meet this challenge.

Alternatives

Expedite permitting for Level 1 chargers in single-family residences only

If local governments are too constrained to staff permitting counters with expert staff that can both turn around permits quickly while ensuring quality control, they should consider limiting eligibility for express permitting to Level 1 charging stations in single family residences. Since Level 1 EVSE can be plugged in to an existing dedicated wall outlet, it often does not require upgrades to electrical service, just an upgrade to a dedicated circuit. Level 1 EVSE is less likely to create negative impacts on the grid because it consumes electricity at a lower rate, and because longer charge times make it more likely to be used at night, when overall electricity usage is low. This will still streamline permitting for the EVSE that local governments are most likely to see immediate demand for, and concentrate staff time on Level 2 chargers or chargers in multi-family and commercial buildings, which are most likely to require additional attention due to high levels of electricity demand and more complex site design issues.

Limit expedited permitting to certified contractors

Another alternative is for local governments to consider limiting expedited permitting for EVSE installations to electrical contractors that have been certified by the Electric Vehicle Infrastructure Training Program (EVITP) or a similar educational program, and requiring that these electrical contractors install EVSE to the standards of the program. This can be either an alternative or a complimentary measure to moving technical staff to the counter. Local governments that have sufficient technical staff at the counter to process permits both quickly and thoroughly can further streamline the permitting process for certified electrical contractors by reducing fees or forgoing required plan review for EVSE at certain building types. This would also create an incentive for more Bay Area electrical contractors to get certified in EVSE installation. It would also encourage PEV owners to hire certified electrical contractors, which help avoid damage to electrical systems caused by homeowner self-installations.

Costs

The annual salary for an electrical permitting specialist can be up to $20,000 more than for an entry-level permit technician, and it can be correspondingly expensive for local governments to station specialists at the permitting counter since this level of technical expertise may not be necessary for addressing the majority of questions that come to the counter. However, this is the preferred approach since it allows local governments to respond quickly to the many technical issues that may arise as PEV owners seek to install charging stations at an increasing number and variety of locations. It is important to note that this approach can also save agencies money from responding to any safety issues or power outages that result from improperly installed or poorly planned EVSE in the long term.

The two alternative approaches, limiting expedited permitting to Level 1 EVSE and requiring certified electrical contractors to pull permits for EVSE, can be implemented at no cost.

Train permitting and inspection officials in EVSE installation

Local governments that anticipate significant EVSE installations should consider having electrical inspection officials be certified in EV installation through the Electric Vehicle Infrastructure Training Program (EVITP) or a similar educational program. The EVITP is a 32-hour course that trains and certifies electricians throughout the United States to install EVSE. It is recommended that any staff EVSE training include hands-on installation, instruction in relevant electric codes, and load calculation testing. EVITP courses cover a wide array of key topics in EVSE installation, including:

- EV battery types, specifications, and charging characteristics
- National code requirements for EVSE
- Utility interconnect, notification, policies and requirements, and grid stress precautions.
- Brand- and model-specific installation instructions for Level 1 and 2 charging stations.
- Service-level site assessments, load calculations, and upgrade implementation

For more information on the EVITP and other training programs, see Section 8.

Costs

An EVITP course typically costs between $800 and $1,450 to cover time and travel for volunteer instructors. Local governments can split these costs among a number of jurisdictions by organizing courses through organizations such as the ICC or a sub-regional Clean Cities Council. Assuming that a course has 15 attendees, fees will be no more than $100 per attendee. This means that the total cost of sending a single staff member to be certified would be under $1,000, which accounts both for fees and three days of staff time to attend the course.

Work with local utilities to create a notification protocol for new EVSE through the permitting process

Requiring load calculations in the permitting process can help local governments and their utility service provider partners estimate the collective impacts of new EVSE on the electric grid. Only utilities have the ability to address these potential impacts, and in order to address them they need information on the number and type of installations.

All EVSE installation guidelines recommend that homeowners notify their utility service provider of new installations. Pacific Gas & Electric (PG&E), which provides electricity for most of the Region, recommends that PEV owners notify the utility before installing EVSE, and has created a voluntary protocol for doing so. These are important first steps, but recommendations voluntary protocols do not guarantee that utilities will have the information they need to address grid impacts from new EVSE. If local governments take a more active role in notifying utilities about new EVSE installations, it will result in more thorough reporting since local governments will have information on all permitted EVSE installations within their jurisdictions. It would also likely result in more accurate reporting, because technical specialists rather than PEV owners would be responsible for notifying utilities.

However, most utility service provides are for-profit corporations and regulations prevent local governments from providing residents' information to for-profit corporations. Also, many local governments currently do not have established channels of communication with local utility service providers. In order to create a notification protocol for new EVSE through the permitting process, local governments will need to engage their utility service providers in a conversation about local permitting processes and utility service provider notification needs.

Issues to Consider

Municipally-owned utilities

Several local governments in the Bay Area operate municipally-owned utilities, or MOUs. It should be significantly easier the permitting department and the utility to collaborate in these jurisdictions, since both are part of the same organization. Local governments in areas with MOUs should therefore take the lead in establishing a notification protocol for EVSE installations through the permitting process. These protocols can serve as a model for other local governments that must coordinate with PG&E or other investor-owned utilities.

Alternatives

Conduct outreach encouraging contractors to notify utilities of new EVSE installations

Local governments that are unable to establish EVSE notification protocols through the permitting process because of financial, regulatory, or other barriers can instead consider working to encourage electrical contractors and vehicle dealers to explain the utility notification protocols to customers when installing EVSE and during the vehicle purchasing process. Training programs for electrical contractors, such as the EVITP, provide extensive customer relations training on utility notification processes.

Costs

Any EVSE utility notification program established by a local government should involve only nominal labor for local permitting staff in order to keep ongoing costs at a minimum. The upfront costs of establishing such a program is estimated at $5,000 to cover local staff time to meet with utility representatives and monitor, evaluate, and improve the program in its initial phases. Ideally investor-owned utilities should at least partially cover program costs.

Guidance and Best Practices

- No local governments in the Bay Area have yet established a notification protocol with local utilities, but PG&E's notification protocol for PEV owners can serve as a potential model for local efforts.
  http://www.pge.com/mybusiness/environment/whatyoucando/electricdrivevehicles/contactpge/

Create a permitting checklist for residents and contractors

Regardless of what information local governments choose to require in EVSE permit applications, it is a best practice to combine requirements and guidance into a single document that can guide PEV owners through the process. This document should contain information on EVSE permit application requirements, the number and type (e.g. pre-installation, post-installation) of inspections required, and applicable codes and guidance regarding EVSE installation.

Issues to Consider

Required information in permit applications

At a minimum, local governments should require that applicants for PEV charging station permits provide the following information:

- The EVSE manufacturer's name and the level of EVSE that will be installed (e.g. Level 1, Level 2).
- Existing electrical service at the premises and a load calculation of demand at the premises.
- Whether the EVSE will require upgrades to the building's electrical system.
- Whether the EVSE will include installation of a second meter, if allowed by the local utility.

- A certification from a nationally approved testing laboratory for the EVSE in accordance with the National Electric Code.

In order to verify the safety of the system, local governments may wish to require additional information during the application process, including a site assessment, a site plan showing the location of EVSE relative to vehicle parking and to electrical panels, or an electrical plan., .

Addressing different land uses and charging equipment

Permitting requirements, and hence the elements included in the permitting checklist, may differ according to the land use and the type of EVSE being installed. Permitting checklists should be designed to accommodate these variations and provide guidance to all PEV owners. Permitting requirements are likely to differ between single-family residences and multi-family residences or commercial locations since the latter are likely to involve more complicated electrical permits and potentially a greater number of EVSE. A relatively large number of local governments have created permitting checklists for single-family residential properties, but not as many have created checklists for multi-family residential or commercial properties. Though this may be in part because owners of these properties are more likely to hire electrical contractors rather than attempting to self-install, checklists can still help PEV owners understand the steps to EVSE installation. Below are examples of local governments that have addressed both types of properties below to assist others in developing requirements and checklists for multi-family residential and commercial properties.

Requirements will also vary by the type of charging equipment being installed. Level 1 EVSE will typically not require any upgrades to electrical service, whereas a Level 2 charger at a single-family residence may require a service upgrade. Though permitting and inspection will need to be more thorough for Level 2 EVSE, many PEV owners will be interested in charging vehicles more quickly, and clear guidance regarding Level 2 permitting requirements can help to ensure that the permitting process does not act as a deterrent to PEV owners.

Costs

Compiling the permitting checklist itself is likely to involve minimal effort for local governments. However, it may require a slight amount of staff time to research best practice permitting requirements and to coordinate between different departments to adopt these requirements. Total costs to local governments are estimated to be up to $2,000 per agency.

Guidance and Best Practices

Several professional organizations and local governments have created guidance that local governments can draw upon when creating permitting checklists:

- The **City of Milpitas** does not require plan review for Level 1 or 2 residential PEV charging stations. Instead, homeowners apply for permits over the counter or online and schedule an inspection, during which they provide the following information to the inspector:
    - The type, Underwriters' Laboratory (UL) listing, load, and circuit size of the EVSE.
    - The panel rating of the existing electrical service.

  - Whether the system requires a second electric meter.
  - The proposed location of the EVSE.

- Milpitas has issued a two-page document to walk homeowners through the permitting process, which includes diagrams illustrating typical configurations of EVSE in different garage types. (http://www.ci.milpitas.ca.gov/_pdfs/bld_electric_vehicle_charging_system.pdf)
- The **City of Sunnyvale** allows homeowners in single-family residential districts to obtain permits for charging stations online without submitting plans for review provided that the station will be located within a garage and can be connected to existing electrical panels. Charging stations require at least one follow-up inspection. Sunnyvale has also issued guidance for EV charging stations, including a permitting checklist. (City of Sunnyvale (2012). "Electric Vehicle Chargers: Building Division Requirements." http://sunnyvale.ca.gov/Portals/0/Sunnyvale/CDD/Residential/Electrical%20Car%20Chargers.pdf)
- The **South Bay Tri-Chapter Uniform Code Committee (TUCC)** has created a permitting guideline for EV charging stations in single-family residences that specifies the information required for permit applications and includes installation diagrams. (http://www.eastbayicc.org/pages/TUCCPolicy/TUCC%20policy%2017%20-%20EV%20SFR%20revised%2004-14-11.doc)
- The **City of Sebastopol** has adopted the TUCC guideline for single-family residential charging stations and issued separate guidance for multi-family residential and commercial buildings. The latter require applicants to submit a site plan, electrical plans, and load calculations, and include recommended signage and design guidelines for both conventional and ADA-accessible charging stations. (http://ci.sebastopol.ca.us/sites/default/files/sbd/electric_vehicle_charging_system_in_single_family_residence_0.pdf and http://ci.sebastopol.ca.us/sites/default/files/sbd/commercial_or_multi-family_electric_vehicle_ev_charging_station_0.pdf)
- The **City of Los Altos** has issued a list of permitting requirements for PEV charging stations in single-family buildings. The City requires applicants to submit information on the type and UL listing of the charging station, the existing electrical panel capacity, the location of the charging station, and whether a second meter is required. The City also requires bollards in areas subject to vehicular damage. (http://www.ci.los-altos.ca.us/commdev/building/documents/ELECTRICVEHICLECHARGER.pdf)

Create Cross Jurisdictional Opportunities for Sharing Lessons Learned

Based on the results of the survey conducted by BAAQMD, it appears that many jurisdictions are ready to deal with or have already dealt with numerous diverse and complex PEV infrastructure permitting issues. While there are existing forums such as those provided throughout the Region by the Tri-Chapter Uniform Code Committee, additional engagement may be necessary between planning and building departments to disseminate lessons learned. This engagement may be possible through coordinating committees at the county level throughout the Region, via ABAG or through other special training and coordinating meetings set up by entities such as the Clean Cities Coalitions. As part of these meetings, it will be important for permitting "experts" from local jurisdictions to share and offer solutions to common

PEV problems and make recommendations with regarding adjustments to local permitting practices based on their experience of what works. These efforts can be supported by guidelines documents that are available via the BAAQMD, ABAG and the PEV Collaborative.

6.4. Implementation Actions

The analysis above identifies key elements that need to be implemented in the region to achieve PEV readiness for local governments in the area of permitting. A number of actions and strategies need to be considered in order to help local governments accomplish these key goals. These may include policy and leadership actions, education initiatives, incentives and legislation. As these implementation actions are part of common solutions to all of the PEV readiness elements associated with this plan, Section 11 of this document focuses on implementation actions, which contains cost estimates for each of the recommended actions and outlines a roadmap on how each element can be achieved using a number of different solutions.

7. Zoning, Parking Rules, and Local Ordinances

7.1. Introduction

The widespread deployment of PEVs presents an opportunity for electric utilities to increase asset utilization through increased electricity use, and has the potential to reduce electricity rates. One of the primary concerns associated with PEV deployment is the potential negative impact from the increased load on the local electric grid. The degree of the impact depends on parameters such as PEV penetration rates, the current condition of local distribution infrastructure, and strategies used by the local utility to manage additional load. Utilities across the country have implemented a wide variety of pilot projects and assessments to better understand consumer usage patterns and how certain management tools, such as smart meters, may mitigate impacts on the grid. Through the use of tariff structures and incentives, utilities are actively seeking solutions to shift PEV charging to periods of lower electrical demand, such as off-peak hours.

Zoning

Zoning code provisions can encourage appropriate placement of electric vehicle supply equipment (EVSE) in various land-use designations. Zoning code provisions also include requirements regarding purpose, definitions, allowed uses, design and installation criteria, signage, accessibility, quantity, lighting and maintenance.

Local agencies should specify where EVSE is allowed as an outright permitted use, or as an accessory to an outright permitted use, and if applicable, specify which EVSE (Level 1 or Level 2, DC fast charge, and Battery Switch) apply. Suggestions for these criteria are located in the *Ready, Set, Charge* document[31] and PEVC statewide guidelines. Local agencies can also encourage, require, or incentivize EVSE installation through the parking requirements and other provisions within their zoning code.

Parking requirements for PEVs

Local governments routinely specify the amount of parking required for different land uses, often in the form of the minimum amount of parking spaces per dwelling unit or per employee. Communities seeking to accelerate PEV deployment may wish to consider implementing minimum requirements for PEV parking and charging stations.

PEV adoption is still in its infancy, so available data are scarce with respect to the number of EV charging stations that should be required for a specific development. Ordinances should strive for a balance that achieves an appropriate amount of incentive for PEV use, but do not burden a developer or property owner with onerous, unjustified EVSE requirements. Agencies should consider adopting an ordinance similar to that offered by the City of Mountlake Terrace, Washington[32] or an ordinance which incorporates the guidance provided by the California Green

[31] *Ready Set Charge California, A Guide to EV-Ready Communities,* November 2011, Section 3.2, available online at www.readysetcharge.org
[32] *Ibid.,* Section 3.2.2., Page 20, Table C

Building Standards Code (CALGreen), Section A5.106.5.3 Electric Vehicle Charging (page 90, voluntary measures). Sample PEV parking requirements from the City of Mountlake Terrace[33] are shown in Table 16, and Section 7.3 contains sample requirements developed for the Bay Area based on the projected level of PEV demand.

Table 16. Sample requirement for PEV Charging

Land Use Type	Percent dedicated to PEV parking/charging
Multi-Family residential	10%
Lodging	3%
Retail, restaurant	1%
Office, medical	3%
Industrial	1%
Institutional, Municipal	3%
Recreational, Entertainment, Cultural	1%

These requirements should be considered as a starting point for new developments of a certain size, or expansions (over a certain percentage) of existing facilities. The requirements should allow for an exemption if the applicant can provide reasonable evidence that the PEV parking and charging exists in the vicinity that can be used to reduce these requirements. As an option, ordinances can be amended to require installation of certain infrastructure (e.g. conduit, wiring, junction boxes, electrical panels and circuitry) to serve this level of PEV charging, but only provide a lesser actual number of charging stations. The cost of installing EVSE with pre-existing wiring is one third the cost of having to add wiring during installation. This would significantly lower the costs of installing more chargers to meet increased demand in the future.

Counting PEV parking toward parking requirements

Local governments with minimum parking requirements in place may also wish to consider whether PEV parking should count toward overall parking requirements. Allowing PEV parking to count toward parking requirements would allow developers to provide PEV parking without increasing the total number of spaces required.

Zoning incentives

Local governments routinely offer developers the opportunity to develop more intensively than zoning codes typically allow in exchange for a contribution to environmental mitigation or public facilities. Instead of requiring dedicated PEV parking, local governments can use this tactic to create incentives for developers to provide PEV parking by allowing more intensive development in exchange for providing PEV spaces.

The City of San Carlos has amended its zoning code in order to create incentives for developers to provide charging stations in mixed use areas. Section 18.05.030.A of the San Carlos Municipal Code allows developers to exceed the maximum allowable floor area ratio by 10% if

[33] *Ibid*., Table B, Section 3.2.1

they provide additional environmental design features on-site or contribute to off-site improvements at open spaces or public facilities. The code lists "electric car facilities" as one of the on-site features that developers can include in order to qualify for this exemption.[34]

Design Criteria

PEV parking and charging spaces should be the same size as standard parking spaces or accessible parking spaces, whichever is applicable. Lighting should comply with local codes at a minimum. Where no local codes apply, criteria should be specified to provide enough lighting to provide visibility of cables, charging equipment and vehicle charging points.

Parking Rules

Parking rules for PEV charging stations should address minimum parking requirements, accessibility, time restrictions, parking supply, location, and preferential parking programs. The PEV Collaborative[35] suggests that a distinction be made between PEV *charging* and PEV *parking*. PEV parking should be defined as parking that is preferentially provided to users of PEVs (whether or not charging is provided) while a PEV charging site provides the location where EVSE is available for the purpose of charging the PEV.

Accessibility

PEV charging and PEV parking are different services and should have different accessibility requirements. Accessibility is addressed here for three scenarios: where PEV parking is provided, where PEV charging is provided, and where both are provided and co-located.

PEV parking should meet the accessibility requirements as parking for other vehicles. Newly constructed facilities and existing facilities that undergo alteration must meet accessibility requirements as found in the Americans with Disabilities Act (ADA) Accessibility Guidelines, the California Building Code, and the California Department of General Services.

Regarding PEV charging, this plan adopts the general recommendations of the PEV Collaborative[36], which address accessibility of EVSE charging device itself, as well as the path of travel from the vehicle to the EVSE. Recommendations are provided by the PEV Collaborative for new construction as well as for installation of accessible EVSE in existing facilities, including on- and off-street.

Where PEV parking and charging are co-located, the rules for PEV charging (as noted above) would apply.

[34] City of San Carlos, City of San Carlos Municipal Code, Development Standards for Mixed-Use Districts, Section 18.05.030.A, revised April 2012, available at http://www.codepublishing.com/CA/sancarlos/

[35] *Accessibility and Signage for Plug-In Electric Vehicle Charging Infrastructure*, PEV Collaborative, May 2012, available online at http://www.evcollaborative.org/sites/all/themes/pev/files/AccessibilityReport-4%2726%20final.pdf

[36] *Ibid*, *p.13.*

Time Restrictions

PEV parking and charging should be subject to similar time restrictions as parking for other vehicles in the same area, whether on or off-street[37]. However, PEV charging should generally be subject to time limits of no less than two hours. If PEV charging can only be provided where existing parking is time-restricted to less than two hours, then the restriction on the PEV charging space(s) should be modified to a two-hour restriction.

Figure 9. Example of Sign Displaying Time Restriction on PEV Charging

Location

The location of PEV parking and charging should take into consideration the following, in order of decreasing importance:

- **Accessibility**: If PEV charging/parking needs to be accessible then the location will be dictated by accessibility requirements.
- **Convenience, visibility and safety**: PEV parking and charging should be located such that is easy to locate and convenient and safe to access. To incentivize PEV use, agencies should consider locating PEV parking in a more convenient (i.e., closer to destinations, garage exits and elevators, on lower floors of garages, etc.) location relative to parking for other vehicles.
- **Cost**: PEV charging supply infrastructure (i.e., conduit and wiring) will cost more the farther it is away from the point of connection to the utility service. PEV charging should be located as close to that point of connection as possible.

Preferential Parking Programs

As a means to incentivize adoption of PEVs by the public, preferential parking programs should be considered. Parking location-based incentives are discussed above. Cost-based incentives can also be considered. Examples include the following:

- **City of San Jose, Clean Air Vehicle Parking Program**: A temporary incentive that provides free parking for qualifying vehicles in city-owned garages, parks, and downtown.
- **Preferred Parking:** San Francisco International Airport (SFO) and Oakland International Airport (OAK) offer preferred or priority parking for PEVs. The charging is currently free for users. The facility has both Level 1 and Level 2 chargers, installed as part of the ChargePoint America program.

[37] A relaxation of existing time restrictions can be considered to incentivize PEV use but this should be considered as a short-term measure.

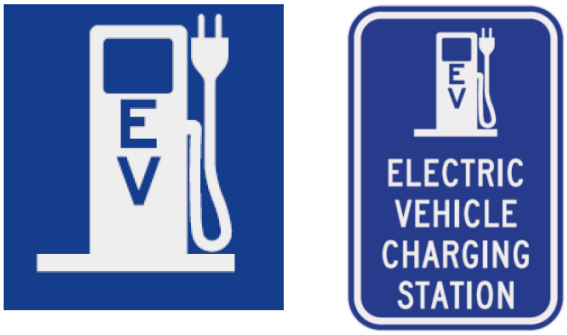
Signage and Enforcement Considerations

Signage is needed to help PEV users locate and identify charging stations, and to provide direction regarding how the PEV charging station is to be used. Local authorities have had the flexibility to develop publicly-accessible EVSE signage independently to suit the needs of the community; however, local authorities generally attempt to align signage with the Manual on Uniform Traffic Control Devices (MUTCD) in the Code of Federal Regulations. For public charging purposes, local authorities must implement general service and regulatory signage according to the California MUTCD. Anecdotal evidence from EVSE deployments indicates that in some instances the signage employed by local authorities has created confusion, particularly in areas where the public did not understand the nature of a PEV parking stall, or did not understand the need to maintain accessibility for PEVs and misidentified the designated spots as disabled access parking.[38] The early PEV deployment and EVSE deployment efforts nationwide, such as The EV Project, have encountered difficulty with regard to signage.

For that reason, this report takes the position that signs placed in the public right-of-way for the purposes of guiding PEV users to charging stations and regulating their use are considered traffic control devices and must (signs in the private right-of-way should as well) conform to the Manual on Uniform Traffic Control Devices (MUTCD) in the Code of Federal Regulations (CFR).

The PEV Collaborative in May 2012 released a document that offers guidance on signage based on the input of several stakeholders, and on their experience with PEV installations to-date.[39] This document, as does the PEV Collaborative, supports the use of standardized signs to minimize confusion and provide the greatest convenience to PEV users. This includes standardized signs that have interim approval from FHWA, and signs that are not currently approved but have been submitted for approval and are currently being tested in Oregon and Washington.

Figure 10. FHWA-approved PEV General Service Symbol and Sample Parking Sign[40]



The issues related to accessibility and parking enforcement discussed elsewhere in this section may require additional signage at parking spaces. It is important to keep this signage simple and clear in order to provide clear signals to drivers.

[38] The EV Project, "Lessons Learned – The EV Project EVSE Signage," *ECOtality*, April 2012.
[39] *Accessibility and Signage for Plug-In Electric Vehicle Charging Infrastructure*, PEV Collaborative, May 2012, p.30
[40] Ibid.

Enforcement

In order for regulatory signs to be enforceable, they must be supported by local ordinances that specify time limits, penalties, definitions, etc. Definitions of terms are key to identifying precisely who can park and charge at PEV charging stations. Suggested definitions can be found in the California Building Code, as well as in guidance offered by the PEV Collaborative[41] and by ABAG and others[42].

AB 475, passed in October 2011, requires that a PEV charging spot be properly identified with signage, and allows for the owner of the space to remove illegally parked vehicles (in accordance with the law). The CVC also allows the owner of a space to remove a vehicle if it occupies a space in violation of posted regulations, after appropriate notification to the vehicle owner and to local law enforcement.

Marin County recently adopted a series of amendments to its county code focused on electric vehicle parking that address several of the issues discussed above. The code now includes an electric vehicle charging station parking stall designation and states, "It shall be unlawful to park in a designated electric vehicle charging station parking stall unless the vehicle is a charging electric vehicle." The amendments also allow the Board of Supervisors to levy fees on PEV owners who use public charging stations.[43]

It is recommended that local governments and property owners implement signage recommendations identified in the previous section, and as a parallel action, work to modify municipal codes as necessary to make the signage enforceable, and to ensure that the ordinances are understood by those responsible for enforcement.

7.2. Gaps and Deficiencies

As PEV adoption continues, issues will continue to present themselves and these recommendations will need to be considered for amendments. The recommendations in Section 7.3 are an attempt to ensure that enough PEV charging is provided to incentivize PEV use but to avoid significant oversupplies of EVSE.

Implement parking requirements

One obvious example is the requirement for a certain number of PEV charging stations for new construction and for expansion of existing construction. Many jurisdictions have adopted parking requirements for various land uses. Because PEV use is in its infancy, there is little data on how much PEV parking and charging need to be provided, however, some initial guidance is provided by Section 7.3 of this document, as well as the California Green Building Code, *Ready, Set, Charge!* and the PEVC, which local governments can use as initial guidance for local jurisdictions. It is likely, however, that as the number of PEV increases over time that these guidelines will need to be amended and new standards be developed and implemented.

[41] *Accessibility and Signage for Plug-In Electric Vehicle Charging Infrastructure*, PEV Collaborative, May 2012, p.35
[42] *Ready Set Charge California, A Guide to EV-Ready Communities,* November 2011, Section 3.1, available online at www.readysetcharge.org
[43] County of Marin, Ordinance No. 3572. November 15, 2011, available online at http://www.co.marin.ca.us/depts/BS/Main/BOSagmn/ordinances/ord-3572.doc

Signage, zoning, and accessibility requirements

It is also likely that signage and zoning requirements will be revisited once agencies begin to enforce new parking rules for publically-available EVSE. Examples of potential issues include the following:

- AB 475 requires EVSE providers and installers to mount a sign that states, “Unauthorized vehicles not connected for electric vehicle charging purposes will be towed away at owner’s expense. Towed vehicle can be reclaimed at ____.” However, the CA Interim Disabled Access Guidelines for Electrical Vehicle Charging Stations states, "An information sign must be posted which reads, “Parking for EV Charging Only; This Space Designed for Disabled Access; Use Last.” To streamline signage requirements, EVSE providers will need reconciliation and clarification on the intent of each requirement so that unnecessarily complicated signage is not installed.
- Regarding ADA compliance, 350Green reports that some cities in the Bay Area require ramps, alter slope, or other significant and potentially costly modifications. Although the CA Interim Disabled Access Guidelines for Electrical Vehicle Charging Stations carry no jurisdiction over local municipalities, the guidelines do state that "for installation at an existing site, an accessible path of travel is required to the extent that the cost of providing such path does not exceed 20% of the cost of the EV equipment and installation of all EV charging stations at the site, when such valuation does not exceed the threshold amount referenced in Exception 1 of Section 1134 of Title 24." Based on 350Green’s experience, many cities do not abide by the 20% cost consideration. As a result, the installation becomes cost-prohibitive.
- Regulations and signage must address the potential for "camping" at charging stations i.e., prolonged use at a particularly spot where EVSE is available. For instance, PEVs at airport parking garages may be parked for days at a time while plugged into the charging station, regardless of the fact that the vehicle is charged within the first several hours. These stations are not available to other users and, even worse, they count towards the total electrical service coming into the garage even though no electricity is flowing through them once the vehicle is charged. The result is that parking lots end up with much more service than they actually require when they allow long-term PEV parking. If an entity wants to enforce a time restriction on charging in a parking zone where there are no time restrictions on parking, it is not clear how the charging time restriction would be enforced.
- In a residential area where a Residential Permit Parking program is in place (where parking is time-restricted except those with a residential permit), it is not clear whether a public PEV charging station could be reserved for residents only.

Survey Results: Review of Readiness in the Bay Area

There were considerably fewer respondents to this section of the survey, with only 22 agencies responding. Of the respondents, only 21% are involved in creating zoning and parking ordinances, while 79% are not. Most agencies (59%) have started considering zoning and parking ordinances or are looking other agency’s ordinances. Only two of agencies have

already adopted best practice requirements for EVSE and approximately 14% of agencies responding have not yet started looking into zoning or parking ordinances. Of the two agencies that have existing EVSE zoning and parking ordinances, both include ADA compliance.

Table 17. Progress of Zoning and Parking Ordinances

Response	Count	Percent
Adopted best practice EVSE requirements	2	9%
Not started to look EVSE requirements	3	14%
Started to consider EVSE requirements	7	32%
In the process of adopting EVSE requirements	1	5%
Looking at other agency's EVSE requirements	6	27%
Requires further information on EVSE requirements	3	14%
Total Permitting and Inspection Respondents	22	

Many jurisdictions (31%) have not developed zoning and parking ordinances for EVSE; however, some agencies are in the process of developing requirements via their staff (13%), in consultation with other agencies (2%), and by looking at other city or agency requirements (2%). All agencies (100%) would find zoning and parking ordinance best practice references and examples helpful, but only 33% are willing to share their own best practice documents.

7.3. Recommendations

Local governments in California have exclusive authority over all land use decisions within their jurisdictions. These decisions extend from general plans and other policies that guide the long-term growth of a community down to zoning and parking ordinances that regulate the physical form of streets, buildings, and public spaces. At every step of the process, local governments have opportunities to prepare to accommodate greater numbers of PEVs. These include establishing a policy framework for PEV readiness as well as adopting standards, guidelines and requirements for PEV parking and charging stations. In order for the region to become PEV ready in the areas of zoning and parking, the following six elements are identified as key recommendations for local governments: :

- Adopt a climate action plan, general plan element, or stand-alone plan that encourages deployment of PEVs and EVSE.
- Adopt regulations and enforcement policies for PEV parking spaces.
- Specify design guidelines for PEV parking spaces.
- Allow PEV parking spaces to count toward minimum parking requirements.
- Create minimum requirements for PEV parking

Each of these recommendations is discussed below in detail:

Adopt a climate action plan, general plan element, or stand-alone plan that encourages deployment of PEVs and EVSE.

Staff at local governments that have taken steps to amend their municipal codes to encourage PEV deployment have found that adopting policies that establish a goal of accelerating PEV deployment is a critical first step in building consensus among policymakers and the public in support of more specific implementation measures. These policies not only build consensus, but also make it easier to fund plans and capital projects to accelerate the deployment of PEVs. The incremental cost of PEV readiness planning is lower if part of a large-scale effort such as a climate action plan (CAP), and tying PEV readiness to city policies can make it easier to allocate different funding streams toward PEV plans and projects. Including implementation strategies related to PEVs in general plans or climate action plans can also streamline environmental review these strategies in the future, since the CEQA Guidelines allow lead agencies to streamline project-level environmental review off of these plans.

Issues to Consider

Local governments have three different opportunities to integrate PEV readiness strategies into high-level policies: climate action plans, general plan amendments, and stand-alone EV readiness plans.

Climate Action Plans

Many local governments have adopted climate action plans (CAPs) that establish targets for reducing greenhouse gas (GHG) emissions and outline actions that local governments can take to meet these targets. Even if a CAP does not mention specific actions related to PEVs, it can still help to establish a framework for encouraging PEVs and EVSE, since PEVs demonstrably reduce GHG emissions compared to conventional vehicles.

However, CAPs will lay a much more effective groundwork for future EV deployment measures if the plan discusses specific measures and quantifies the GHG reductions from these measures. This can be challenging because it requires local governments to analyze both the likely effect that implementation measures will have on PEV deployment and the effect of new PEVs on GHG emissions. However, the PEV demand forecasts contained in Section 3 can simplify this analysis. If local governments adopt the measures identified in this plan, they can assume that they will experience an increase in EV ownership that is proportional with these forecasts, and use this assumption as the basis for calculating the GHG benefits of PEV readiness strategies.

General Plan Updates

Local governments can also update their general plans to include policies, goals, and objectives that encourage the deployment of PEVs. Since a general plan is the guiding policy document for a city, this is the most effective way to establish a policy direction in favor of PEV readiness. As with CAPs, more specific actions (i.e. actions and objectives instead of policies) are more useful in laying the groundwork for future implementation measures. The primary benefit of incorporating PEV readiness into a general plan is that it lays the groundwork for local governments to allocate funding from a wider variety of sources toward these efforts rather than

limiting funding for these efforts to grants and other sources that are specifically devoted to PEV readiness. Integrating PEV readiness policies and strategies into a general plan can also be less labor-intensive than creating a CAP because it does not require local governments to conduct a quantitative analysis of GHG reductions for each strategy in the plan. However, it is important to note that analysis of GHG impacts may be required as part of environmental review of the plan. The most thorough approach is for local governments to both thoroughly outline and analyze PEV readiness strategies in the context of a CAP or PEV readiness plan and adopt policies, objectives and actions to support these strategies when updating their general plan.

PEV Readiness Plans

In addition to including PEV readiness policies and strategies in CAPs and general plans, local governments also have the option to create a stand-alone PEV readiness plan. General plans and CAPs are wide-ranging documents that will address issues other than EVs, and are expensive to create and update. Though the incremental costs of addressing PEVs in these plans is likely lower than the cost of creating a stand-alone PEV readiness plan, the latter may be a preferable option for local governments that do not have any immediate plans to update their general plans or create a CAP, or for agencies where there is sufficient political will and funding to address PEVs in depth through a separate planning process.

Costs

Both general plans and CAPs are expensive and labor-intensive to create or update. A CAP for a mid-size city with a population between 50,000 and 100,000 can cost as much as $100,000, and a general plan update can be even more expensive. Though these costs make it unlikely that any city would create a CAP or update its GP for the sole purpose of encouraging EV readiness, the incremental cost of including policies or strategies related to EVs in these plans are relatively small.

There are currently few examples of local governments that have created stand-alone PEV readiness plans. The cost of creating such plans would likely be comparable to the cost of creating a city- or countywide plan focused on another transportation mode, such as a bicycle or pedestrian plan. However, these costs are likely to decrease in the future due to the growing number of regional, sub-regional, and county plans that local governments can draw upon.

Guidance and Best Practices

- The **Transportation Element of the City of Berkeley's General Plan** includes an action to collaborate with BART to include EVSE at BART stations.
- The **City San Carlos' CAP** quantifies the GHG benefits of encouraging developers to include more EV charging infrastructure.
- **Sonoma County's Electric Vehicle Charging Station Program and Installation Guidelines** is a comprehensive plan that addresses many of the elements of this plan, including siting, design guidelines, and outreach to local property owners.

Adopt regulations and enforcement policies for PEV parking spaces.

Having established policies and strategies to encourage the deployment of PEVs, a next step for local governments is to amend parking ordinances to specify the regulations that apply to parking spaces designated for PEVs. The goal of these amendments should be to ensure that PEVs have unobstructed access to PEV charging, create incentives for drivers to purchase PEVs, and to make sure that local governments can recoup the costs of publicly-available charging.

Issues to Consider

When designating PEV parking, local governments should consider the applicable definitions, restrictions, enforcement policies, time limits, and fees. It is worth noting that local governments may not have sufficient information to establish these regulations during the early stages of charger deployment. As a result, many local governments initially provide access to charging stations for free and work with EVSE infrastructure providers to collect data on usage patterns, which they then plan to use as a basis for creating regulations.

Definitions

Before amending any ordinance, local governments must adopt definitions of terms such as “electric vehicle,” charging,” and “electric vehicle supply equipment.” These terms will be used not only in regulations related to PEV charging and parking, but also in zoning and building codes. Several state agencies, including the Building Standards Commission and the Air Resources Board, have created definitions that local governments can draw upon, and these resources are as follows:

Restrictions and enforcement

In general, it is a best practice to restrict use of PEV charging stations to vehicles that are currently charging in order to ensure that chargers are available for drivers who need them. This is supported by recent changes to the California Vehicle Code, which only allows vehicles that are “connected for electric charging purposes” to park in spots designated for electric vehicles (CVC §22511.1(a)), and authorizes local governments to tow vehicles that are illegally using these spaces.

However, these changes are considered advisory, and the Vehicle Code specifically does not prohibit local governments from adopting additional parking ordinances, including designating preferential or free parking for non-charging PEVs. For example, local governments may wish to create additional incentives for drivers to purchase fuel-efficient vehicles, including but not limited to PEVs, by creating dedicated parking spaces or waiving parking fees for these vehicles. Local governments that exceed current demand for PEV parking in order to meet anticipated future demand may also wish to specify interim regulations that allow conventional vehicles to use these spaces in order to avoid under-utilization.

Enforcement is an important factor to consider when adopting restrictions. Local governments need to ensure that enforcement of policies is feasible and that enforcement officers are trained to distinguish between PEVs and conventional vehicles. Even the language in the California

Vehicle Code is not necessarily sufficient to ensure that vehicles are actually utilizing charging stations, since PEVs may remain connected even after they are fully charged. Since different vehicle models have different ways of indicating the level of charge, and there is often no indicator of charge status on the exterior of the vehicle, it can be challenging to identify vehicles that are simply utilizing charging spaces for long-term parking, leaving those spaces unavailable for other users. Furthermore, some conventional vehicles contain appliances that can be connected to Level 1 chargers.

Time limits

Time limits at PEV parking spaces will vary depending upon both the anticipated demand for PEVs and upon adjacent land uses. Generally, no time limits or longer time limits will ensure that vehicles have sufficient time to reach a full charge. However, at locations where local governments anticipate high demand for charging, time limits will help to increase turnover and ensure that chargers are available. Local governments may also wish to impose time limits on PEV parking in activity centers in order to be consistent with time limits on adjacent conventional parking. Furthermore, if local governments allow PEV parking spaces to count toward overall parking requirements, time limits will discourage drivers from parking in these spaces just to charge their vehicles without visiting the associated land use.

Fees

So far, most local governments that provide public EVSE have initially been providing free charging, and intend to levy fees on EVSE users in the future. In order to protect themselves from legal challenges when levying fees, local governments need to demonstrate that fees are reasonable given the costs of providing electricity and maintaining charging infrastructure. Establishing a process for collecting fees with infrastructure providers can also be challenging, especially due to the fact that local governments may need to collect both relevant parking fees and fees to cover the cost of providing EVSE.

Costs

BAAQMD is working with ABAG, MTC, and other stakeholders to estimate the costs associated with this aspect of the readiness planning. Updated estimates will be included in the Final Plan.

Guidance and Best Practices

- Various state codes offer definitions of terms related to PEV readiness, including:
  - Section 406.7 of the California Building Code
  - Article 625 of the California Electrical Code
  - The California Air Resources Board's California Certification and Installation Procedures for Off-Vehicle Charge Capable Conversion Systems for 2000 and Subsequent Model Year Hybrid Electric Vehicles
- **The City of Santa Rosa** has established a fee of one dollar per hour for use of its EV charging stations. Approximately 25 percent of the fee will go toward paying the city's electricity costs, and the remainder will go toward covering maintenance and operations of

the EV charging stations. The City pays Coulomb Technologies, the manufacturer of the charging stations, 50 cents for every charging session plus 7.5 percent of total transaction fees, as well as subscription fee of $320 per month for each charger.

Specify design guidelines for PEV parking spaces.

Local governments should also adopt design guidelines that address the many unique considerations associated with PEV parking spaces. At a minimum, these guidelines should address the following issues:

- Minimum dimensions of PEV parking spaces.
- Parking configurations, including guidance on whether it is preferable to locate EVSE in perpendicular, parallel, or angled parking spaces, and on the location of wheel stops, guard posts, and signage.
- Adopted technical standards that apply to EVSE.
- Regulatory signage and signs directing drivers to available PEV parking.
- Area lighting.
- Clearances, including minimum clearances around chargers in order to maintain access to controls, as well as on adjacent walkways to maintain pedestrian access. Pedestrian clearance guidelines should also include recommendations for keeping sidewalks and walkways clear of cords and cables.
- Location, such as which spaces on a block of on-street parking or in a parking lot are the best candidates for PEV parking. For example, Sonoma County's EV Program Guidelines include the following guidance on locating on-street parking: "The last space on the block in the direction of travel will usually minimize cord management issues, and places user closer to crosswalks and curb ramps."
- Additional considerations that apply in overlay zones, such as flood control zones.
- Disabled access, including requirements for the number of spaces in areas that must be ADA accessible in areas with multiple PEV parking spaces and design standards for ADA-accessible spaces.

Through this can be a complex process, there is a wealth of existing guidance, summarized in the Guidance and Best Practices section above, that local governments can draw upon.

Issues to Consider

Local governments will likely need to create multiple sets of PEV parking guidelines that apply to a wide variety of contexts. Design guidelines will likely vary depending upon the configuration of the parking and upon the context in which parking is located.

ADA Accessibility

Currently, no standards exist for ADA-accessible PEV parking or charging stations. Local governments can choose between two relevant sets of standards in the California Building

Code: the standards for required accessible parking (Section 1129B) and the standards for accessible fueling equipment (Section 1101C). A key distinction is that the former have a maximum grade of two percent, while the latter have a maximum grade of five percent. This means that applying the standards for fueling equipment can save money for local governments and businesses looking to designate PEV parking spaces because it is less likely to require additional grading of sites. However, local governments adopting some of the other recommendations in this section, such as creating minimum requirements for PEV parking or allowing PEV parking to count toward overall parking requirements, may find that the standards for accessible parking are more appropriate, because they are designed to ensure access between parking and adjacent land uses.

Guidance and Best Practices

- The **Sonoma County Electric Vehicle Charging Station Program and Installation Guidelines** contain thorough design guidelines for PEV parking in a variety of different configurations and contexts. Many local governments, both within Sonoma County and across the Bay Area, have either formally adopted these guidelines or used them when installing EVSE.
- **Ready, Set, Charge, California**, a guide to EV readiness created by a group of regional agencies and electric vehicle advocacy groups, contains design and signage guidelines for PEV parking.
- The California Manual on Uniform Traffic Control Devices contains interim signs indicating PEV parking.
- **Section 22511(d) of the California Vehicle Code** specifies signage requirements for spaces that are restricted to charging EVs.

Allow PEV parking spaces to count toward minimum parking requirements.

Many jurisdictions have minimum parking requirements specifying the number of spaces that developers must provide for new construction in different land uses. If PEV parking is not counted toward these requirements it can discourage developers from installing EVSE, since developers must either build more structured parking or reduce the amount of developed space to accommodate the extra parking needed for PEVs to access charging stations. Amending the zoning or parking code to allow PEV parking to count toward parking requirements would allow developers to provide PEV parking without increasing the total number of spaces required.

Issues to Consider

Restrictions on PEV Parking

When making this change, local governments may wish to create additional regulations on PEV parking spaces in order to ensure that PEV spaces associated with a given land use are actually used by visitors to that land use, and not by drivers who are solely taking advantage of charging. These may include time limits that prevent PEV drivers from taking unlimited advantage of charging.

Costs, Guidelines and Best Practices

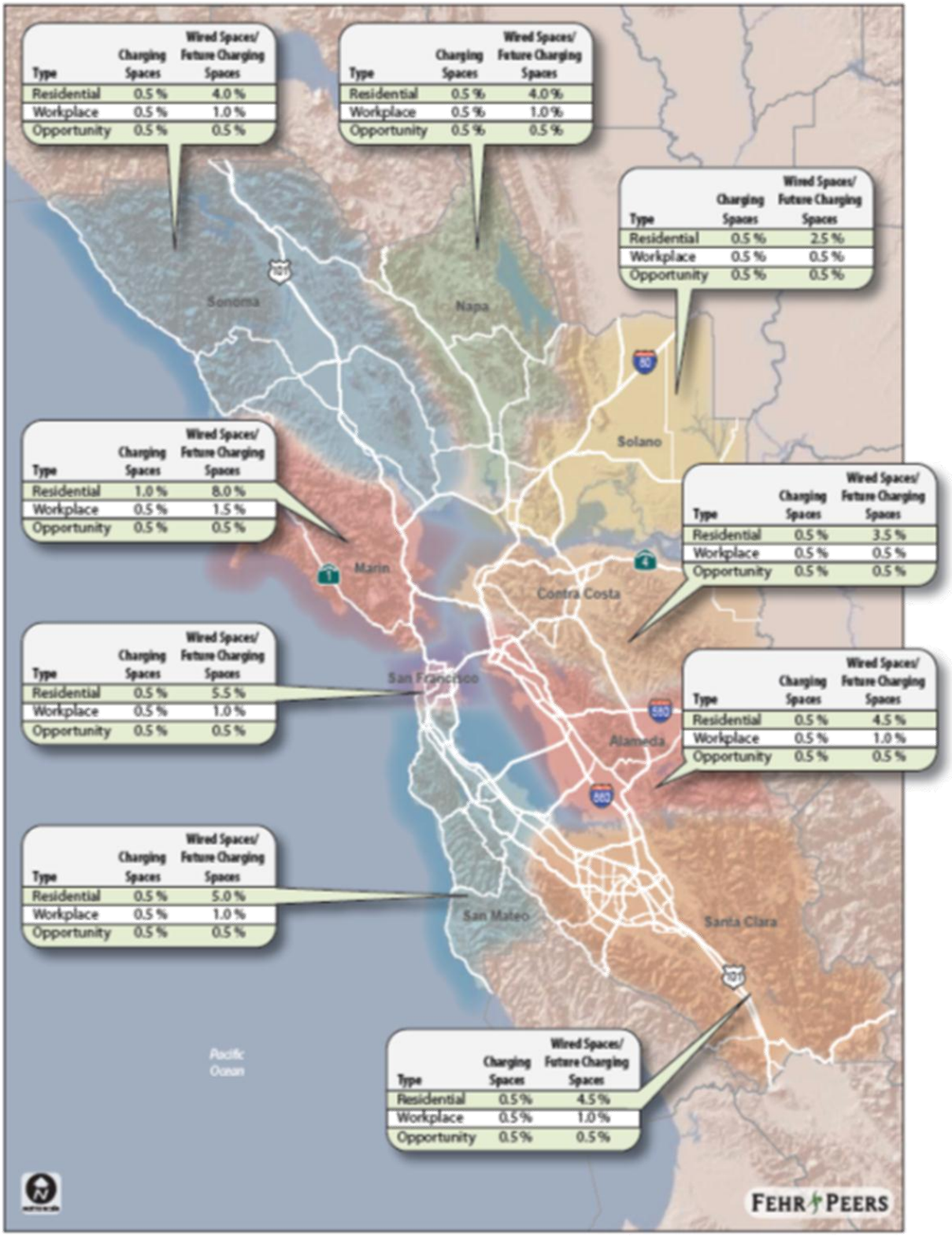
BAAQMD is working with ABAG, MTC, and other stakeholders to estimate the costs associated with this aspect of the readiness planning. Updated estimates will be included in the Final Plan.

Ready, Set, Charge, California contains sample code language allowing PEV parking spaces to count towards minimum parking requirements.

Create minimum requirements for PEV parking

Over the long term, the best way for local governments to ensure that there is adequate PEV charging infrastructure to support future demand is to adopt minimum requirements for the number of PEV parking spaces at different land uses. Figure 11 shows preliminary parking requirements for both Level 2 charging stations and pre-wiring for future Level 2 EVSE. These requirements are based on the PEV demand forecasts contained in Section 3 and upon likely demand for different types of charging opportunities.

Figure 11. Recommended PEV Parking Requirements for the SF Bay Area



Note that the preliminary requirements shown in Figure 11 vary by county, by the type of charging (residential, workplace, or opportunity charging), and by the type of infrastructure required (charging stations or pre-wired charging spaces). Requirements are expressed as the percentage of total parking spaces at a given land use that should either contain Level 2 EV charging stations or be pre-wired for Level 2 chargers.

These requirements should be considered as a starting point for new developments of a certain size, or expansions of existing facilities. In order to apply these preliminary requirements locally, cities and counties should consider the following:

- **Anticipated level of PEV demand**: the preliminary requirements in Figure 11 reflect average county-wide demand for PEVs. However, cities that anticipate higher or lower demand than the county average may wish to adjust these requirements upward or downward accordingly. For example, demand for EVSE is likely to be higher than average in major regional employment centers, mixed-use areas where travelers can reach a greater number of destinations with shorter trips, and communities that currently have high levels of hybrid electric vehicle ownership.

- **Demand for different types of charging opportunities at different land uses**: the preliminary requirements in Figure 11 reflect average demand for different types of charging, but the demand for some types of charging will vary among different land uses. In general, the residential charging requirements should apply to multi-unit residential developments, and the workplace requirements should apply to office buildings and other high-volume employment centers where employees typically work long enough shifts to complete a significant charge, such as medical centers. Demand for opportunity charging is likely to be concentrated in commercial land uses with high volumes of visitors that are on site for long enough to complete a significant charge, such as major retail and entertainment centers. These land uses may experience significantly higher-than-average demand for opportunity charging, while other commercial land uses may experience less demand. Requirements at major retail and entertainment centers should take into account the need for PEV charging among both employees and visitors.

The relatively low requirements for opportunity charging shown in Figure 11 in part reflect the fact that many retail centers are already installing EVSE of their own initiative in order to attract and retain PEV drivers. For instance, the first retail fast charging station in the state, installed at Stanford Shopping Center in Palo Alto in 2011, was privately-funded, and several other Bay Area shopping centers have either already added or are in the process of installing EVSE in parking lots.

Local PEV parking requirements should allow for an exemption if the applicant can provide reasonable evidence that publically-available PEV parking and charging exists in the vicinity that can be used to reduce these requirements. In order to meet PEV drivers' charging needs without over-burdening developers, local governments could produce requirements that allow for shared parking. Accounting for the fact that different land uses will experience demand for PEV charging at different times may reduce overall demand for EVSE. In the case of PEV

parking at a shopping center, for example, PEV parking could be shared by retail shoppers and movie-goers since they would use the parking at different times. Accounting for this when creating PEV parking requirements would lower the overall requirements compared to the conventional approach of calculating the required parking discretely for each land use and summing across all land uses to calculate the total requirement.

As we discuss in more depth in the following chapter, some local governments in California have amended their building code for the number of spaces in multifamily buildings that must be pre-wired for Level 2 EVSE. It is recommended that local governments specify PEV parking requirements through zoning codes and parking ordinances rather than building codes, because the requirements in zoning codes are more likely to vary according to land use or other factors that may influence charging demand. However, the existing amendments to building codes may serve as a source of guidance for local governments in the Bay Area that area creating parking requirements for multifamily buildings.

Issues to Consider

Type of EVSE Required

A common practice among local governments that currently have minimum EVSE requirements is to require pre-wiring for Level 2 chargers rather than requiring installation of the chargers themselves. Pre-wiring can reduce the cost of charger installation by up to 65 percent, making it much more feasible to install chargers at a later date. On the other hand, it does not create immediate charging opportunities for PEVs. Local governments must therefore decide whether parking requirements apply to the number of chargers that must be installed, to the number of pre-wired spaces, or to a mix of the two.

When making this decision, it is important to consider how frequently parking requirements will be updated. If requirements will be updated frequently, it may be preferable to apply requirements to the number of chargers that must be installed, and adjust requirements to meet changing demand. Otherwise, it may be best to require pre-wiring.

Restrictions on PEV Parking

When adopting minimum requirements for PEV parking, local governments may need to create additional regulations on PEV parking spaces in order to ensure that PEV spaces associated with a given land use are actually used by visitors to that land use, and not by drivers who are solely taking advantage of charging. These may include time limits that prevent PEV drivers from taking unlimited advantage of charging.

PEV Charging vs. PEV Parking

When creating parking requirements, it is important to distinguish between PEV charging and PEV parking spaces. The recommended requirements in Figure 11 above apply to charging spaces, which are reserved for PEVs that are actively charging. However, local governments may wish to create additional incentives for drivers to purchase fuel-efficient vehicles, including but not limited to PEVs, by creating dedicated parking spaces or waiving parking fees for these

vehicles. In this case, local governments may wish to create additional minimum requirements for such spaces.

Alternative Approaches

Density Bonuses

While this plan recommends that local governments adopt minimum PEV parking requirements, some local governments may wish to take a more conservative, incentive-based approach in the short term. One potential approach is to amend zoning codes to offer density or floor area ratio bonuses for buildings that include EV charging stations. This approach will provide developers with additional developable area to offset the cost of providing EVSE. Local governments should use Figure 11 as a basis for determining whether a developer has provided a sufficient number of charging stations to qualify for incentives.

Allowing PEV Parking

Local governments can allow rather than require parking. In order to clarify regulations for property owners, local governments that take this approach should include guidance in the zoning code identifying the districts in which different types of PEV charging stations are allowed and specifying whether chargers are allowed as a stand-alone use or as an accessory to a principal use.

Guidelines and Best Practices

No local governments in the Bay Area have yet adopted minimum parking requirements for EVSE into their zoning codes or parking ordinances. However, a growing number of projects contain parking spaces with EVSE, and these can serve as guidelines for requirements at comparable land uses. Table 18 contains current examples of EV charging station supply from the San Francisco Bay Area. The responsible entities tend to not collect parking occupancy data, so these examples do not necessarily reflect demand for PEV charging.

Table 18. Examples of EVSE Supply (Source: Fehr and Peers field observations, September 2012)

Entity	Land Use Type	Number and type of charging stations	Percentage of total parking spaces with available EVSE
Walnut Creek	City-owned parking garage[44]	3 Level 2	0.2%
Pleasanton	Municipal	9 Level 2	3%
Brentwood	City-owned parking garage	5 Level 2	4%[45]
Google	Office	330 Level 2 140 Level 1	4%
Facebook	Office	2 Level 2	.07%[46]
88 Townsend[47]	Multi-Family residential	1 Level 2	0.8%
Park Merced[48]	Multi-Family residential	15 Level 2 3 Shared EVs	0.9%

Other guidelines and best practices on zoning and parking can be found in the following sources:

- **Ready, Set, Charge, California** contains sample minimum parking requirements and ordinance language adopting these requirements, as well as sample zoning code tables specifying the type of EVSE that is allowed in different zoning districts.
- The **City of San Carlos** has amended its zoning code (§18.05.030.A) to allow developers to exceed the maximum allowable floor area ratio by 10% if they provide additional environmental design features on-site or contribute to off-site improvements at open spaces or public facilities. The code lists “electric car facilities” as one of the on-site features that developers can include in order to qualify for this exemption.

Some local and state building codes also contain requirements for PEV parking that can serve as best practices for local governments that are creating parking requirements:

- The **City of Los Angeles** (Green Building Code, §99.04.106.6) requires one outlet capable of accommodating a Level 2 charger in all single-family residences and townhomes, and that five percent of parking spaces in multifamily buildings contain Level 2 outlets.

[44] Chargers are distributed across three separate city-owned garages.

[45] Approximate; parking is shared between multiple uses.

[46] These chargers were shared by four different vehicles on the day the observation was made.

[47] Part of the MultiCharge SF Project, described in a presentation at *Charged 2012* Conference, August 23, 2012

[48] *Ibid*

- The **City of Sunnyvale** requires that all garages and carports attached to single-family buildings be pre-wired for Level 2 chargers, and that 12.5 percent of parking spaces in shared facilities at multi-family buildings be pre-wired.
- The **California Green Building Code (CALGreen)** (§A5.106.5.3.1) includes voluntary requirements for the number of designated PEV charging spaces at nonresidential locations. They require one PEV space for lots of up to 50 spaces, two spaces for lots of up to 200 spaces, and four spaces for lots with over 200 spaces.

7.4. Implementation Actions

The analysis above identifies key elements that need to be implemented in the region to achieve PEV “readiness” for local governments in the area of zoning and parking. A number of actions and strategies need to be considered in order to help local governments accomplish these key goals. These may include policy and leadership actions, education initiatives, incentives and legislation. As these implementation actions are part of common solutions to all of the PEV readiness elements associated with this plan, a list of implementation actions has been added to this document (Section 11), which contains cost estimates for each of the recommended actions and outlines a roadmap on how each element can be achieved using a number of different solutions.

8. Stakeholder Training and Education

8.1. Introduction and Overview

Transitioning the region's fleet over to PEV will require extensive marketing, outreach, training, and education relating to PEV, charging services, and infrastructure. This section reviews the specialized training and education for PEV industry service providers that is currently available that addresses those needs. This section also identifies additional training, to be developed, to ensure that vehicles and related electric charging equipment is installed, maintained, and operated in a safe and proper manner. Later, in Section 9, this Plan will discuss organizations whose work focuses on educating the general public consumers on the benefits of PEVs.

EVITP Training Agenda

- Overview of Electric Vehicles
- Types of Electric Vehicles—Past and Present
- Electric Vehicle Manufacturers
- Electric Vehicle Charging Unit Manufacturers
- Utility Policy and Integration
- Electric Vehicle Rules and Regulations
- Electrical Vehicle Charging Site Assessment
- Electric Vehicle Charging Stations and Charging Load Requirements
- Code Officials and Inspection
- Electrical Codes, Safety Requirement, Other Regulations and Standards
- Electric Vehicle Charging Installations
- Renewable Energy and Electric Vehicles
- First Responders
- Customer Code of Excellence/Contractor's Role; Electricians Role
- Field Installation Practicum (Lab)
- Electric Vehicle Certification Phase One (Lab)

There are already a number of organizations and stakeholders that are leading efforts at the national, state, and regional level to develop curriculum and specialized training for electrical contractors and inspectors, workforce development training for PEV fleet technicians, public charging station owners and operators, fleet managers, dealers, and automotive shops, and first responders and other safety officials. The following is a listing of the organizations that are working to provide training opportunities in the Region:

- The Electric Vehicle Infrastructure Training Program (EVITP) - The EVITP is a 24-hour course set up to train and certify electricians throughout California to install residential and commercial scale EVSE. The training program addresses the technical requirements, safety imperatives, and performance integrity of industry partners to ensure that the equipment is properly installed and maintained, using the highest quality standards.
- Clean Cities – At the national level, Clean Cities has developed a 30-minute online presentation for electrical contractors and inspectors regarding EVSE residential charging installation. This online video covers a broad spectrum of topics aimed at informing electrical contractors of the key issues related to residential EVSE. The presentation begins with the history and evolution of the EV market and briefly summarizes the benefits of EVs. Then the presentation dives deeper into the responsibilities of electrical contractors and the details of the system setup, codes and standards, specific equipment and parts, types of stations, and safety. The presentation also touches on the importance of project management and communication with the utility and customer.

- Green Transportation Workforce Development (GTWD) - The Green Team (Silicon Valley Clean Cities Coalition, Breathe California, and the Electronic Transportation Development Center (ETDC)) is offering a series of green transportation technical classes taught by the stakeholder member, GTWD. The target audience for the workforce development training is fleet technicians, automotive shop employees, returning veterans, and hobbyists. The following four 50-hour classes are offered: electric vehicles, hybrid electric vehicles, compressed natural gas vehicles, and infrastructure.
- California Plug-in Electric Vehicle Collaborative -The PEV Collaborative is working to launch a PEV Resource Center that will provide answers to key issues. The PEV Resource Center is currently under construction, but is anticipated to be live sometime in 2012. The PEV Resource Center website will target the following audiences:
  - Vehicle Consumers and Homeowners
  - Local Government Officials
  - Fleet Managers
  - Infrastructure and Electrical Contractors
  - Emergency First Responders
  - Educators and Instructors
- Advanced Transportation Technology and Energy (ATTE) Initiative - In 1994 the California Community Colleges Chancellor's Office through its Economic and Workforce Development Program created the ATTE Initiative in order to maintain California's competitiveness as a national leader in advanced transportation and energy technologies through the development and continuous improvement of technical education at community colleges throughout the state. Since that time the ATTE has served California's transportation and energy technology businesses through a myriad of program and workforce training activities. The ATTE program is offered by several community colleges throughout California and provides 8 to 16 hour courses on:
  - Hybrid Electric, Electric, and Gaseous Fuels Vehicle Identification
  - Fundamentals of Hybrid Electric, Electric, and Gaseous Fueled Vehicles
  - Vehicle components
  - Alternative Fuels Infrastructure, Transport, Stations, and Safe Handling
  - Equipment Identification for HEVs and Other Alternative Fueled Vehicles
  - First Responder Procedures for:
    - Police (securing the area, recognizing potential hazards, protecting the public, etc.)
    - Firefighters (General Firefighting Measures, etc.)
    - Other Emergency Personnel

- Electric Power Research Institute (EPRI) – EPRI conducts research and development related to the generation, delivery and use of electricity for the benefit of the public. EPRI developed a plethora of technology, policy and economic analyses to drive long-range research and development planning and to support research in emerging technologies. This includes the development of research and resource material on electric vehicles, such as installation guidelines, grid interface requirements, and life-cycle cost analysis.
- The Electrification Coalition - A nonpartisan, not-for-profit group of business leaders committed to promoting policies and actions that facilitate the deployment of electric vehicles on a mass scale. They developed two policy reports: the fleet electrification roadmap and the electrification roadmap.
- PG&E - Educates its consumers to help make them aware of the best rate plans for home charging and stressing the importance of coordination with the utility to make sure that the grid can accommodate increased demand. They also developed an installation guide to upgrade electric service at home and a PEV electric rate calculator to estimate PG&E electricity costs for various PEV models.
- U.S. Department of Energy - Has developed a series of training material for consumers, electrical contractors, fleet managers, and public charging stations hosts. These resources communicate benefits of PEVs and provide guidelines to installing infrastructure and maintaining PEVs.
- Tri-chapter Uniform Code Committees (TUCC) - Information on code specifications and standards on PEV installation is available from the TUCC.
- *Ready, Set Charge, California* - Provides guidance to cities and counties on uniform inspection codes and PEV policy development and deployment.

8.2. Gaps and Deficiencies

Outreach to Dealers

In most cases, dealers are delivering sound and robust advice to potential PEV consumers, particularly with regard to PEV vehicle specifications and residential EVSE deployment. However, anecdotal evidence suggests that some initial PEV deployments, and associated EVSE installations, are being performed without the assistance of an electrician and without the required permit. When this happens, it can create a couple of problems. Firstly, these types of cases establish a bad precedent and may lead dealers to communicate potentially inaccurate information to consumers, thereby perpetuating risk and misinformation regarding the deployment of EVSE. Furthermore, these types of ill-advised situations can cause problems that lead to additional confusion regarding other aspects of the PEV ecosystem e.g., the permitting and installation process and the utility notification.

At this early stage, the degree to which this issue may impact (or has impacted) PEV deployment is not well understood. As such, further research is required, particularly performing at least initial outreach to dealers.

Coordinated and Expanded Stakeholder Education

As outlined in the previous subsection, there are many efforts that have been initiated at the state and regional level to educate stakeholders. As more local and regional agencies seek to educate themselves about the PEV ecosystem, a more coordinated effort will be required by prioritizing the most likely early- and mid-adopter regions. Jurisdictions of these regions should be educated on the training courses and resources available to them from local community colleges, the DOE Clean Cities, and other jurisdictions.

Furthermore, anecdotal evidence from the Region indicates that there are some key stakeholders who are largely unfamiliar with their role in the PEV ecosystem. As a result, this uncertainty may cause additional challenges to PEV and EVSE deployment. For instance, in its efforts to deploy EVSE for the new PEVs placed in its fleet, City CarShare has taken on the role of educating stakeholders such as parking management companies. City CarShare has stated that the process to educate these stakeholders about the issues associated with EVSE, in some cases, has taken more than 4 months, which increases the time required to deploy EVSE. There is similar anecdotal evidence in the Region from stakeholders such as property management companies and home owner associations (HOAs). Due to the make-up of the Bay Area's stock of residential and commercial buildings, effective outreach and education for these stakeholders is essential.

8.3. Recommendations

Develop Schedule for Stakeholder Training and Outreach

Based on the review of gaps and deficiencies identified via stakeholder interviews and survey responses, it is clear that coordination of efforts and additional stakeholder training and outreach is necessary. As a result, the following steps have been outlined for a regional plan to train stakeholders, with a focus on local government staff.

- **Identify roles and responsibilities**

BAAQMD anticipates that there will be significant stakeholder engagement required to develop a coordinated training schedule. Recommended stakeholders and their corresponding roles are highlighted in Table 19 below:

Table 19. Recommended Roles and Responsibilities of Stakeholders Engaged in Stakeholder Training and Outreach

Stakeholder / Agency	Role / Responsibility
East Bay, San Francisco and Silicon Valley Clean Cities Coalitions	• Hosts: organize venues, coordinate outreach, and advertising • Coordinate day-of logistics
MTC, BAAQMD**, and ABAG DOE / CEC Utilities	• Co-funding and logistical support • Advertising and outreach to promote events • Utilities could conceivably use revenue from LCFS credits to help co-fund training*
EVITP	• Training instructor

* Assuming that proposed modifications to the LCFS are approved

**BAAQMD has recently applied to DOE for funding for training for first responders and local officials via the Clean Cities Funding Opportunity "Implementation Initiatives to Advance Alternative Fuel Markets"

Scope of training

A 6–8 hour training session is recommended, focusing on codes, safety, standards, site assessments, electric load calculations, permitting processes, and utility notification.

Identify attendees

Based on responses to the Regional PEV Readiness Survey, a survey recently conducted by the BAAQMD of local Bay Area governments, we assume approximately 130 agencies in the Region have staff requiring some degree of training and outreach. We also assume that 2-3 staff per agency will likely require training. If we also assume that about 5% of agencies are already or on the way to being PEV ready, then approximately 250-370 local government staff will require training. BAAQMD recommends an over-estimate for staff because it is likely that more than just local government staff will be interested in the training session.

Additionally, the BAAQMD has applied to DOE on behalf of the State of California in partnership with the South Coast Air Quality Management District, California PEV Collaborative, and 13 Clean Cities Coalitions to perform an assessment of training that is already been offered to first responders and local jurisdictions. If this application is selected for award, funding in the amount of $200,000 will also be provided for additional training to local jurisdictions and first responders via ATTE training organizations and other locally offered PEV training. In the event this application is not selected for award, BAAQMD may seek other sources of funding (AB118 funding from CEC) to begin this assessment and conduct training.

Devise schedule

BAAQMD devised a schedule assuming that all staff would need to be trained by December 2014 – this timeline is intended to reflect the varying levels of PEV adoption that are anticipated across the Region based on considerations such as socioeconomic data (e.g., income, home ownership, dwelling type), infrastructure availability, and other parameters (e.g., hybrid electric vehicle ownership). We also assumed that each training session would include 25-30 participants. To ensure the full range of staff receive the recommended training we estimate that 8-15 sessions will be required; if training sessions commence in the first quarter of 2013 and end in December 2014, then training sessions will have to be held quarterly or bi-monthly. We

refer to the scenario with 8 sessions as aggressive and the scenario with 15 sessions as conservative.

Estimate costs of sessions

Each of the training seminars will incur a number of costs, including renting a venue, paying an instructor, catering, and materials. Estimates for these costs are shown in Table 20 below.

Table 20. Breakdown of Training Session Costs

Cost Item	Low Cost	High Cost	Includes:
Venue Rental[1]	$800	$1,000	Seats 30 people at tables
Instruction[2]	$850	$1,450	One instructor plus reimbursement for travel expenses
Catering[3]	$731	$878	Breakfast: coffee/tea/juice, pastries and fresh fruit Lunch: sandwiches served w/ salad
Materials	$125	$150	Notebook, Handbook, and Pen
Total	**$2,506**	**$3,478**	

(1) http://www.pge.com/mybusiness/edusafety/training/pec/events/facilinfo.shtml, (2) Based on information provided by EVITP. (3) http://www.pge.com/mybusiness/edusafety/training/pec/events/catermenu.shtml

In order to estimate the cost of a training seminar, PG&E's Pacific Energy Center in San Francisco is used as a proxy. Renting a venue that fits 30 attendees seated at a table would cost between $800 and $1,000. Depending on the number of attendees, catering breakfast and lunch at the Pacific Energy Center would cost between $731 and $878. Based on EVITP, instruction and travel expenses would cost approximately $800 and $1,450. Lastly, printing a take-home handbook or presentation notes and providing a notebook and pen to attendees would cost between $125 and $150. Based on these estimates, we estimate a cost of $2,506–$3,478 per training session. For the sake of simplicity, the conservative scenario, assuming 15 sessions, yields a total cost between $37,600 and $52,170 (see Table 21).

Table 21. Estimated Costs for Stakeholder Training

Scenario	Sessions	Low Cost	High Cost
Aggressive	8	$20,000	$27,800
Conservative	15	$37,600	$52,170

As noted previously, although this is a substantial investment, the return on this investment via benefits such as streamlining permitting processes and expanding local consideration of zoning modifications to incentivize PEV parking has the potential to reduce barriers to PEV adoption in the Region. As noted throughout, BAAQMD developed these costs using conservative estimates; it is conceivable that there are ways to reduce the cost burden through avenues such as donated venue space. In many cases, it may possible to incorporate the training session into existing agendas for other events related to alternative fuels or similar initiatives. It is important, however, to note that a 6-8 hour session is not something that can be added to any agenda; and based on feedback from instructors from EVITP, BAAQMD recommends against shortening the training sessions.

Regardless of cost share potential, the scope of these training session falls well within the purview of regional Clean Cities Coalitions; with regional support, it is highly likely that sources such as the CEC or DOE would support these activities. Coordinated and collaborative action in the Region – with the support of BAAQMD, MTC, and ABAG – will also bolster the chances that these training sessions can be funded. ABAG and the Clean Cities Coalitions are well positioned to ensure that the sessions generate sufficient interest to warrant a quarterly or bi-monthly frequency.

9. Consumer Education for PEVs

This section covers educating consumers on benefits and available incentives of PEVs. To learn about training and education for industry stakeholders and service providers, please see Section 8.

9.1. Introduction

The introduction of new technologies like PEVs requires careful coordination and outreach to consumers. The familiar aspects of car ownership – such as vehicle pricing, fuel pricing, vehicle range, availability of refueling infrastructure – changes with PEV ownership. With a focus on providing the market and policy signals at the federal and state level through incentives for vehicles (e.g., tax credits and rebates) and for infrastructure (e.g., through The EV Project or the Home Charger Rebate Program), it is incumbent upon local and regional agencies to provide key, high-level messages that highlight PEV availability and benefits, including total cost of ownership, environmental, health, and community benefits.

At the national level, NREL developed a Vehicle Cost Calculator,[49] which allows users to calculate the purchase price, fuel costs, repair and maintenance costs, and applicable tax incentives, as well as the cost and emissions savings associated with purchasing PEVs compared to the costs associated with conventional vehicles. Furthermore, NREL has provided the option to organizations to host a simplified version of the tool by placing the Cost Calculator widget[50] on their own webpages. Similarly, both the DriveClean website (hosted by ARB) and the California PEVC website host calculators.

Many communities in the Region have already started local outreach campaigns. For instance, Sonoma County has been particularly proactive via community outreach and education campaigns through the Sonoma County Local Governments Electric Vehicle Partnerships. Similarly, the San Francisco City and County government has been actively promoting PEVs through outreach and education, primarily through the Department of Environment. The city maintains a resource for information on electric vehicles called SF Electric Drive. PG&E has also done outreach and education to its consumers to help make them aware of the best rate plans for home charging and stressing the importance of coordination with the utility to make sure that the grid can accommodate increased demand.

Several national and local organizations are dedicated consumer advocates for PEVs and have been working to promote PEV ownership and outreach to potential and current PEV drivers to help them navigate PEV-specific ownership and operational requirements and to access available incentives and funding. The following is a listing of established organizations that provide consumer PEV education to Bay Area and Monterey Bay residents:

- **Plug In America (PIA)** - Consumer-oriented voice in the U.S. promoting the use of electric vehicles and effective policy at the local, state and federal levels. PIA provides a range of

[49] Available online at: http://www.afdc.energy.gov/afdc/calc/
[50] Available online at: http://www.afdc.energy.gov/afdc/widgets/

expert assistance related to the widespread adoption of electric vehicles and conducts consumer outreach and awareness - through individual events and aggressive use of online campaigns - to connect prospective drivers to new electric vehicles now available. PIA outreach efforts include supporting National Plug-In Day, a multi-city celebration of consumer enthusiasm that brings together current and prospective drivers; the event's second year, 2012, included activities in over 60 cities. PIA maintains a consumer-focused website that provides extensive information about the emerging PEV market that features a consumer guide to new products that is updated annually and an online vehicle tracker that has the most comprehensive set of information about the products currently available in the market.

- **Electric Auto Association and locally associated chapters** – Golden Gate Electric Vehicle Association, East Bay EAA, North Bay EAA, San Jose EAA, Silicon Valley EAA, and Central Coast EAA – Provides information on the developments of electric vehicle technology, sponsors public exhibits and events to educate its members and the public on the progress and benefits of electric vehicle technology. The EAA hosts regularly scheduled member meetings open to members and the general public.
- **San Francisco BayLEAFs** – Provides a community to the Nissan LEAF owners in the San Francisco Bay Area. Although membership is open to all PEV enthusiasts, SF BayLEAFs is focused on the Nissan LEAF owner and to maximize the LEAF EV owner experience. SF BayLEAFs provides a forum for its members to communicate directly with Nissan about their current and future EV products, and advocates on behalf of its members to federal, state, and local government agencies as they develop public policy for EV and other clean energy transportation programs.
- **Monterey Bay Electric Vehicle Alliance (MBEVA)** – A project of Ecology Action is a public-private partnership of stakeholders from Monterey, San Benito, and Santa Cruz counties. MBEVA Teams meet regularly to advance goals related to: funding, policy improvement, public outreach, economic development/workforce development, and infrastructure development. MBEVA's Outreach Team organizes communication and education initiatives to educate and involve a variety of audiences.
- **Spare the Air Program (STA)** – BAAQMD sponsored STA program recently launched the Bay Area Plug-In Electric Vehicle Ready website – bayareapevready.org – which offers a clearinghouse of information for current and prospective electric vehicle drivers across the region. Additionally, the BAAQMD's program has provided funding for eligible PEV drivers who install Level 2 EVSE in their residence.
- **Clean Cities** and locally associated **Coalitions (CCC) – East Bay CCC, San Francisco CCC, and Silicon Valley CCC -** Clean Cities is the U.S. Department of Energy's (DOE) flagship alternative-transportation deployment initiative. Today, a nationwide network of nearly 100 Clean Cities Coalitions are working together to reduce petroleum use from the transportation sector. Clean Cities Coalitions are composed of businesses, fuel providers, vehicle fleets, state and local government agencies, and community organizations. These stakeholders come together to share information and resources, help craft public policy,

consumer education and outreach, and collaborate on projects that advance use of alternative fuels.

9.2. Go EV Campaign for the Bay Area

Gaps and deficiencies that are not currently covered by the aforementioned efforts will be addressed in a *Go EV Campaign* that is currently under development for the Bay Area region.

There are many stakeholders in the Region engaged in the deployment of PEV and EVSE, including public and private actors, that have greatly contributed towards helping to realize the analysts' and industry observers' forecasts on the importance of the Region as a market leader in PEV and EVSE deployment. With a potential market of more than 5 million light-duty vehicles currently registered in the Bay Area, a local, well-coordinated educational campaign that specifically targets consumers is needed in order to successfully capture the attention and acceptance of PEVs by the broader general public. The key regional stakeholders – led by MTC in collaboration with ABAG and BAAQMD – have responded to that need and are developing a *Go EV Campaign* that will target potential consumers in the Region. The campaign will begin the first stages of development in coordination with a firm specializing in public interest campaigns, in October 2012.

Campaign Objectives

The effort will be a promotional campaign aimed at building awareness, action and demand for PEVs (including both BEVs and PHEVs) in the Bay Area. One of the primary objectives of the campaign is to communicate the potential of PEVs to displace gasoline and save consumers money, stimulate the local economy, create jobs, reduce GHG emissions, and improve public health. The specific goals of the Campaign include:

- **Educate** Bay Area residents about electric vehicles, including vehicle operation, differentiation between vehicle types and vehicle charging (e.g., charging station locations, charge times, miles per charge, etc.); vehicle rebates; State and federal tax incentives/credits, reductions in sales taxes or registration fees (if available); rebates or cost reductions on the permitting, purchasing, or installation of EVSE or EV infrastructure; rebates or reductions in State or local toll road access (if available) and other consumer benefits such as preferred parking spaces and high occupancy vehicle (HOV) lane access.
- **Behavior change** of Bay Area drivers to purchase PEVs or use PEVs when offered the choice;
- Develop **core messages that create awareness** to communicate PEV benefits (e.g., cost savings, convenience, regional economic and job benefits, environmental and health benefits, "fun to drive" and "cool factor");
- Continue to promote the Bay Area identity as a **center for high tech and green culture**;
- Identify **prominent individuals/organizations to deliver campaign messages**, including civic and business leaders, PEV-related companies, auto companies, cities (e.g., San

Francisco and San Jose), regional public agencies, environmental groups and prominent EV drivers (e.g., George Schultz, Gavin Newsom, etc.); and

- **Motivate individuals** to reduce their contribution to Bay Area GHG emissions.

Implementing the Campaign

For local government engaged in PEV readiness planning, it will be important to identify the key areas for coordination with the *Go EV Campaign* – this will help maximize the utility of the outreach efforts. In an effort to identify these opportunities in advance, the following steps highlight the initial steps for scoping the *Go EV Campaign*, distinguished as four (4) phases over the next five to six months, followed by the implementation of the campaign.

- **Phase 1: Research and Discovery**

Over the next several months, MTC will be reviewing existing research on potential EV consumers and their knowledge and interest in PEVs, as well as reviewing existing campaigns. More specific research in the Region will be conducted by using survey tools to develop an improved understanding of how consumers are "talking" about and sharing information regarding PEVs. This work will focus on websites and social media platforms, and will seek to identify where the most robust conversations are already taking place, and how key actors are using digital technology to communicate. MTC will also be conducting stakeholder interviews, including with local governments that have been the most actively engaged in PEV readiness planning. This aspect of the planning for the *Go EV Campaign* will be an important integration point for the most proactive local governments.

- **Phase 2: Strategy Development**

Based on the research and discovery in Phase 1, MTC will develop a target audience profile and develop the initial brand story language. The target audience will be a key factor for local governments trying to understand the needs and concerns of their constituents that are most likely to purchase PEVs in the region in the near-term future.

The strategy development will also include an assessment of the current communication landscape, which will seek to identify the strengths and weakness of existing efforts while characterizing the opportunities for the campaign moving forward. This analysis will, to some extent, be informed via engagement with stakeholders. The local governments that have been the most engaged in EVSE deployment should be actively involved in this process to help communicate the on-the-ground feedback that they are receiving, which perhaps may not have been reflected in the survey of information sharing on websites and social media.

- **Phase 3: Message and Content Testing**

MTC will execute Phase 3 of the scoping process for the *Go EV Campaign* by conducting informal focus groups. Focus groups are an effective mechanism to ensure that the outreach and communication strategies being developed resonate with various audiences. The focus groups are also a convenient way to test more granular aspects of the *Go EV Campaign*, including campaign language and mock materials.

Phase 4: Full Plan Development

At the conclusion of the 6 months of scoping, MTC will have an outline of a full plan, which will include:

- Specific measureable campaign goals;
- An updated audience profile;
- Strategies and tactics and recommendations on the organizing structure of the campaign; and
- A master brand story with rationale, talking points and recommendations for branded materials on how to talk about civic engagement and a sample success story.

After the four phases of the scoping effort are complete, MTC in coordination with BAAQMD and ABAG will approve the *Go EV Campaign* plan and initiate the process of implementation over an approximately 18-month period.

The four initial scoping phases will help regional stakeholders ensure that the *Go EV Campaign* will fulfill the need for a centralized resource for consumers in the Region.

Additional Incentives

See Section 11, Implementation Actions for more information.

10. Minimizing Grid Utility Impacts

10.1. Introduction

The widespread deployment of PEVs presents an unprecedented opportunity for electric utilities to increase asset utilization through increased electricity use, and has the potential to reduce electricity rates. One of the primary concerns associated with PEV deployment is the potential negative impact from increased load on the local electric grid. The degree of the impact depends on parameters such as PEV penetration rates, the current condition of local distribution infrastructure, and strategies used by the local utility to manage additional load. Utilities across the country have implemented a wide variety of pilot projects and assessments to better understand consumer PEV usage patterns and how certain management tools, such as smart meters, may help mitigate impacts on the grid. Through the use of tariff structures and incentives, utilities are actively seeking solutions that maximize PEV charging to periods of lower electrical demand, such as off-peak hours.

The utilities in the Region include:

- Alameda Municipal Power
- City of Healdsburg Electric
- City of Hercules
- City of Palo Alto Utilities
- Marin Clean Energy
- Pacific Gas & Electric
- San Francisco Public Utilities Commission
- Silicon Valley Power

The following subsections review the key issues that must be addressed to minimize the potential for negative impacts to the grid as a result of high rates of PEV adoption. We first consider the potential impacts of PEV deployment on the grid, focusing on the **load and transformer impacts**, with implications for the San Francisco Bay Area highlighted to the extent possible. Following the review of potential impacts, we review the **pricing and incentives** that utilities are employing to minimize the negative impacts of PEVs in the near-term, as well as the importance of **utility notification** in the planning process. Finally, we consider the integration of **renewable energy** purchasing or deployment with the charging of PEVs.

As the largest utility in the Bay Area and Monterey Bay Region, Pacific Gas & Electric (PG&E) has taken a leading role in PEV readiness. PG&E has worked closely with local and regional stakeholders to communicate the importance of utility notification protocols for new EVSE installations, particularly in residential applications. PG&E has also proposed two new PEV rates that are aligned with the goal of maximizing PEV charging during the off-peak hours, EV-A and EV-B. Both PEV rates are non-tiered, which means that the cost of electricity does not increase the more electricity you consume as is typical for all other residential rates. For the new EV rates, off-peak charging of PEVs is at a significantly reduced rate to the consumer, roughly $0.10/kWh during off-peak hours to $0.35/kWh during on-peak hours. Thus, the PEV rates do not discourage increased electricity consumption that is associated with charging

PEVs. EV-A is a "whole-house" rate designed so that customers do not need to install a separate meter to monitor the PEV's electricity consumption. Instead, under EV-A, the entire home's electricity consumption is given the PEV rate. EV-B is designed to allow customers to monitor only the PEV's electricity consumption and gives customers the option to have their home on a different rate. PG&E is planning phase out its current E-9 rates that discourage additional EV charging due to their tiered structure.

This section provides information on the projected impacts of EVs on electric utility systems and operation. Information is presented on changes in system peak demand, loading of distribution system transformers, and overall utility system operation when EVs are plugged in. This information is useful in determining the extent of potential utility system upgrades required by the increased load.

Potential Impacts on the Grid

Load Impacts

The nation currently consumes about 4.1 trillion kWh of electric energy each year. If 150 million light-duty EVs each consume 8 kWh of power a day, that would represent an additional 440 billion kWh of power consumed each year. If the power is consumed during off-peak periods, flattening the load curve, then costs could be lowered for all customers. However significant adoption of PEVs could create new peaks from 6:00-10:00 p.m. if PEV users charge their vehicles upon return from work.[51]

The Electric Power Research Institute (EPRI) performed a first-order macro-analysis showing that even in a very aggressive PEV market penetration scenario of achieving 30% market share and a combined installed base of 52 million vehicles in 2030, the impact on the grid capacity is only about 5-6% in the worst electrical grid use case (with all PEVs charging in summer on-peak periods at the same time).[52] According to the EPRI Prism study, smart grid investments, if successful in shifting 80% of this load to off-peak hours, can result in significant deferred capacity and reduce the grid capacity impact of PEV charging to between 1-2% of the total capacity (and a corresponding 4-5% increase in base load). If deferred capacity is valued at $800/kW, this improvement amounts to a significant industry-wide savings of about $42 billion in 2030.

A more moderate PEV market penetration scenario without making use of the smart grid and demand response resulted in less addition to grid capacity in the 1-2% range total in 2030 (as against a natural grid capacity growth rate of 1-2% annually). The effect of smart grid and EVs participating in demand response and energy efficiency programs on this moderate scenario resulted in less than 1% of on-peak load growth. Equivalent capacity deferment savings were found to be $15 billion in 2030.

Assumptions for the EPRI Prism study are given in Table 22 below.

[51] *Electrification Roadmap, Revolutionizing Transportation and Achieving Energy Security*, Electrification Coalition November 2009
[52] S. Chhaya and M. Duvall, *Impact of Plug-in Electric Vehicle Technology Diffusion on Electricity Infrastructure, Preliminary Analysis of Capacity and Economic Impacts,* EPRI 1016853, December 2008

Table 22. EPRI Prism Study Assumptions

Overall Assumptions	Market Penetration Scenarios	Grid Assumptions
All Vehicles charge at 120V, 1.5 kW All charging occurs at summer peak All vehicles uniformly distributed across the entire system	30% total market penetration by 2030	Smart grid enables demand response, load control, and off-peak charging
	Adoption rates same as hybrid in past 10 years	Legacy system without capacity to influence charging times or duration

ARB reported on several studies performed by the DOE, EPRI and other regarding the impact of PEVs on the electric grid.[53] A 2007 DOE Study found the nation's supply of fossil-fuel-based, off-peak electricity production and transmission capacity could fuel up to 84% of the country's existing 220 million vehicles if they were all plug-in vehicles. The study assumed drivers would charge their vehicles overnight, when demand for electricity is much lower, and did not include hydroelectric, nuclear, renewable, or peaking power plants in its estimates. The study found that 15-23% of California's and Nevada's 26 million light-duty vehicles could be fueled with idle, off-peak electricity generating capacity within the California/Nevada study area.[54]

Research conducted by EPRI found that more than 40% of the nation's electric generating capacity sits idle or operates at reduced loads overnight and could accommodate tens of millions of PEVs without requiring new plants. This research also concludes that utilities could better utilize their power-generating assets by allowing for more efficient operation and gaining a new market for off-peak power that now sits idle.[55] The additional 1.8 million PEVs by the year 2020 are expected to increase the State's electric system load demand by 4.6 TW-hrs by 2020. If most of this additional demand is supplied by off-peak power, it is likely that PEVs would not create an adverse impact on California's supply of available electric power within the 2020 timeframe.[56]

The energy use and demand results from a CPUC analysis for PHEVs and BEVs are shown in Table 23.[57]

[53] *Proposed Regulation to Implement the Low Carbon Fuel Standard Volume I Staff Report: Initial Statement of Reasons*, California Air Resources Board, March 2009

[54] M. Kintner-Meyer, K. Schneider, and R. Pratt, *Impacts Assessment of Plug-in Hybrid Vehicles on Electric Utilities and Regional U.S. Power Grids Part 1: Technical Analysis*, PNNL, 2007

[55] Driving the Solution: The Plug-In Hybrid Vehicle, Lucy Sanna EPRI Journal, 2005

[56] These assessments do not include impacts on local feeders and distribution circuits in areas with high concentrations of electric vehicles needing charging from the grid.

[57] *Light-Duty Vehicle Electrification in California: Potential Barriers and Opportunities,* Staff White Paper, Policy and Planning Division, CPUC, May 2009

Table 23. Energy Use and Demand Impacts of Low, Medium and High EV Penetration Scenarios

EVs in 2020	GWh/yr	GWh/Yr % increase	Peak Load MW increase	Peak Load MW % increase
3,000 BEVs 58,000 PHEVs	202	0.1%	10	0.01%
33,000 BEVs 312,000 PHEVs	1,136	0.3%	56	0.08%
455,000 BEVs 2,500,000 PHEVs	9,645	3.0%	474	0.64%

The upper bound is a 3% increase in electricity generation and a 0.64% increase in peak demand. Each million PEVs would add 2.4-4 TWh of consumption, at a cost to consumers of $0.24-$1.2 billion. The results of this study demonstrate how PEVs can provide more efficient use of utility assets and therefore potentially lower rates.

For the planning horizon of this particular effort, the potential for negative grid impacts are minimal and are largely limited to intense clustering of PEVs in areas with stressed infrastructure. For instance, a CPUC report cited a Southern California Edison (SCE) analysis that shows potential load shifts and increases in load (shifting the peak from the 4:00 to 5:00 p.m. window to about 7:00 p.m. and adding demand for several thousand MW by 2020) that could be substantial if a *large* number of PEV *customers plug in and charge immediately upon returning home from work*. The CPUC staff found that in the extreme worst case uncontrolled scenario, when 3 million PEVs were plugged in simultaneously, the added connected load will be 5,400 MW if a 120 V connection is used and 19,800 MW for 220V outlets. The scenario for 3 million PEVs deployed in California by 2020 was considered the high estimate. The long-term potential for PEVs and the increased electricity consumption they might require is highlighted by an analysis from Oak Ridge National Laboratory, which found that if 25% of the U.S vehicle fleet (more than 60 million vehicles nationwide) were PEVs, and all charged at 6:00 p.m., then up to 160 new power plants will be needed nationwide. These projected increases will require a corresponding 20% increase in renewable generation to comply with RPS requirements.[58] These numbers are provided to highlight the potential long-term impacts of PEV adoption; however, the timeframe for making these grid requirements (e.g., significant increased capacity, widespread transmission upgrades, etc.) are beyond the planning horizon for this Plan.

Transformer Impacts

Although the initial penetration of PEVs is expected to be low, local distribution equipment (at the individual residential block level) can contribute to premature failure if several neighbors plug in their vehicles during peak demand. To avoid this potential issue, utilities need to communicate with PEV owners at the time of purchase to that they can track where they will be most frequently charged.

[58] *Light-Duty Vehicle Electrification in California: Potential Barriers and Opportunities,* Staff White Paper, Policy and Planning Division, CPUC, May 2009.

An EPRI presentation[59] discussed transmission and distribution issues with calculations performed at the distribution system level (at the house using circuit models and loading) and the higher level substation level (using aggregate feeder loading). The high level loading addressed the sensitivity to vehicle penetration, vehicle types, different charging patterns and customer habits and characterized the aggregate impact of these factors. Specific utility results were incorporated into micro-level analysis to investigate loading profiles of distribution assets. EPRI developed scenarios using information from various sources on PEV market penetration, PEV charge spectrum and profile, customer charging habits and battery state of charge based on miles driven. The scenarios included the following assumptions:

- At any time no less than 50% of cars are at home and most end up at home each day.
- At any given time a maximum of 12% of people are arriving home and will begin charging.
- Most arrive home during peak electricity use hours.
- By 8:00 p.m., 70% of drivers have arrived home.
- 74% of trips involve less than 40 miles per day.

Profiles were calculated for uncontrolled charging using the following charge profile:

- 50% at 120 V or 1.44 kW
- 20% at 240 V or 3.3 kW
- 30% at 240 V or 6.6 kW

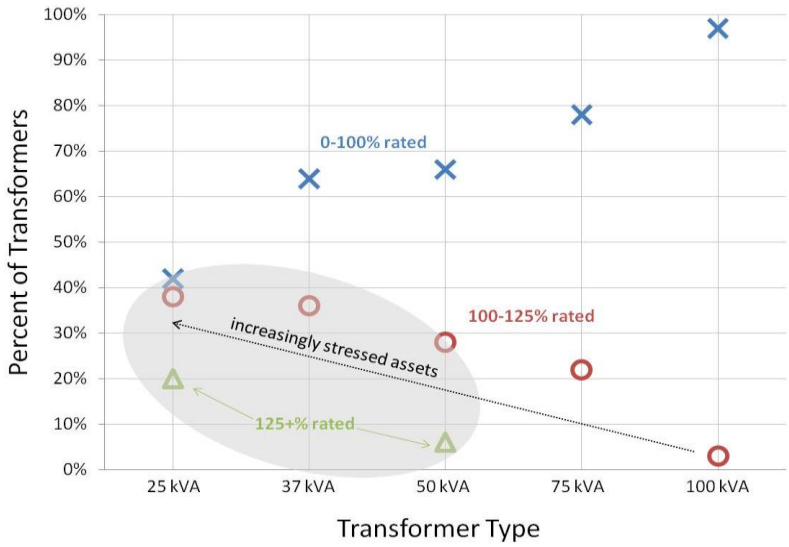
The peak load of about 500 W per vehicle occurs at between 5:00-7:00 p.m. and lasts longer into the evening. If all the PEVs are BEVs then the peak load is about 700 W per vehicle and still occurs at around 5:00-7:00 p.m. and lasts into the evening.

PEVs are likely to be concentrated in particular neighborhoods. Particularly, with respect to older equipment, assets may already be stressed with many 25 kVA transformers already operating with narrow margins today, as shown in Figure 12. Transformers typically serve five to fifteen households. The peak load of about 500 W per vehicle occurs at around 5:00-7:00 p.m. and lasts longer into the evening. If all the vehicles are BEVs then the peak load is about 700 W per vehicle and still occurs at around 5:00-7:00 p.m. and lasts into the evening.

Vehicles can be concentrated in particular neighborhoods. Assets may already be stressed with many 25 kVA transformers already operating with narrow margins today, as shown in Figure 12. Transformers typically serve five to fifteen households.

[59] A. Maitra, *Effects of Transportation Electrification on the Electricity Grid*, EPRI, Plug-In 2009 Conference, August 11, 2009

Figure 12. Transformer Loading by Transformer Size



Source: Figure modified from A Maitra, *Effects of transportation electrification on the grid*, Plug-In 2009 Conference, Long Beach, CA, August 11, 2009.

Figure 13 shows overloading for different transformer voltages. Asset overloading can increase quickly as PEV charging comes on line. With medium rate charging, it takes less than one PHEV per household to significantly increase the loading on local distribution transformers. The impact of PHEVs and EVs on transformer loading and utility upgrades requires further analysis.[60]

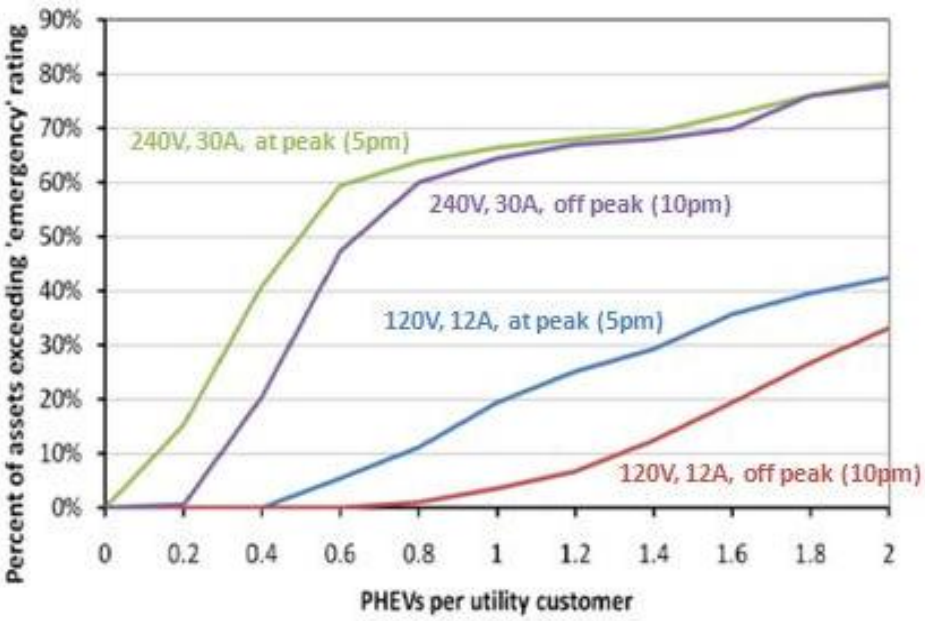
Distribution system impacts including transformer stress could occur due to clusters of EVs increasing loading beyond capacity. Encouraging customers to charge when load is low is important. Rate design and demand response options are targeted to mitigate these issues.[61]

Utilities will need to upgrade transformers in some areas. Understanding where PEVs will charge is critical to this task and increased coordination amongst different stakeholders is essential to allow utilities to receive this information. The last transformer in the network prior to electricity being delivered to residential customers reduces the voltage to 220 volts. These transformers typically serve between five and fifteen homes, often with a relatively small margin of excess capacity. PEV charging represents a significant power draw for most U.S. homes. A Level 2 charger operating at 220 volts on a 15 amp circuit is expected to draw 3.3 kilowatts of power, a load that is equivalent to between 50-100% of the average load in a typical home. Utilities will need to upgrade their transformers to accommodate this additional load and should be able to do this as rate-based infrastructure improvements.[62]

[60] *Effects of Transportation Electrification on the Electricity Grid*, A. Maitra, EPRI Plugin Conference, Long Beach, CA, August 11, 2009.

[62] A typical peak demand for an average single family residence is about 5 kW. Thus a PEV charging at 3.3kW would represent a bit more than 50% of one additional house and a PEV charging at 6.6 kW or 7.7kW would exceed the peak demand of one house. The coincidence of the PEV demand and the system or feeder peak demand is a subject for detailed analysis.

Figure 13. Transformer Overloading at Different Transformer Voltages



Source: A Maitra, *Effects of transportation electrification on the grid*, Plug-In 2009 Conference, Long Beach, CA, August 11, 2009.

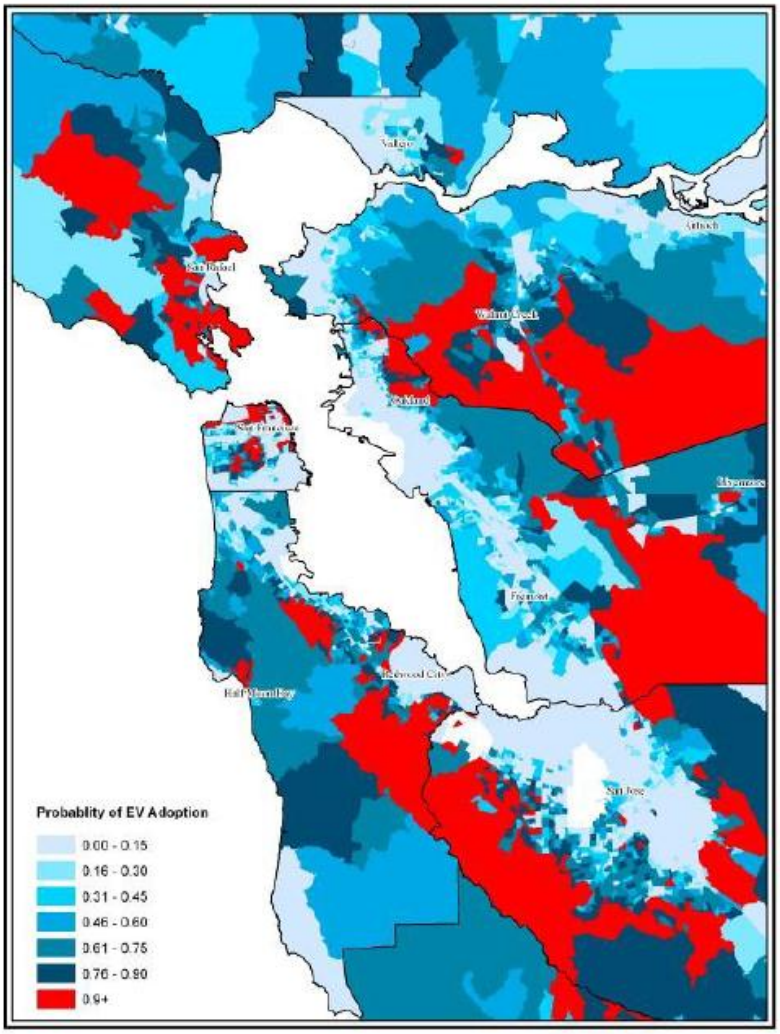
Clustering

PG&E identified the areas in the service territory where PEVs were likely to be located using a linear discriminant analysis to identify the characteristics of potential PEV customers. Figure 14 below highlights PG&E's estimates regarding the probable level of PEV adoption in the San Francisco Bay Area and displays the classification coefficient for each census block group. The census block groups identified as *least likely* to *most likely* to have dense concentrations of PEVs range from pale blue to red. The white areas are not a part of PG&E's electricity distribution area. The areas with the highest levels of probable adoption are concentrated in San Francisco suburbs, Monterey, and the suburbs of Sacramento.

According to a study by the University of California, Berkeley, the current California grid (defined as the CAMX grid within the study), is capable of handling a significant number of PEVs, as long as utilities policies promote off-peak charging.[63] This coincides with the study by PG&E, which did not anticipate the need for system level planning (used to determine the needs for generation and bulk transmission infrastructure) based on projected PEV loads. However, even if customers primarily charge during off-peak hours, this assumes a homogenous distribution of PEVs, which is not the case according to demographic data from PG&E (Figure 14).

[63] DeForest, N., et al., "Impact of Widespread Electric Vehicle Adoption on the Electrical Utility Business – Threats and Opportunities," University of California, Berkeley, August 2009, pp. 13-16, available online at: http://cet.berkeley.edu/dl/Utilities_Final_8-31-09.pdf.

Figure 14. Probable level of PEV adoption in the San Francisco Bay Area[64]



Pricing and Incentives

Time of Use Tariff Structures

Some utilities have opted to charge higher rates during times of peak demand and lower rates during off-peak hours through time of use (TOU) tariff structures. Historically, TOU tariffs have motivated consumers to use electricity during off-peak hours to prevent high utility bills. Technological solutions to reduce grid impacts and minimize costs for consumers include smart charging technologies, which track daily usage patterns and restrict charging to periods when surplus electricity is available.

[64] Swanson, J., Aslin, R, and Yucel, Z., "Electric Vehicle Penetration Study Using Linear Discriminant Analysis," Pacific Gas & Electric Company, June 2011, p. 8, available online at: http://www.energy.ca.gov/2012_energypolicy/documents/2012-02-23_workshop/comments/Pacific_Gas_and_Electric-Electric_Vehicles_Penetration_Study_2012-03-01_TN-63900.pdf.

Currently, many different time-variant structures exist and each has advantages and disadvantages. Since many utilities are just beginning to experiment with demand management, different regions may find different combinations more beneficial. Some of these time-variant structures include:

- **Whole-house Time of Use with One Rate** – this rate has both the house and the PEV on the same rate with one meter. This type of rate encourages electricity consumption during off-peak hours. One of the primary benefits of this rate is that it avoids the need and costs associated with a second meter. The primary requirement to achieve lower bills on this type of rate is that customers need to adjust their typical behavior to minimize the amount of electricity consumed during peak hours and maximize the amount of electricity consumed during off-peak hours.
- **Fixed fee/fixed fee off-peak** – this rate requires PEV owners to pay a flat monthly fee for unlimited charging (the time could be restricted, such as limiting to off-peak charging). Though this rate is easy to use for both the utility and the customer and doesn't require the use of a second meter, the rate may not necessarily encourage use during off-peak periods.
- **Two-meter house with high-differential pricing** – this rate has the house and the PEV on the different rates with one meter for the house usage and another meter for the PEV consumption. This encourages electricity consumption during off-peak hours for the PEV and allows the house to be on a normal residential rate, such as a flat rate. One of the primary benefits is that it allows the residents of the house to continue consuming as before without any disincentive to consume during peak hours. The primary requirement to achieve lower bills on this type of rate is that customers need to adjust only their PEV charging times to maximize the amount of electricity consumed during off-peak hours. The disadvantage of this rate structure is the need and costs associated with installing a second meter.
- **Sub-metering off PEV charging circuit with high-differential pricing** – This rate is similar to the two-meter house rate, except the PEV charging circuit is sub-metered and simply subtracted from main meter use. The advantages of this rate are that it is appropriate for MUDs, potentially less expensive for customers, and allows for differential pricing. However, these rates are typically experimental at this time, and may not be available at all.
- **Demand response (can be combined with options above)** – in this rate structure, the utility enters into a contract with a user or an aggregator to control the power flow to PEV during high load times or provide a financial incentive for reduced charging level. This feature may be especially useful for local grids near 100% capacity and for providing other grid services to the utility. However, poorly implemented demand response programs by the utility or aggregator could inconvenience PEV drivers if the battery is not charged to the desired level when needed.

Utility Incentives

Table 24 below provides a sample of utility pilot programs offering EVSE incentives and special PEV rates. This list includes a review of pilot programs and the potential applicability of projects to the Region. Other utilities around the country provide TOU rates specific to PEVs, EVSE

purchase and installation incentives, and even PEV purchase incentives. For more information refer to the Driveclean.ca.gov website, which includes relevant utility incentive descriptions.[65]

[65] California Air Resources Board website, http://www.driveclean.ca.gov/

Table 24. Utility Pilot Programs with PEV rates and EVSE incentives

Utility/Location	Pilot Program Name	Incentive Type	EVSE Included	PEV Rate
Austin Energy Austin, Texas[66]	Plug-in Everywhere	Rebate up to $1,500 for Level 2 EVSE	Level 2 EVSE installed ; need pre-approved contractor	None
Consumers Energy Michigan[67]	PEV Incentive Program	Rebate up to $2,500 for purchase and installation of Level 2 EVSE; limited to first 2,500 participants	Must supply EVSE	Option 1: no additional meter - combines PEV and household usage Option 2: second meter, TOU rate Option 3: second meter; flat rate for PEV only, limited to 250 participants
Dominion Resources (DOM) Virginia[68]	EV Rates Pilot	PEV-specific pricing rates; each rate plan limited to first 750 participants	Must supply EVSE	Requires installation of second meter to be supplied by DOM; Off-peak 8 hour window; in EV + Home Pricing Plan meter is replaced by interval meter which allows DOM to read in 30 second increments
DTE Energy Michigan[69]	Plug-in Ready Option 1	Rebate up to $2,500 for installation of a separately metered Level 2 EVSE; limited to first 2,500 customers participants	Level 2 EVSE provided and installed by SPX; DTE installs second meter	D1.9 (EV TOU Rate); $40 Monthly Flat Rate available to the first 250 customers
Duke Energy North & South Carolina[70]	Charge Carolinas	Rebate up to $1,000 of installation costs for residential customers	Level 2 EVSE provided w/ maintenance; can purchase the EVSE for $250 at end of pilot	None
Duke Energy Indiana[71]	Project Plug-IN	Rebate up to $1,000 of installation costs for residential customers and $1,500 for commercial customers	Level 2 EVSE provided with maintenance for the duration of the pilot program	None

[66] Austin Energy, "Plug-In Partners," accessed March 13, 2012, http://www.austinenergy.com/About%20Us/Environmental%20Initiatives/Plug-In%20Partners/index.htm.
[67] Consumers Energy, "Plug-In Electric Vehicles," accessed March 13, 2012, http://www.consumersenergy.com/content.aspx?ID=3363.
[68] Dominion Power, "Plug-In Electric Vehicles," available online at: http://dom.com/about/environment/electric-vehicles.jsp.
[69] DTE Energy, "Powering Your Energy Future," available online at: http://www.dteenergy.com/residentialCustomers/productsPrograms/electricVehicles/overview.html.
[70] Duke Energy, "Plug-in Electric Vehicles (PEVs)," available online at: http://www.duke-energy.com/plugin/default.asp.
[71] Duke Energy, "Plug-in Electric Vehicles (PEVs)," available online at: http://www.duke-energy.com/plugin/default.asp.

Utility/Location	Pilot Program Name	Incentive Type	EVSE Included	PEV Rate
Hawaiian Electric Company Hawaii[72]	EV Pilot Rates	Participants receive new TOU meters free of charge; limited to first 1,000 participants on Oahu, first 300 in Maui, and first 300 on the Island of Hawaii	Must supply EVSE; load control and load monitoring devices will be installed free of charge	Customers enrolling on the TOU-EV or Schedule EV-R rates will have a new meter installed exclusive for PEV charging. The rate EV-R customer's existing load will remain on the existing meter and account
LADWP Los Angeles, California[73]	Charge Up LA!	Rebate up to $2,000 for purchase and installation of Level 2 EVSE; limited to first 1,000 participants	Must supply EVSE	EV TOU rate available and requires separate meter; PEV discount of 2.5 ¢/kWh during off-peak, nighttime hours, and on weekends
SMUD[74] Sacramento, CA	Discount Rate	Discount rate for residential customers that own or lease PEVs and install a time-of-use meter at the charging location	Must supply EVSE	Discount of 2.43 ¢/kWh off the winter off-peak residential rate and 2.71 ¢/kWh off the summer off-peak residential rate. Customers must provide proof of vehicle registration
SDG&E[75] San Diego, CA	Clean Transportation Program	Two time of use (TOU) discount rates are available for PEV charging	Must supply EVSE	The TOU rate is available to residents in single family dwellings flats and apartments. The super off peak rate is 14.5 ¢/kWh
SCE[76] Los Angeles, CA	Discount Rate	Two time of use (TOU) discount rates are available for PEV, NEV and golf cart charging	Must supply EVSE	The first rate provides discount of 8.1 ¢/kWh for off-peak summer; 9.2 ¢/kWh for off-peak winter. The second rate provides discounts for off-peak and super off-peak as well as a peak time rebate

[72] Hawaiian Electric Company, "Residential EV Pilot Rates," available online at: http://www.heco.com/.
[73] Los Angeles Department of Water and Power, "Charge Up L.A.! Utility Support for Electric Vehicles," available online at: http://www.caletc.com/wp-content/uploads/2012/01/LA_DWP_LA_Auto_Show_Nov_20111.pdf.
[74] Sacramento Municipal Utility District, "PEV Rates," available online at: https://www.smud.org/en/residential/environment/plug-in-electric-vehicles/PEV-rates.htm.
[75] San Diego Gas and Electric, "EV Rates," available online at: http://sdge.com/clean-energy/electric-vehicles/ev-rates.
[76] Southern California Edison, "Rate Information – Residential Rates," available online at: http://www.sce.com/CustomerService/rates/residential/electric-vehicles.htm.

Utility Notification

PEV consumer notification programs are typically voluntary data provided to the utility by automakers, dealers, third-party organizations, and utility customers. The information provides insights into where new PEVs are charging or housed and allows the utility to evaluate if the local distribution system is adequate to serve PEV charging needs. In California, advance notification began on an ad hoc basis, but in July 2011 the California Public Utilities Commission (CPUC) directed utilities to conduct an assessment of early notification efforts and evaluate opportunities to formalize the process.

In a joint report with SCE regarding PEV notification,[77] PG&E identified the following requirements for notification data needs to meet its needs:

- **Comprehensiveness**: To ensure grid reliability, safety and stability, PG&E would require data to be as comprehensive as possible to properly anticipate areas where transformer loading is nearing failure. This would include data for charging locations for not only new PEVs, but used PEVs or use resulting from a change of address. PG&E estimated it had captured 80% of new PEVs sold in the service territory using existing notification processes.
- **Granularity**: The location information should be as specific as possible, ideally with a street-level address as opposed to a zip code or city block. The data should also include charging levels to evaluate potential demand and impact on circuits. Though privacy and confidentiality concerns exist, PG&E expressed commitment to protecting customer data in compliance with applicable regulations and laws. Currently, OEMs are sharing notification data at the street address level, but may require PG&E to pay for supplemental reports including delivery date to customer.
- **Timeliness**: Utilities would prefer notification of new EVSE prior to the installation in order to identify potential distribution infrastructure issues resulting from incremental coincident peak loading. Currently, a reporting period from OEMs and other third parties has not been standardized and should be addressed.
- **Scalability**: As the PEV market becomes more mature, PG&E has expressed concern about the amount of manual activities required to collect data, and that unless they could become automated in some way, the process would not scale well with increased PEV adoption. Notification sources could provide data in a standardized way that would allow it to be automated. Currently, reports provided by OEMs are based on internal processes and will require additional automation to be able to be useful at higher PEV adoption rates.
- **Costs**: PG&E expressed concern about potential internal and external costs for obtaining notification data, including the costs to secure notification commitments from third parties and analysts to compile the data. Though costs are currently not high, there is a potential for costs to increase in the future and options to mitigate notification costs will be evaluated.

[77] Southern California Edison Company, "Joint IOU assessment report for PEV notification," December 2011, p. 14, available online at: http://docs.cpuc.ca.gov/efile/REPORT/156710.pdf.

According to the same report, [78] the primary methods PG&E uses to collect PEV data in its service territory include data provided by OEMs, such as General Motors and Nissan. GM's regional manager for California provides data to PG&E on a biweekly basis and Nissan shares data quarterly through its third-party analytics firm, Oceanus. ECOtality provides PG&E weekly reports on its Level 2 charger installations. Individual customers also contact PG&E by phone or via its on-line PEV reporting tool to schedule a service appointment or discuss the EV rate options.[79] As of the end of March 2012, PG&E estimated 3,096 PEVs were owned or operated by customers in its service territory, but at that time did not track PEV ownership over time except to the extent an individual customer required service planning support or an EV rate option.[80]

Through recent legislation, utilities are also able to get data for vehicles registered with the State of Californian directly from the Department of Motor Vehicles (DMV). Senate Bill 859 (SB 859, Padilla, Statutes of 2011), sponsored by the California Electric Transportation Coalition (CalETC), LADWP and SMUD, authorizes California utilities to obtain PEV registration data from the DMV; however, the law also imposes restrictions on how to use DMV data to protect consumer privacy.[81]

Integrating Renewable Energy with PEVs

Investor owned utilities (IOUs) in California are at various stages of preparedness regarding the deployment of PEVs. Based on research, the IOUs in California – PG&E, SCE and SDG&E– have not prioritized providing opportunities for PEV drivers to purchase greener electricity for charging i.e., green charging. The IOUs are currently focused on ensuring that the PEV customers and their neighbors have reliable service, which includes, but is not limited to, interconnection, ensuring that distribution infrastructure is sufficient for residential EVSE (especially in areas where PEV purchasers may be clustered), and interfacing with EVSE providers to facilitate PEV deployment.

10.2. Gaps and Deficiencies

Clustering

Though the generation and transmission capacity may be sufficient to serve a statewide PEV adoption rate of a certain percentage, in local areas where city or neighborhood adoption rates are much higher, the local distribution grid may not be sufficient resulting in the overloading of the local distribution grid and causing premature degradation of infrastructure such as pole-top transformers and decreased reliability.

[78] Pacific Gas & Electric Company, "Filing of Information in Response to Administrative Law Judge's Ruling," March 2011, p. 4, available online at: http://docs.cpuc.ca.gov/efile/RESP/166108.pdf.
[79] Pacific Gas & Electric Company, "Contact PG&E to get plug-in ready," available online at: http://www.pge.com/myhome/environment/whatyoucando/electricdrivevehicles/contactpge/.
[80] Pacific Gas & Electric Company, "Filing of Information in Response to Administrative Law Judge's Ruling," March 2011, p. 4, available online at: http://docs.cpuc.ca.gov/efile/RESP/166108.pdf.
[81] Senate Bill No. 859, Chapter 346, Padilla, Vehicles: records, confidentiality. Available Online: http://leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_859_bill_20110926_chaptered.pdf

The clustering of PEV loads may be one of most immediate threats to utilities in the Bay Area and Monterey Bay Region, and accordingly each utility should examine the structure and condition of the local distribution grid as it relates to the potential for local PEV clusters. In order to avoid serious or long-term degradation of electricity reliability, PG&E and other local utilities will need to continue to evaluate the efficacy of existing utility notification protocols and refine the PEV adoption model to provide additional insight to local transmission planners responsible for projecting local area loads and ensuring sufficient infrastructure exists.

Congestion and Exceeding Capacity

Even if Bay Area and Monterey Bay Region utilities are able to overcome the threat of local clusters, long-term challenges will be created by high levels of PEV adoption. If PEV loads were to push peak demand higher, there will be additional costs to ensure that sufficient generation capacity is available to meet consumer demand. Shifting PEV loads to off-peak hours will mitigate the increases in peak demand.

Municipal Utility Gaps

Despite PG&E's leadership, other utilities serving Bay Area and Monterey Bay Region communities will need support from local communities regarding issues such as notification protocols and understanding potential demand for PEVs in order to assess the potential impact on local distribution infrastructure. These utilities should consider adopting TOU rates to encourage off-peak charging, comparable to those outlined previously from PG&E.

10.3. Rate Structures, Provisions, and Billing Protocols for PEVs

Utilities in the Region have a variety of different rate structures, provisions and billing protocols – only a few of which are specifically designed for PEVs. There are a variety of opinions concerning consumer fairness and equity concerning PEV rate structures and provisions, particularly as it relates to public utilities obligated under California's Proposition 26. Proposition 26 was a regulation passed in 2010 which limits the ability of a public utility to provide subsidies to a subset of a rate class, which in this case may be PEV drivers. Fairness and equity is an issue that utilities in the Region, and elsewhere, will need to consider when developing experimental or permanent rates in the future. Another potential barrier to PEV adoption is the prevalence of tiered residential rate structures among the utilities in the Region. California has long used the tiered structure to incentivize conservation. Unfortunately, the tiered rate structure does not take into account the environmental benefits of PEVs and in many cases could result in significantly higher utility bills for the average PEV driver.

The subsequent sections outline the current rate structures available to PEV drivers in the Region with scenarios for residential consumers using demand curves generated by The EV Project through a partnership with ECOtality and Bay Area utilities and stakeholders. The data have been accrued from the inception of the project in 2010 through June 2012 and most closely represents the average monthly charging patterns of PEV owners in the Region.

This section does not analyze the costs for public or workplace infrastructure due to the prevalence of PEV rates targeted at residential customers and the wide diversity of commercial and industrial rates. Additionally, unforeseen grid impacts may be far more acute at the residential sector than within public or workplace charging locations. Public infrastructure using Level 2 and DC Fast Charging is much more likely to go through a utility notification process due to the energy requirements and likelihood of a system upgrade than a residential system.

Alameda Municipal Power (AMP)

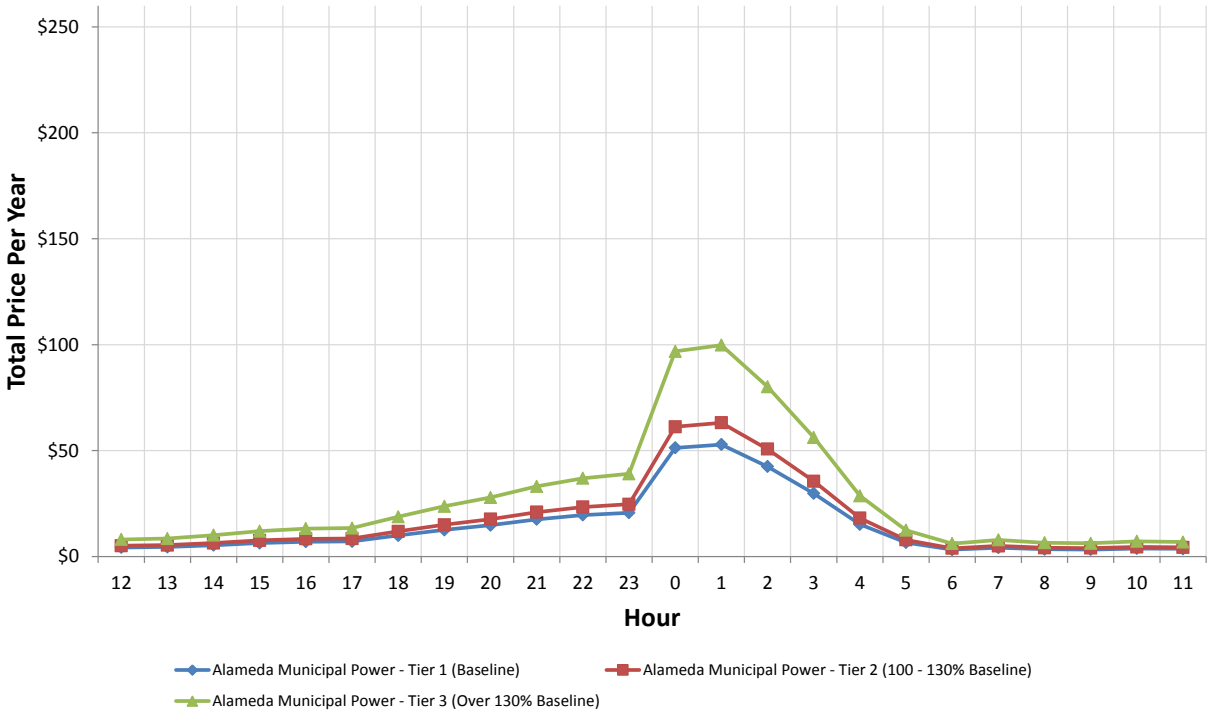
The Alameda Municipal Power (AMP) currently offers an experimental PEV discount, which is applicable to customers operating registered, street-legal PEVs with a vehicle weight between 750 and 8,000 lbs., to privately-owned golf courses operating electric golf carts, and to electric fleet operations. The program is voluntary and will remain in effect until AMP implements a superseding TOU rate schedule for PEVs or until cancelled by the Public Utilities Board. The EV-X discount will be applied to the charges under the applicable residential (D-1 or D-2), commercial (A-1, A-2, A-3, A-4, CT, or OL) or municipal rate schedules (MU-1, MU-2, or MU-3).

In order to get the discount the customer must agree to charge the vehicle during off-peak hours (between 8:00pm and 8:00am) Monday through Friday and anytime on the weekends and holidays. The discount cannot be greater than the total charges for the month and if the average monthly usage falls below a certain level without proper justification (e.g., vacation); AMP can remove the customer at any time from the EV-X discount program. With the exception of golf carts and fleet electric vehicles, a separate electric meter is not required, but the utility may incorporate one for research and forecasting purposes. Customers may be asked to participate in an energy audit and a customer survey and must re-qualify for the rate annually by submitting an application and proof of registration. The total annual discount for a Very Light Duty Vehicle (750 lbs.–1,999 lbs. GVW) is $108 per year, for a Light Duty Vehicle (2,000 lbs. – 4,999 lbs. GVW) is $180 per year, and for a Medium Duty Vehicle (5,000 lbs. – 8,000 lbs. GVW) is $252 per year. Commercially-operated golf carts and fleet vehicles may discount 50% of the sub-metered kWh. Considering the low kWh rates and the attractive EV-X discount, it is extremely cost-effective to operate a PEV in the AMP service territory. For purposes of demonstration, the D-1 Rate Schedule was analyzed using the EV-X discount. As shown in Table 25 below, the discounts for the Tier 1, 2, and 3 average annual costs are significant.

Table 25: Total Annual Cost with EV-X Discount for D-1 Rate Schedule Customers

Average Annual Cost per Tier	Vehicle Class	Total Annual Cost with EV-X Discount
Tier 1 (Baseline) $350 per year	Very Light Duty (750 lbs. – 1,999 lbs. GVW)	$242
	Light Duty (2,000 lbs. – 4,999 lbs. GVW)	$170
	Medium Duty (5,000 lbs. – 8,000 lbs. GVW)	$98
Tier 2 (100 - 130% Baseline) $420 per year	Very Light Duty (750 lbs. – 1,999 lbs. GVW)	$312
	Light Duty (2,000 lbs. – 4,999 lbs. GVW)	$250
	Medium Duty (5,000 lbs. – 8,000 lbs. GVW)	$168
Tier 3 (130%+ Baseline) $660 per year	Very Light Duty (750 lbs. – 1,999 lbs. GVW)	$552
	Light Duty (2,000 lbs. – 4,999 lbs. GVW)	$480
	Medium Duty (5,000 lbs. – 8,000 lbs. GVW)	$408

Figure 15: Alameda Municipal Power D-1 Residential Rate (without EV-X discount)



Note: In this figure, as in all subsequent figures related to estimate annual pricing for various rates, the x-axis goes from 12noon to 12noon; the midpoint of the graph is 12midnight.

City of Healdsburg Electric

The City of Healdsburg does not currently provide a special PEV rate and does not anticipate providing one in the future.[82] The utility does provide the E-7 Residential TOU rates for customers who can shift load to the off peak hours, which may benefit PEV owners, but according to a utility survey, very few customers take advantage of the TOU rates. Currently, the City is aware of two PEV charging stations within the service territory, both of which are privately-owned. The utility is under the impression these charging stations are operated during both peak and off-peak hours. At this time, the City has not promoted PEVs among utility customers due to a slow adoption rate in the area and the lack of requests for assistance from current PEV drivers.

The D-1 Residential Rate Schedule is comprised of four tiers which are each assigned a daily baseline quantity based upon the billing season. The tiers are set by a baseline quantity, 10.2 kWh per day for each tier in the summer (May 1 – October 31) and 10.8 kWh per day for each tier in the winter (November 1 – April 30). The tiers are designed to indicate annual average usage; first and second tier represent the average household consumption, while the third and fourth tier represent above average household consumption. For PEV customers with above average consumption, the E-7 Residential TOU rate may be a good option to consider. Below is a table portraying the costs for the D-1, Tier 2, 3 and 4 rates compared to the E-7 TOU rate using the average PEV electricity demand within the region. The D-1 Tier 2 rate comes in at the lowest price at $470 per year, but it may be difficult for the average household to accommodate both PEV charging needs and average residential consumption at the daily consumption levels required.

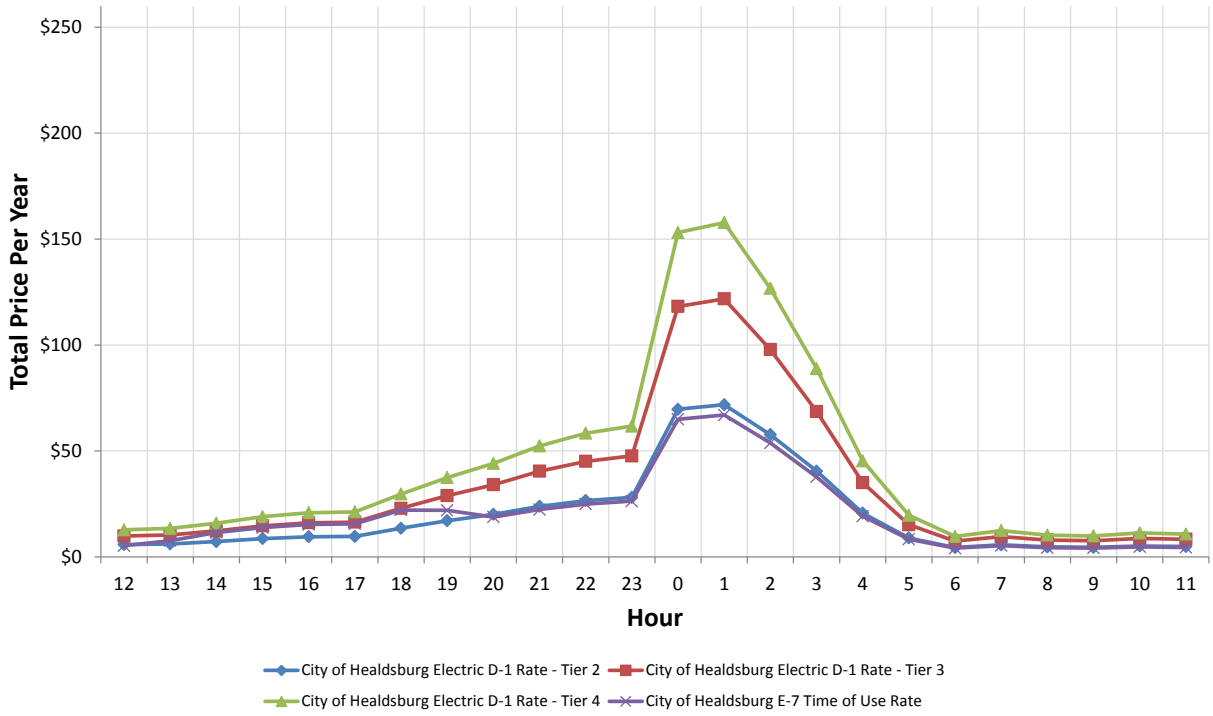
Table 26: Average Annual Cost for the City of Healdsburg D-1 Rate Schedule & E-7 Time of Use Rate

Rate	Daily Consumption	Average Annual Cost
E-7 Time of Use	Unlimited	$480
D-1 Tier 2	20.4 kWh/day summer 21.6 kWh/day winter	$470
D-1 Tier 3	30.6 kWh/day summer 32.4 kWh/day winter	$800
D-1 Tier 4	40.8 kWh/day summer 43.2 kWh/day winter	$1,040

Figure 16 below portrays the average expenses spread out over the course of the year by rate structure. The E-7 TOU rate does have a slight increase in cost over the D-1 Tier 2 rate, due to a slight increase in costs in the late afternoon.

[82] Email interview, Terry Crowley, Electric Director, City of Healdsburg, August 31, 2012.

Figure 16: City of Healdsburg D-1 Rate Schedule compared to the E-7 Time of Use Rate



The City does not have an official notification protocol for new EVSE. However, most EVSE would require a building permit, which would be issued by the City's Electric department and the City's Building department. To date, the City has not performed a detailed analysis of potential grid impacts to the service territory by PEVs. Until the customer adoption rate increases significantly, the City is not concerned about PEV integration. PEVs would only add a load to the system equivalent to a large hot tub or large AC unit, and customers generally add these appliances without significant impact to the system. The City has never experienced grid impacts in the past from the integration of other high energy demand equipment, and to minimize system consumption the City promotes energy efficiency through a variety of customer rebates.

The City has not made plans to integrate PEVs with smart grid technology or to minimize peak usage through the use of battery banks or solar systems. These options are far less cost-effective than shifting commercial AC peak load to off-peak periods through the use of chillers or ice-storage. The City is currently requesting proposals for a pilot program to install chillers on a municipal building. If the pilot project works as planned, roughly 35kW will be shifted to the off-peak period. This single "shift" will make room for roughly 5 PEV chargers or 10 households.

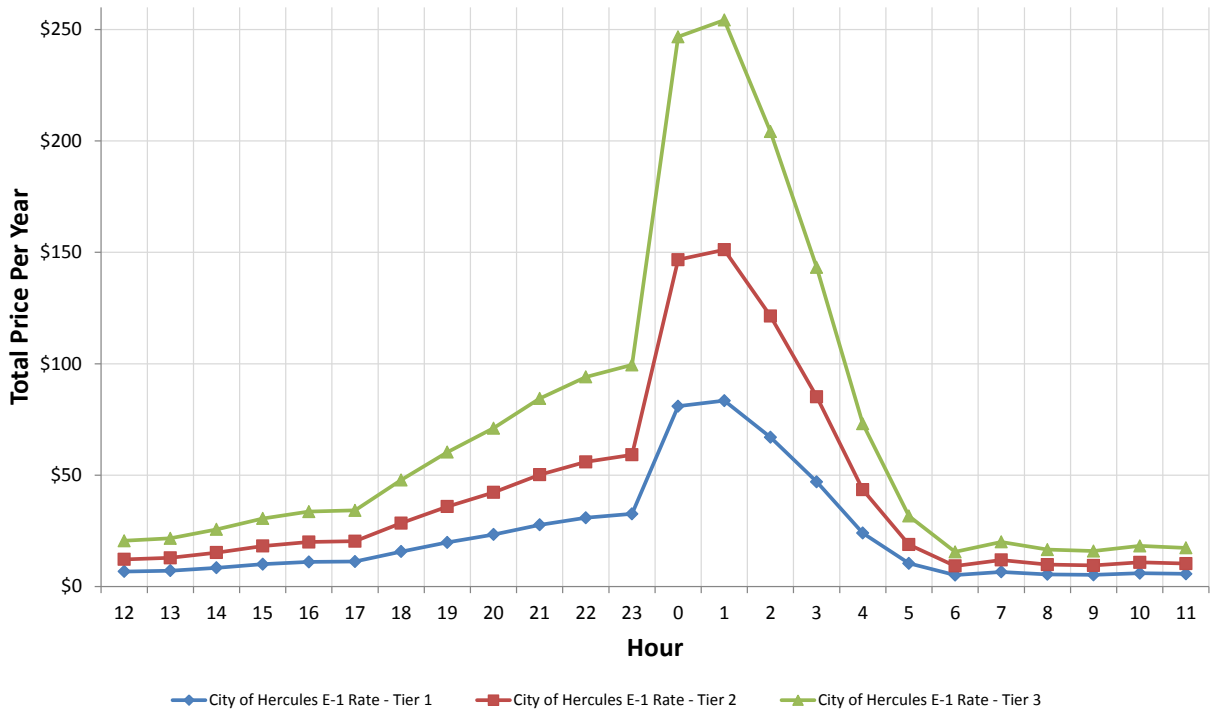
City of Hercules

The City of Hercules does not currently provide a special PEV rate and does not anticipate providing one in the future. The City also does not offer a Time of Use rate for customers. So far, the City has documented a few residents with EVSE in the service territory and permit residents to meter their EVSE separately to reduce their rates as needed, but only a few

customers have taken this option.[83] The City has not engaged in any type of public outreach or education for PEVs, other than demonstrating their commitment through the installation of two PEV charging stations at City Hall.

The City has an E-1 Residential Rate Schedule applicable to all residential customers receiving metered service and applies to customers in single family dwellings and apartments metered separately by unit. The rate includes a tiered structure which is based on daily energy consumption. Tier 1 is defined as using 0 – 12 kWh per day, Tier 2 is from 12 – 35 kWh per day, and Tier 3 is anything above 35 kWh per day. Figure 17 below demonstrates the average yearly costs by hour using the average PEV electricity demand within the region. If residents choose to meter separately, they could easily stay within the Tier 1 service level, spending an average of $550 per year. If residents chose not to meter separately they would most likely be charged at the Tier 2 rate for an average of $1,000 per year or Tier 3 rate for an average of $1,680 per year.

Figure 17: City of Hercules E-1 Rate Schedule



The City does not have any official notification protocols for the installation of PEV infrastructure, other than informal notification through City staff. The City also has not performed any research to analyze demand for PEVs in the service territory or potential grid impacts, but feels confident given the low number of PEVs to date that they could handle future loads. The City has never ever experienced grid impacts in the past from the integration of other high

[83] Email interview, John McGuire, Municipal Services Director, City of Hercules, August 29, 2012.

energy demand equipment. So far the City has not seen the need to integrate PEVs with smart grid technologies or to reduce peak demand with battery storage or renewable energy.

City of Palo Alto Utilities

The City of Palo Alto Utilities does not currently have a special PEV rate for residential customers, but intends to conduct a PEV pilot study of specialized time of use rates in the 2013 fiscal year. The Utilities Advisory Commission submitted a resolution to the Utilities Department in 2012 with an outline of the PEV pilot program rate and conditions.[84] It is expected that this resolution will be adopted in November or December of 2012.[85] The special PEV rate, also known as the E-1 EV TOU rate, would be based on the E-1 tiered rate structure with a rate reduction during off-peak hours from 11pm to 6am coupled with a rate increase from Noon – 6pm during summer peak. The TOU rate will require the entire house to be on the same rate; a secondary meter is not an option at this time in part due to the additional costs borne by customers and potential lack of interest.[86] The average annual cost to charge a PEV at the Tier 1, 2 and 3 rates, is approximately $300, $420 and $550 respectively. It is unlikely that a household could charge a PEV and maintain average household consumption at Tier 1, so most likely the household would be billed for the Tier 2 or Tier 3 rate.

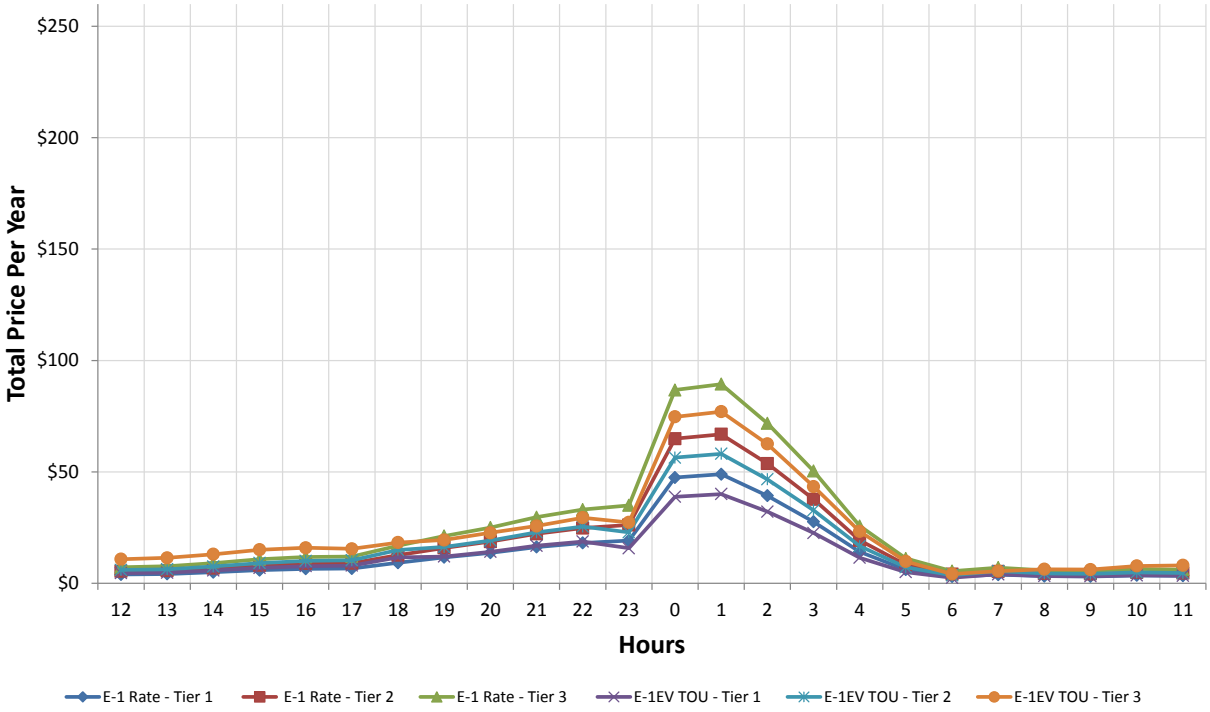
The City's tiered residential flat rate, otherwise known as the E-1 Residential Rate Schedule, is based on 10 kWh per day, regardless of the season. Based on PEV consumption data, it is likely that the average annual Tier 1, 2, and 3 rates would cost approximately $320, $440 and $600 per year respectively. Given the uncertainties surrounding the potential cost savings from the TOU rate, it is unclear whether or not customers will choose this rate. Based on information from the City of Palo Alto, the utility currently has a commercial TOU rate, which includes a demand charge. To date, no commercial customers have opted for this rate.

[84] City of Palo Alto Utilities Advisory Commission, "Memorandum," July 11, 2012, http://www.cityofpaloalto.org/civicax/filebank/documents/30094.

[85] Telephone interview, Shiva Swaminathan, Senior Resource Planner, City of Palo Alto Utilities, August 7, 2012.

[86] City of Palo Alto Utilities Advisory Commission, "Memorandum," July 11, 2012, pg. 5, http://www.cityofpaloalto.org/civicax/filebank/documents/30094.

Figure 18: Palo Alto Utilities E-1 Rate Schedule



The City estimates it currently has between 180 and 200 PEVs currently within its service territory of 25,000 residential and 4,000 commercial customer accounts. The City primarily educates its customers through its website, joint efforts with regional PEV groups, and through City policies, such as the Electric Vehicle Infrastructure Policy, which created recommendations to streamline city EVSE permitting processes and develop City public infrastructure guidelines.[87] The City also has five publicly-accessible charging stations in downtown Palo Alto which are free to the public.

The City does not have any official notification protocols for EVSE installations. However, the City does require permits for certain residential EVSE installations and the City building permit department notifies the Utilities Department when permits are approved. The City also obtains vehicle sales information from GM and Nissan as part of The EV Project. Based on preliminary growth projections from the CEC, Palo Alto may have an additional 3,000 to 10,000 PEVs in the area by 2020 which would increase consumption by 1–2%, however, it is not clear what specific grid impacts would occur under that scenario.

The City has taken precautions to prevent potential grid impacts by providing an EV TOU rate and through a demand response program that would reduce load during critical times. They currently have an on-going pilot project with a local organization which would include features such as remote disconnection of charging units and vehicles. However, the utility does not have

[87] City of Palo Alto, "Electric Vehicle Infrastructure Policy," December 19, 2011, http://archive.cityofpaloalto.org/civica/filebank/blobdload.asp?BlobID=29734.

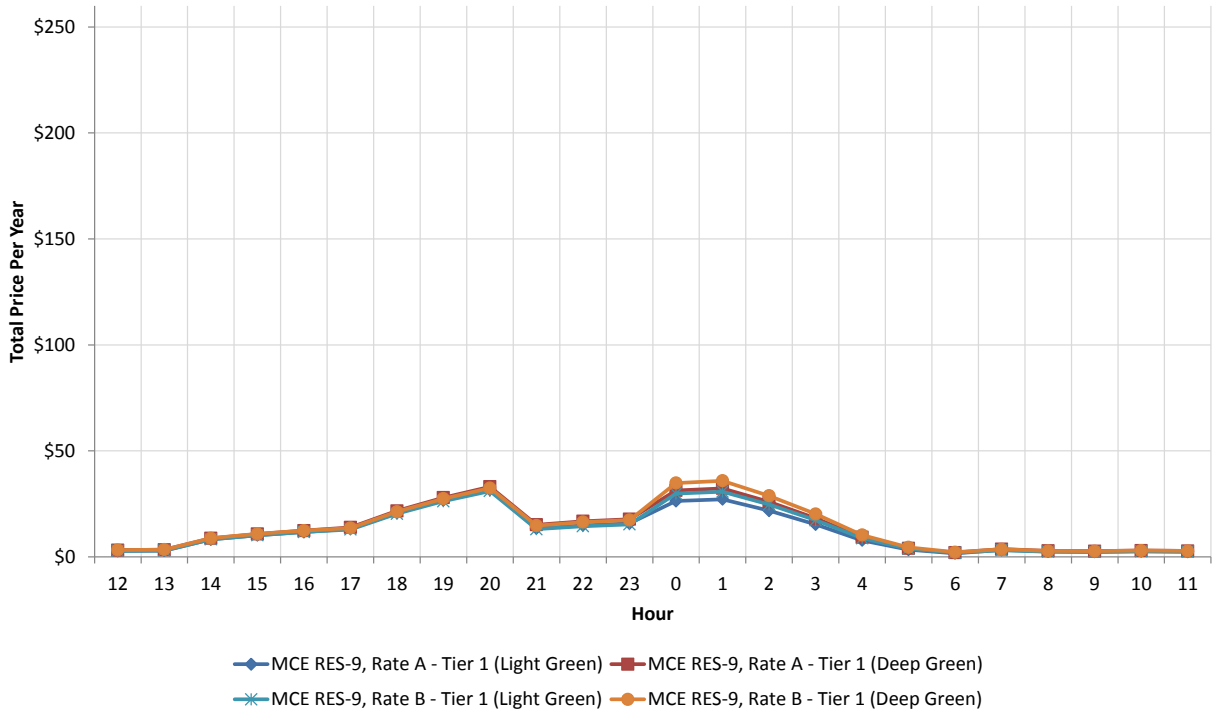
plans to immediately implement these programs at this time. Most of the current grid impacts experienced within the City are related to frequent power quality issues, more so than residential demand. The City does not have any future plans to promote PEVs through other incentives, such as rebates, and has not made plans to mitigate peak PEV charging through battery storage or renewable energy.

Marin Clean Energy (MCE)

Marin Clean Energy (MCE) is a non-profit electric service provider, which is governed by the Marin Energy Authority, and offers two renewable energy options for customers within the PG&E service territory. The Light Green option provides 50% renewable energy and the Deep Green option provides 100% renewable energy for an extra penny per kWh. MCE has a special PEV rate, known as the RES-9, which is comparable to PG&E's E-9 rate. Like all of MCE's TOU schedules, and due to transmission and distribution services from PG&E, the RES-9 schedule uses the same TOU periods to PG&E's current E-9 rate schedule. MCE also offers other flat rate and TOU options comparable to PG&E. The RES-1 is the equivalent flat-rate option to PG&E's E-1, and is tiered in the same way as PG&E's rates, via PG&E's Conservation Incentive Adjustment. For purposes of Figure 19, only Tier 1 rates and the current PG&E Schedule E-9 are shown, since MCE has not yet released their revised generation costs for the new PG&E Schedule EV.

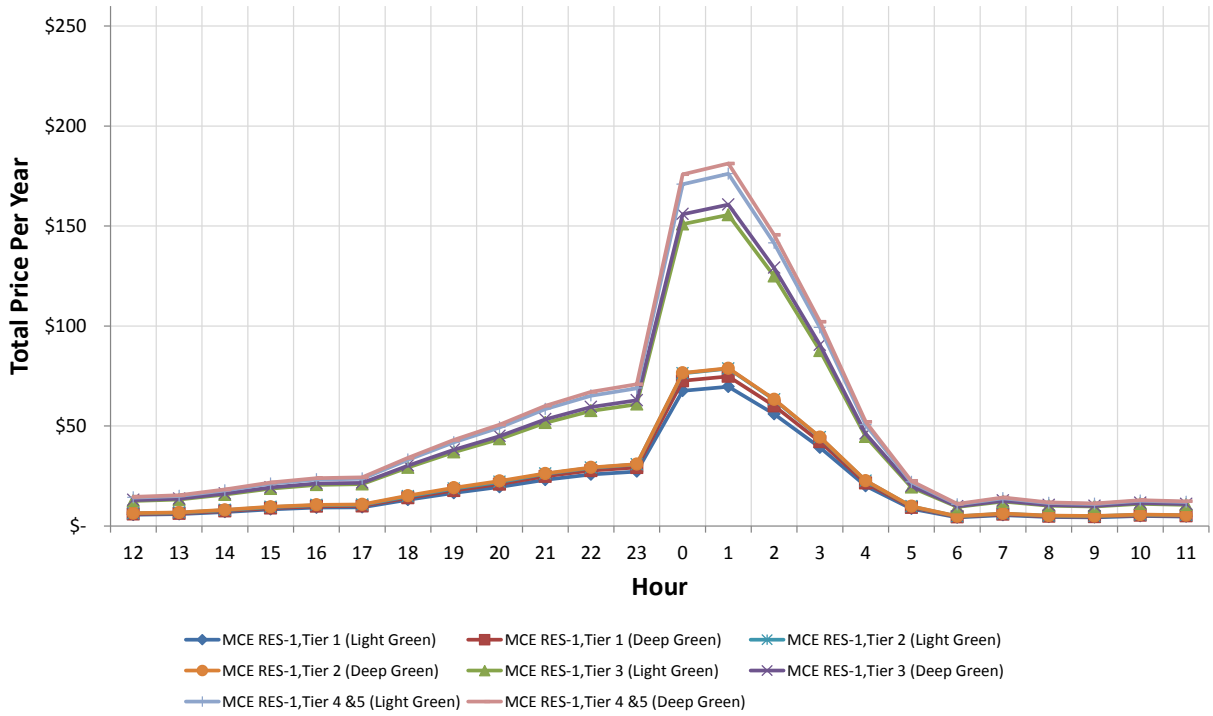
If a customer were to switch to MCE after July 2012, PG&E would charge a PCIA Fee of $0.00841/kWh and a Franchise Fee of $0.00049/kWh, in addition to corresponding PG&E transmission charges and fees. As customers remain with a third-party electric provider, they can expect these fees to decrease. Despite the additional customer charges, the MCE Light Green RES-9, Rate A and Rate B are both affordable at $460 and $300 per year respectively as shown in Figure 20 below. The Deep Green option adds an extra $35 per year.

Figure 19: Marin Clean Energy RES-9 Rate Schedules



The RES-1 tiered rate schedule may be potentially much more costly for consumers. The Tier 1 rates are very attractive at $460 per year, but it is unclear whether or not the average household would be able to remain under that threshold with the baseline quantities ranging from 7.5 – 23.5 kWh per day in the summer depending on the baseline territory. As customers advance to the Tier 2, Tier 3, and Tier 4 & 5 (same rate) their yearly costs go up to $520, $1,020, and $1,160 per year respectively. The Deep Green option adds an extra $35 per year.

Figure 20: Marin Clean Energy RES-1 Rate Schedules



Since MCE does not have any way of tracking how many PEV customers are in their service territory, it is unclear how many PEVs are currently in operation.[88] MCE does not encourage PEV customers to use any particular rate, as it greatly depends on the lifestyle and consumption patterns of the individual customer. Additionally, all rate changes for MCE customers must still be done through PG&E, so MCE is rarely asked to participate in such decisions.

MCE supports PEVs and has assisted with the installation of five electric vehicle charging stations for its member agencies. While MCE does frequently discuss PEV usage during company activities, the company does not spend significant effort educating customers, as it is outside of their scope of business. MCE has been supportive of PEVs and have been making community investments to promote their use. However, the RES-9 rate schedules have only seen limited use, and will need to be evaluated for their efficacy as MCE continues to serve additional customers with PEVs.

MCE does not have any notification protocols for PEV customers, as installers would need to contact PG&E, which handles all of the relevant transmission, distribution, and interconnection issues. Transmission and distribution services for Marin, including grid reliability, are still covered through PG&E service and PG&E charges. Unlike a municipal utility, CCA programs are only responsible for procuring electricity for its customers' demand, not for interconnections and maintenance of the grid. As such, MCE has not performed any research to analyze PEV demand in their service territory.

[88] Email interview, Justin Kudo, Account Manager, Marin Clean Energy, August 29, 2012.

Pacific Gas & Electric (PG&E)

As the largest utility in the Region, Pacific Gas & Electric (PG&E) has taken a leading role in PEV readiness. PG&E has worked closely with local and regional stakeholders to communicate the importance of utility notification protocols for new EVSE installations, particularly in residential applications. PG&E has proposed two PEV rates that are aligned with the goal of PEV customers using more electricity to charge on the off-peak hours, EV-A and EV-B. EV-A is a “whole-house” rate and designed so that customers do not need to install a separate meter to monitor the PEV electricity consumption. Instead, under EV-A, the entire home’s electricity consumption is given the PEV rate. EV-B is designed to allow customers to monitor only the PEV’s electricity consumption and gives customers the option to have their home on a different rate. PG&E is planning on sunsetting its current E-9 rates that discourage additional PEV charging due to their tiered structure. For the new PEV rates, off-peak charging of PEVs is at a significantly reduced rate to the consumer, roughly $0.10/kWh during off-peak hours to $0.35/kWh during on-peak hours.

The most significant differences between the previous Schedule E-9 and the new Schedule EV is the elimination of the tiered structure, elimination of the monthly customer charge, and modification of the TOU periods to increase the number of off-peak hours on weekends. In order to address concerns about consumer fairness, PG&E did increase rates for off-peak charging, but with all of the other adjustments to streamline the program and mitigate other costs, the rate increase would most likely benefit the greatest number of PEV customers over the long-term. The current and the new rates are listed in Table 27 below.

Table 27: Current Schedule E-9 compared to future Schedule EV

	Current Schedule E-9		Illustrative Schedule EV	
	E-9(A)	E-9(B)	EV(A)	EV(B)
Summer				
Peak	Tier 1 – 0.30178 Tier 2 – 0.31994 Tier 3 – 0.50415 Tier 4 – 0.54415	Tier 1 – 0.29726 Tier 2 – 0.31541 Tier 3 – 0.49962 Tier 4 – 0.53962	0.35656	0.35120
Partial-Peak	Tier 1 – 0.09876 Tier 2 – 0.11692 Tier 3 – 0.30113 Tier 4 – 0.34113	Tier 1 – 0.09424 Tier 2 – 0.11239 Tier 3 – 0.29661 Tier 4 – 0.33661	0.19914	0.19646
Off-Peak	Tier 1 – 0.03743 Tier 2 – 0.05559 Tier 3 – 0.16011 Tier 4 – 0.20011	Tier 1 – 0.04479 Tier 2 – 0.06295 Tier 3 – 0.24716 Tier 4 – 0.28716	0.09712	0.09674
Winter				
Peak	Not Applicable	Not Applicable	0.26694	0.26118
Partial-Peak	Tier 1 – 0.09864 Tier 2 – 0.11679 Tier 3 – 0.30101 Tier 4 – 0.34101	Tier 1 – 0.09462 Tier 2 – 0.11277 Tier 3 – 0.29699 Tier 4 – 0.33699	0.16472	0.16184
Off-Peak	Tier 1 – 0.04680 Tier 2 – 0.06495 Tier 3 – 0.16011 Tier 4 – 0.20011	Tier 1 – 0.05339 Tier 2 – 0.07155 Tier 3 – 0.25576 Tier 4 – 0.29576	0.09930	0.09889
Meter or Customer Charge	$0.21881/meter per day	$0.21881/meter per day	$0	$0.04928/meter per day

For purposes of demonstration, current Schedule E-9 to the new Schedule EV for the Tier 1, 2, 3, and 4/5 rates are shown. It is evident that the current Schedule E-9 could save consumers money if they were able to remain energy efficient. The Schedule E-9 in the Tier 1 bracket would cost an average of $230 or $250 per year in addition to a $96 annual fee for Rate A and B respectively, but would go up significantly past the new rate once consumers went into the Tier 3, 4 or 5 rates as shown in Table 28 below. According to documents published by the California PUC[89], it appears that PG&E may be receptive to grandfathering consumers who are currently in this rate schedule for an additional period of time. The new EV-A and EV-B rates may help to reduce costs for the average PEV driver if they use more energy or if they are currently on the E-1 Rate Schedule. The EV-A rate will cost a consumer on average about

[89] Public Utilities Commission of the State of California, Resolution E-4805, August 23, 2012.

$580 per year and the EV-B rate will cost an average of $400 plus an annual meter charge of $18.

Table 28: Average Annual Cost for PG&E Schedule E-9 and Schedule EV

Rate	Tier	Baseline	Average Annual Cost	
			Rate A	Rate B
Schedule E-9	1	Baseline	$230	$250
Schedule E-9	2	101-130% of Baseline	$290	$310
Schedule E-9	3	131-200% of Baseline	$700	$900
Schedule E-9	4	201-300%+ of Baseline	$840	$1,030
Schedule EV	N/A	N/A	$580	$500

Figure 21: Current PG&E Schedule E-9 compared to the new Schedule EV

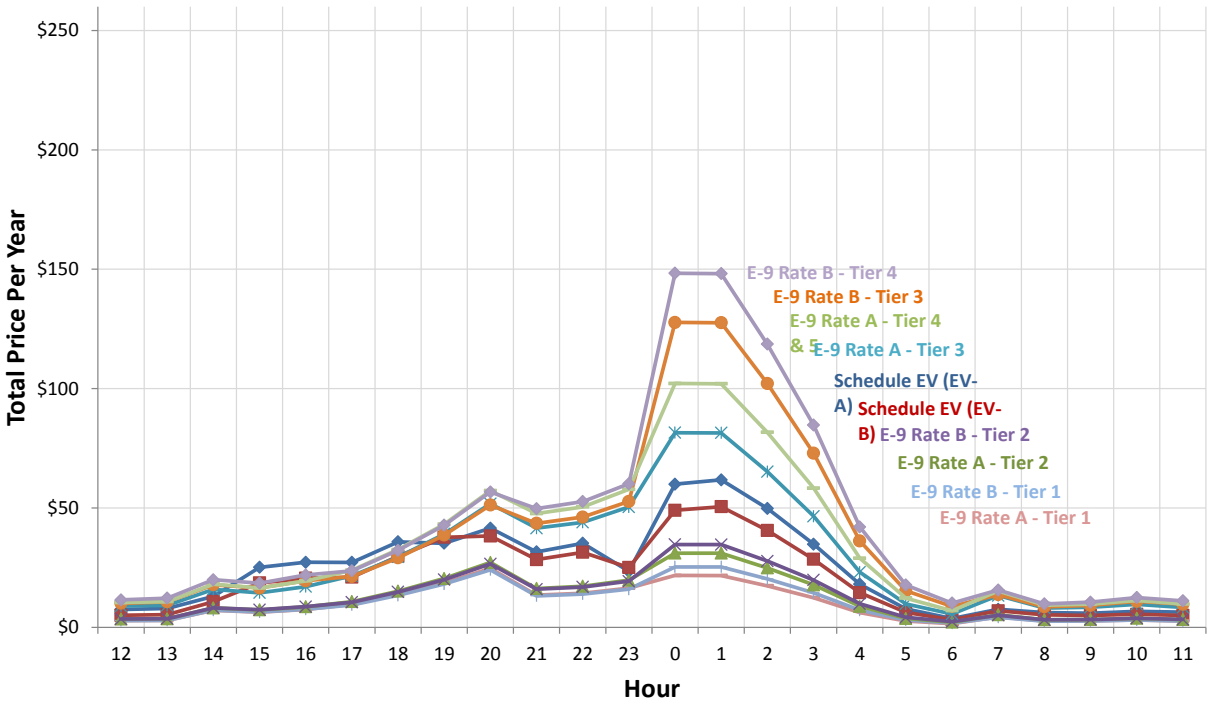
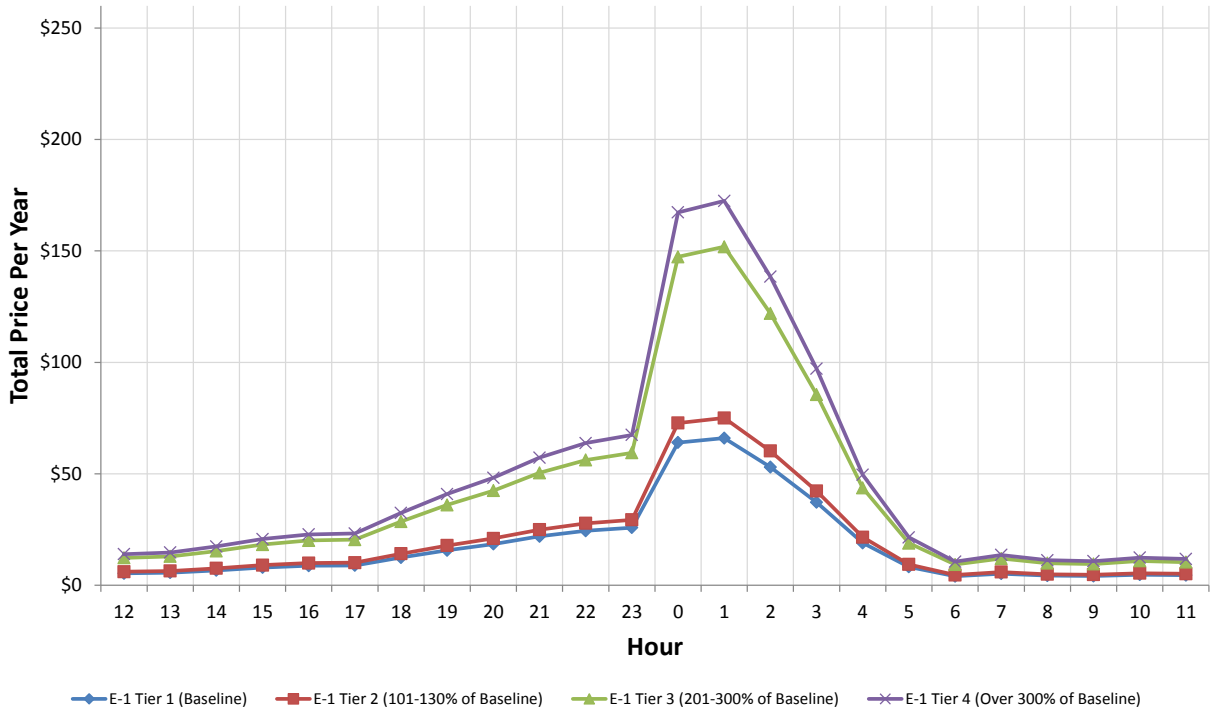


Figure 22: PG&E E-1 Tiered Rates



San Francisco Public Utilities Commission (SFPUC)

The SFPUC does not provide electricity to retail customers, other than a portion of the housing authority.

Silicon Valley Power (SVP)

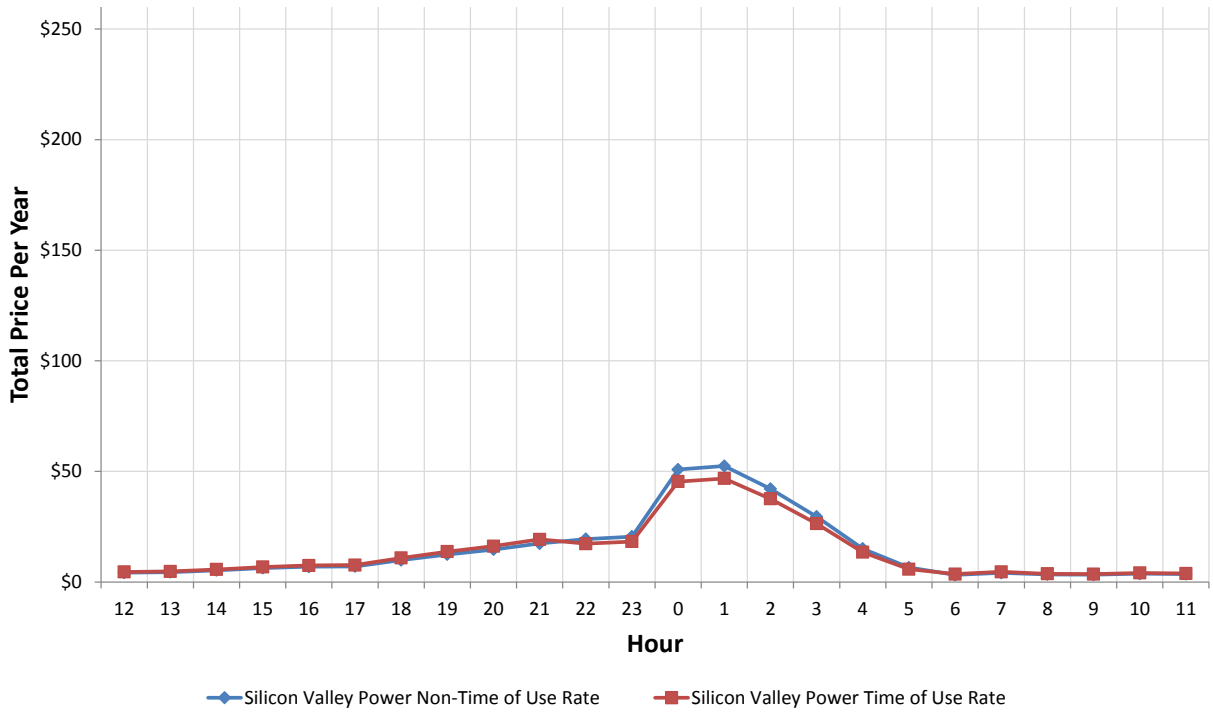
Silicon Valley Power does not have a special PEV rate and does not anticipate creating a separate PEV rate in the next five years, but will reassess the need for Santa Clara electric customers at that time.[90] To date, SVP has nearly 50 customers out of approximately 50,000 who have either purchased or are purchasing PEV's with Level 1 or Level 2 EVSE. The City of Santa Clara's permitting department has worked collaboratively with permitting agencies in the three counties of the South Bay Area to standardize and expedite EVSE permitting with a publicized set of guidelines. SVP has not engaged in any substantive or organized public education on this topic, but has responded to inquiries very positively.

SVP has a D-1 Rate Schedule for Domestic Service defined as single-family dwellings or any other multi-unit dwellings that are individually metered. The D-1 rate offers two options, a non-TOU rate and a TOU rate. The non-TOU rate is $0.08877/kWh for the first 300 kWh each month, and then any excess is $0.10205/ kWh. The TOU option has a peak and off-peak price for the first 300 kWh and a different rate over 300 kWh. At this time, SVP does not have any TOU customers. SVPs unusually high system load factor (a very flat load curve with virtually no

[90] Email interview, Larry Owens, Manager of Customer Services, Silicon Valley Power, August 30, 2012.

summer peak) greatly reduces the on-peak, off-peak cost differential when buying wholesale power, which is characterized by SVPs on-peak time window from 6:00 AM to 10:00 PM. According to SVP, no customers have yet seen the TOU rate as attractive. For purposes of comparison, since sub-metering is not yet an option for EVSE in SVP, Figure 23 below assumes that PEV charging will be charged at the rate over 300 kWh per month given average household consumption and PEV electricity demand for the region. Interestingly, the TOU rate for PEV charging is slightly less than the non-TOU rate at an average of $330 per year compared to $350 per year. However, a residential customer would need to take into account average household consumption over the course of the day, which may negate any potential savings from the TOU rate.

Figure 23: Silicon Valley Power Non-Time of Use Rate compared to the Time of Use Rate



EVSE notification is done in two ways at SVP; through the permitting department and through a special PEV industry report (via Oceanus) of sales to businesses and residents of Santa Clara. SVP does not have an official notification protocol at this point and relies primarily on the above two methods. SVP cannot account for new PEVs in instances where a PEV driver uses Level 1 charging and therefore does not require a permit, or missing notifications from the permitting office as SVP only requests permits related to service panel upgrades.

SVP commissioned a telephone survey in 2010 of residents in its service territory which covered a variety of topics including interest in PEVs. A full 25% of those surveyed expressed interest in owning or leasing an electric vehicle with 72% of those considering a move in the next 2-3 years. SVP anticipates the potential for grid impacts to be minimal and focuses primarily at the local distribution transformer level for grid upgrades. SVP has more than enough generation, transmission and distribution capacity to accommodate even the highest penetration estimates

for PEVs and that the majority of its existing distribution transformers can handle the addition of PEV charging at the expected penetration without concern. As a practice, SVP designs and builds its system to handle twice the expected load. SVP runs its distribution loaded to 50% and make upgrades when that level is exceeded. SVP does this intentionally so that added load (expected and unexpected) is not a problem. A 25% penetration of PEVs would not cause impacts to SVP's grid, with the potential exception of overloading a local distribution transformer. However, if issues arise at the local distribution transformer level, SVP is prepared to upgrade any suspect transformer at its own cost.

SVP has prepared to react to such overloading and are working to predict that potential overload through its SVP MeterConnect program (advanced metering). SVP has designed the advanced metering system program to obtain data and device carrying capacity with a robust set of options for communicating with PEVs, solar photovoltaic systems and smart appliances. SVP has expressed interest in sub-metering EVSE, but to date has not enacted a policy. One of the primary reasons for sub-metering PEV charging stations is to account properly for greenhouse gas (GHG) production. A second reason for sub-metering is to analyze the merits of load management. SVP is not interested in unnecessarily limiting a PEV customer's flexibility to charge whenever they want, but may need to institute demand response upgrades through electric vehicles to avoid transformer overload instead of the preferred and simple upgrade of a transformer. At this time, SVP has not invested in battery storage or on-site renewable energy for PEV integration, as less expensive alternatives are available.

10.4. Recommendations

The following sections outline prioritized steps for utilities in the Region and their corresponding local governments to modify utility rates and grid infrastructure to prepare for increased deployment of PEVs. As there are significant differences between an approval process for an investor-owned utility, such as PG&E, and a publicly-owned utility, such as Alameda Municipal Power, each community will need to assess the relevance and likelihood of adoption for certain portions of the plan.

It is important to note that in many cases, the prioritized elements below apply almost exclusively to utilities and are likely beyond the purview of local government action. However, many local governments in the process of becoming PEV Ready may not be involved in utility planning. This is particularly true for local governments that are in PG&E's service territory. In these cases, it is incumbent upon PG&E to identify the optimal pathway for becoming PEV Ready. However, the issues outlined below should be familiar to local government staff as they work to become PEV Ready – and increased familiarity with these issues and concerns will improve the communication between local governments and utilities like PG&E.

Evaluate Rate Structures and Impact on PEVs

Utility rate structures are one of several key decision factors for potential PEV consumers, and can represent the difference between a consumer accruing a return on their investment or a realizing a net loss. Given the higher purchase price of PEVs compared to conventional vehicles, the most significant savings for consumers is from a reduction in fuel expenditures.

Utilities in the region should evaluate their rate structures in the context of the potential impact on PEV consumers. These include an analysis of a secondary meter options, alternatives to the traditional tiered rate structure, and options for existing or future of TOU rates.

A detailed analysis of current rate structures available to PEV drivers in the Region was performed using a combination of charging data provided via The EV Project and BAAQMD. The data have been accrued from the inception of the project in 2010 through June 2012 and most closely represents the average monthly residential charging patterns of PEV owners in the Bay Area and Monterey Bay. The key findings of our analysis of existing rates and current charging profiles include the following:

- To date, the most attractive rates and programs available to PEV drivers are through Alameda Municipal Power, which has an experimental PEV discount and Silicon Valley Power, which has low residential rates.

- PG&E may want to consider amending an existing PEV rate. The PG&E PEV TOU rate, also known as the E-9 Rate Schedule, was initially very confusing for consumers and has since been revised. However, the rate does not align the peak and mid-peak rates to correlate with the average demand curves of customers. This has resulted in a spike in energy usage in the late evening, which could cost the average PEV driver an extra $130-$160 per year.

As a result of our analysis and outreach to local government staff and utilities, BAAQMD recommends the following priority actions related to residential rate structures:

Assess alternatives for tiered rate structures

A potential barrier to PEV adoption is the prevalence of tiered residential rate structures among the utilities in the Region. California has used the tiered structure to incentivize energy conservation. Unfortunately, the tiered rate structure does not take into account the environmental benefits of PEVs and in many cases could result in significantly higher utility bills for the average PEV driver. According to our analysis presented in Section 10.3, the most significant annual costs were the direct result of the highest tiered rate structures. Given their high daily consumption of approximately 9 kWh, charging a PEV at home may bump a residential consumer into to a higher tier. To remedy this problem, some utilities have evaluated alternatives to tiered rates. For instance, Silicon Valley Power offers a single rate structure for PEVs and PG&E offers TOU rates for PEV charging.

Utilities should consider amending existing tiered rate tariffs to include PEV-friendly programs, such as:

- The development of a PEV rate structure comparable to a medical baseline program. A medical baseline rate increases the baseline level for qualified consumers who have significant energy consumption at home due to the use of medical equipment. A similar program could be made available to qualifying PEV owners.

- The development of a PEV discount rate comparable to that offered by Alameda Municipal Power, which provides a flat discount based on gross vehicle weight to eligible customers off their tiered rates. Customers must apply annually for the program and agree to charge during off-peak hours.

- The elimination of the tiered rate structure for PEV drivers.

Evaluate Time of Use Rates

As discussed previously, TOU rates can be an effective tool to mitigate grid impacts by encouraging consumers to charge during certain periods. However, based on information gathered from utilities in the Region, not all utilities offer a TOU option. Among the utilities that do offer a TOU option, very few customers currently use that rate. Utilities cited lack of interest, concerns about costs, particularly for whole-house TOU rates, and lack of consumer information as the primary reasons for the lack of adoption. PG&E and municipal utilities should consider TOU options that include a secondary meter, eliminate or prevent the introduction of demand charges (if applicable), and ensure that consumers have adequate information to select the best rate for their lifestyle.

In addition to mitigating grid impacts, there are other reasons why utilities may want to encourage TOU rates among customers. For example, under proposed modification to the Low Carbon Fuel Standard (LCFS) regulation, utilities that earn LCFS credits for electricity supplied as a transportation fuel must use proceeds from the sale of said credits to benefit current PEV customers. Among these benefits, the proposed modifications explicitly state that utilities must provide rate options that encourage off-peak charging and minimize adverse impacts on the electrical grid. The differential between the carbon intensity of PEVs and conventional vehicles using gasoline is significant; even at relatively modest levels of PEV adoption; the revenue potential from the sale of LCFS credits earned by utilities is significant. This is effectively a built-in mechanism for utilities to recoup some of, if not all of, the costs associated with evaluating TOU rates that benefit consumers while avoiding on-peak charging.

Review options for secondary meter

Only a few utilities within the Region currently offer an option for residential customers to install a secondary meter for EVSE, such as the City of Hercules and PG&E. A secondary meter, or sub-meter, would provide a number of added benefits to both the consumer and the utility. These benefits include:

- For the consumer, the benefits of secondary metering are largely based on potential cost savings:

  - Secondary metering may save consumers substantially on the installation of EVSE. About 75% of California's residential building stock was constructed before 1985, which means that many homes will have circuits ranging from 60–100 A. Newer homes may have circuits up to 200 A. The costs of upgrading to a more appropriate circuit for EVSE and PEV charging (e.g., 200 A) are substantial: These costs have been estimated up to $12,000 depending on the work required and the service territory. On the other hand,

the cost for a consumer to add a secondary meter using a new drop would be between $500 and $1,500[91], representing a significant cost savings.

- Maintaining low bills for residential customers. A second meter option would guarantee a reduced rate for the majority of PEV drivers in the Region by staying within the baseline level of tiered rate structures and eliminating the need to be on a whole-house TOU rate structure, which is typically not optimal for the majority of residential customers.

- For the utility, the benefits may include the following:
  - Analyzing the merits of load management and demand response programs. With a second meter option, a utility could accurately account for charging patterns of its consumers and determine whether or not load management or demand response programs would be sufficient to mitigate grid impacts.
  - Built-in assessment for local grid upgrades. A second meter would determine whether or not the utility would need to make upgrades to the local distribution infrastructure and transformers were required in certain service territories – particularly in areas experiencing PEV clustering.
  - Improved accounting for GHG emission reductions. A second meter option would potentially simplify and streamline the process of earning LCFS credits for electricity consumed by PEVs. Based on proposed modifications to the LCFS regulation (December 2011 proposed regulatory amendments), utilities will have an opportunity to earn LCFS credits.

Utilities without a second meter option could request an amendment to the tariffs from their local utility review boards to approve the inclusion of a second meter option. Considering all of the potential benefits to the utility for a second meter, utilities may want to consider providing a rebate program that would supplement the consumer's cost of installing the second meter or pro-rate the cost of the second meter over a period of time on the monthly utility bill instead of requiring the cost to paid for entirely up front.

Create Utility Notification Protocol

In order for utilities to minimize the potential grid impacts of charging PEVs, they need to know where the vehicles are being deployed and how they are being charged (e.g., Level 1 vs. Level 2). This information allows the utility to evaluate if the local distribution system is adequate to serve PEV charging needs. For commercial installations that require electrical inspectors and permitting (e.g., Google's facilities team installing 40 Level 2 EVSE at its main campus), there is less risk associated with utility notification because the entities involved are more accustomed to dealing with utilities. However, with residential installations, utility notification protocols that can adequately manage large volumes of residential notifications through automated processes are non-existent.

[91] Telephone interview, Shiva Swaminathan, Senior Resource Planner, City of Palo Alto Utilities, August 7, 2012.

The typical residential installation will have three (3) parties: 1) the homeowner and PEV driver, 2) the contractor, and 3) the electrical inspector. The electrical inspector is there to protect the interests of the homeowner on behalf of the local government. Contractors engaged in the installation of EVSE have generally been trained to encourage the homeowner to contact his/her local utility and notify them of the installation. Even if homeowners do not contact their utility expressly to notify them of an EVSE installation, most homeowners likely will take advantage of special PEV rates offered by utilities. Despite these various opportunities to notify the utility, there is still considerable anecdotal evidence of homeowners who have chosen to forgo utility notification after installing EVSE and charging a PEV. Even at low rates of non-notification, this has the potential to become a significant problem.

In California, advance notification began on an ad hoc basis, but in July 2011 the CPUC directed utilities to conduct an assessment of early notification efforts and evaluate opportunities to formalize the process. In a joint report with SCE regarding PEV notification,[92] PG&E identified the following requirements for notification data needs to meet its needs:

- **Comprehensiveness**: To ensure grid reliability, safety and stability, PG&E would require data to be as comprehensive as possible to properly anticipate areas where transformer loading is nearing failure. This would include data for charging locations for not only new PEVs, but used PEVs or use resulting from a change of address. PG&E estimated it had captured 80% of new PEVs sold in the service territory using existing notification processes.
- **Granularity**: The location information should be as specific as possible, ideally with a street-level address as opposed to a zip code or city block. The data should also include charging levels to evaluate potential demand and impact on circuits. Though privacy and confidentiality concerns exist, PG&E expressed commitment to protecting customer data in compliance with applicable regulations and laws. Currently, OEMs are sharing notification data at the street address level, but may require PG&E to pay for supplemental reports including delivery date to customer.
- **Timeliness**: Utilities would prefer notification of new EVSE prior to the installation in order to identify potential distribution infrastructure problems resulting from incremental coincident peak loading. Currently, a reporting period from OEMs and other third parties has not been standardized and should be addressed.
- **Scalability**: As the PEV market becomes more mature, PG&E has expressed concern about the amount of manual activities required to collect data, and that unless they could become automated in some way, the process would not scale well with increased PEV adoption. Notification sources could provide data in a standardized way that would allow it to be automated. Currently, reports provided by OEMs are based on internal processes and will require additional automation to be able to be useful at higher PEV adoption rates.
- **Costs**: PG&E expressed concern about potential internal and external costs for obtaining notification data, including the costs to secure notification commitments from third parties

[92] Southern California Edison Company, "Joint IOU assessment report for PEV notification," December 2011, p. 14, available online at: http://docs.cpuc.ca.gov/efile/REPORT/156710.pdf.

and analysts to compile the data. Though costs are currently relatively low, there is a potential for costs to increase in the future and options to mitigate notification costs will be evaluated.

According to the same report,[93] the primary methods PG&E uses to collect PEV data in its service territory include data provided by OEMs, such as General Motors and Nissan. GM's regional manager for California provides data to PG&E on a biweekly basis and Nissan shares data on a quarterly basis through its third-party analytics firm, Oceanus. ECOtality provides PG&E weekly reports on its Level 2 charger installations. Individual customers also contact PG&E by phone or via its on-line PEV reporting tool to schedule a service appointment or discuss the PEV rate options.[94] As of the end of March 2012, PG&E estimated 3,096 PEVs were owned or operated by customers in its service territory, but at that time did not track PEV ownership over time except to the extent an individual customer required service planning support or a PEV rate option.[95]

Through recent legislation, utilities are also able to obtain data directly from the DMV. Senate Bill 859 (SB 859, Padilla, Statutes of 2011), sponsored by the California Electric Transportation Coalition (CalETC), LADWP and SMUD, authorizes California utilities to obtain PEV registration data from the DMV; however, the law also imposes restrictions on how to use DMV data to protect consumer privacy.[96]

Upgrade Distribution Infrastructure

When utilities in the Region upgrade or add distribution infrastructure, utilities, regulators and planners should include the potential for PEV charging impacts as part of the analysis and, where possible, make strategic and cost-effective investments. PG&E has been proactively installing new equipment to accommodate increasing rates of PEV adoption since 2010 as part of its multi-year Electric T&D Modernization Plan.[97]

Based on feedback, municipal utilities appear to be less focused on infrastructure upgrades related to EVSE, in large part due to the small number of PEVs currently deployed in their service territories. However, all utilities should begin to explore vulnerable infrastructure, particularly in areas more likely to experience PEV clustering and large public infrastructure projects.

Implement Consumer Outreach Programs

In addition to addressing transmission and distribution concerns, utilities should take necessary steps to ensure consumers are well informed about PEV opportunities. According to a report

[93] Pacific Gas & Electric Company, "Filing of Information in Response to Administrative Law Judge's Ruling," March 2011, p. 4, available online at: http://docs.cpuc.ca.gov/efile/RESP/166108.pdf.
[94] Pacific Gas & Electric Company, "Contact PG&E to get plug-in ready," available online at: http://www.pge.com/myhome/environment/whatyoucando/electricdrivevehicles/contactpge/.
[95] Pacific Gas & Electric Company, "Filing of Information in Response to Administrative Law Judge's Ruling," March 2011, p. 4, available online at: http://docs.cpuc.ca.gov/efile/RESP/166108.pdf.
[96] Senate Bill No. 859, Chapter 346, Padilla, Vehicles: records, confidentiality. Available Online: http://leginfo.ca.gov/pub/11-12/bill/sen/sb_0851-0900/sb_859_bill_20110926_chaptered.pdf
[97] Pacific Gas & Electric, *PG&E Smart Grid Deployment Plan: Deployment Baseline*, June 2011, p. 60, available online at: http://www.pge.com/includes/docs/pdfs/shared/edusafety/electric/SmartGridDeploymentPlan2011_06-30-11.pdf.

prepared by the Edison Electric Institute,[98] utilities should present a uniform set of PEV facts, utility rates, incentives and program information to customers through a wide variety of media, including bill inserts, brochures, public events and presentations, online material, videos, school curriculum, emails and other media. Residential customers should know about the availability and benefits of PEV rates, vehicle fueling costs, charging, as well as the utility role in the installation process. Public and private fleet managers should also receive guidance from the utilities regarding the best method for integrating PEVs into fleets. Local media and local government may also play a role through reporting the information to the public.

This type of messaging will be built into the *Go EV Campaign*, currently being designed by MTC in coordination with BAAQMD. However, this campaign should be considered complementary to utility efforts and not replace them. Furthermore, as noted previously, utilities that earn and sell LCFS credits for electricity supplied as a transportation fuel must use the proceeds to benefit current PEV customers. In addition to the rate options that encourage off-peak charging and minimize adverse impacts on the electrical grid, utilities must make efforts to educate the public on the benefits of PEVs, which also must be documented as part of compliance.

Evaluate Smart Grid Opportunities

Although there have been considerable advances regarding the deployment of Level 2 EVSE, the major focus has been on getting hardware in the ground, particularly at residences. As EVSE is more widely deployed, the issue of networking EVSE and ensuring grid interoperability, particularly through smart grid technologies, arises. This issue is increasingly challenging to address with the deployment of non-networked Level 1 charging, which does not generally require modifications to existing infrastructure.

PG&E has prepared a smart grid deployment plan, which includes steps to prepare for electric vehicles in the service territory.[99] The utility is working with a large number of partners to test PEV “smart charging” technologies, which examine the effect of temporarily reducing the amount of power drawn by PEVs to minimize grid impacts and provide other valuable grid services.

In addition to utilizing existing technologies, PG&E is monitoring vehicle-to-home and vehicle-to-grid applications for the future, which may provide opportunities to reduce peak load through battery storage. PG&E is also working closely with automakers, technology vendors, regulators, and standards organizations, such as the National Institute of Standards and Technology, to ensure that a viable smart charging market that rewards customers that provide these services to utilities will develop.

Based on initial feedback, no municipal utilities in the Region have developed smart grid integration plans for PEVs due to the relative expense of the upgrades compared to other peak load reduction techniques such as energy efficiency retrofits. The City of Palo Alto has explored

[98] Edison Electric Institute, *The Utility Guide to Plug-In Electric Vehicle Readiness*, November 2011, pp. 4, 15-22, available online at: https://workspace.icfi.com/ect/ccs/aerc/EVSE/Edison%20Electric_The%20Utility%20Guide%20to%20PEV%20Readiness.pdf.

[99] Pacific Gas & Electric, *PG&E Smart Grid Deployment Plan: Deployment Baseline*, June 2011, p. 94-95, available online at: http://www.pge.com/includes/docs/pdfs/shared/edusafety/electric/SmartGridDeploymentPlan2011_06-30-11.pdf.

options for demand response programs, but does not have plans to implement them in the near future.

In order to mitigate potential impacts of PEV deployment, municipal utilities should investigate opportunities for the smart grid, particularly as a way to potentially monitor and control charge events. As part of this planning effort, methods for ensuring the charging infrastructure and vehicles are able to send and receive information needed to interact with the grid and be compatible with smart grid technologies should be explored.

Provide Renewable Energy Options for PEV drivers

As noted previously, utilities have not prioritized providing incentives for PEV drivers to purchase greener electricity for charging i.e., green charging. Utilities are at different stages of focusing on ensuring that the PEV customers and their neighbors have reliable service, which includes, but is not limited to, interconnection, ensuring that distribution infrastructure is sufficient for residential EVSE (especially in areas where PEV purchasers may be clustered), and interfacing with EVSE providers to facilitate PEV deployment. Research shows that some early PEV adopters prioritize environmental benefits as a key reason to switch from internal combustion engine (ICE) vehicles. By integrating renewable energy options into existing or future PEV rates, some utilities in the Region may see accelerated PEV adoption rates.

Some PEV drivers may opt to install solar panels as a renewable option to offset the power draw of their vehicles, and some employer/fleet sites may provide direct daytime charging to their PEVs, but this is generally seen as a higher-cost option. For example, the Ford Company plans to offer a 2.5 kilowatts solar array produced by the SunPower Corporation at a cost of under $10,000 following federal subsidies. With the incremental cost of PEV already well above that of an ICE vehicle, the ROI for consumers in this case could potentially be even longer.

The two viable and relatively lower cost pathways for consumers to pursue renewable energy as part of the deployment for PEVs are likely:

- Green Pricing Programs
- Community Choice Aggregators (CCAs)

The existing green pricing programs and CCAs are listed below with a brief description of each program.

Green Pricing Programs

The most common pathway for consumers to send a market signal indicating a demand for renewable energy today is via voluntary green pricing programs provided by the local utility. These programs are more common for municipally owned utilities (MOUs); of the 3 major California IOUS, PG&E offered a green pricing program, called ClimateSmart™, which recently ended, and has proposed a new green option for customers that want a higher percentage of their electricity to be generated from renewable sources. The programs are voluntary and provide customers the opportunity to commit to paying a premium for electricity with the understanding that this contribution will go towards purchasing renewable energy. MOUs

throughout California have been particularly successful in getting consumers to sign up for green pricing programs, most notably Sacramento Municipal Utility District (SMUD), the City of Palo Alto Utilities, and Silicon Valley Power.

Utility Provider	Program Name	Brief Description
City of Palo Alto Utilities	PaloAltoGreen	1.5 ¢/kWh
Silicon Valley Power	Santa Clara Green Power	1.5 ¢/kWh, 100% renewable

The provision of renewable energy to interested consumers is a high priority for some utilities; however, in the context of PEV deployment and vehicle charging, it is not a high priority at this time. In the future, it will be important for utilities to have green pricing programs to incorporate renewable electricity purchasing for PEV charging, as it is likely that there is significant overlap between customers interested in the opportunity to purchase green electricity and PEVs.

Premiums for green pricing are generally around $5-10 per month for customers, and this cost would increase with the additional usage from PEV charging. It will be important for customers to be aware of the potential higher costs associated with PEV charging and how this impacts green pricing programs. The operational savings of electricity usage for PEVs compared to gasoline in conventional vehicles is a major incentive for consumers; if these savings are inflated due to a lack of understanding by the consumer, then this may have a small but negative impact on PEV deployment. Furthermore, consumers should be informed that even using the average mix of generation sources in California yields significant GHG reductions compared to gasoline use.

Community Choice Aggregation

Another pathway for those that live in an area that has a Community Choice Aggregator (CCA) to couple the deployment of PEVs with renewable energy is through a CCA green rate option. Community Choice Aggregation was established in California by the Legislature via AB 117 (Statutes of 2002) to give cities and/or counties the authority to procure electricity on behalf of consumers in their jurisdiction. Under a CCA, the IOU is still responsible for the transmission and electrical grid, metering, and billing, and the local CCA authority is responsible for the purchasing the electricity for its customers. There are only 3 confirmed and registered CCAs currently in California: 1) San Joaquin Valley Power Authority (approved in 2007), 2) Marin Energy Authority (MEA) (approved in April 2010), and 3) CleanPower SF (approved May 2010).

The process of establishing a confirmed CCA can be a protracted process. For instance, it took MEA 7 years to complete the process. Although the timeframe is likely to decrease as there is an opportunity for the first mover CCAs to share lessons learned with other areas interested in developing CCAs, the process is still likely to be lengthy and contentious. The MEA includes the Cities of Belvedere, Mill Valley, San Rafael and Sausalito; the Towns of Fairfax, San Anselmo, and Tiburon; and the County of Marin, and the MEA board recently approved a request to include the City of Richmond in Contra Costa County. Their immediate plans regarding renewable electricity offerings to consumers include two levels:

- Light Green – a 50% renewable electricity provision

- Deep Green – a 100% renewable electricity provision

MEA is currently in the implementation phase of the program and is phasing in these options by first offering the program to a smaller sample of consumers – about 9,200. At full subscription, MEA estimates 72,000 customers.

It is beyond the scope of this Plan to consider the potential benefits and drawbacks of CCAs. Similarly, because CCAs are relatively new and there are so few of them in California, it is impossible to conclude one way or another that CCAs are more or less capable of providing green charging options to consumers. At this point, regional and state agencies are encouraged to continue to coordinate and observe CCA developments in the context of PEV deployment.

11. Next Steps: Implementation Actions

11.1. Introduction

The following section discusses recommended steps or specific implementation actions for local governments and other stakeholders to take in order to prepare for increased deployment of PEVs and EVSE in the Region (actions to take to become PEV ready). Each plan section contains a series of recommendations for local and regional governments and other stakeholders that are organized in the order in which they should be implemented. In the case of local governments, these recommendations are based on interviews with staff at agencies that have implemented best practices or indicated that they were taking measures to increase PEV readiness in a survey of Bay Area local governments, as well as a review of guidance and best practices. Each recommendation begins with a brief description of why the recommendation is important, followed by subsections that describe, where applicable, information on issues to consider when implementing the recommendation, potential alternative approaches, information on the costs of implementing the recommendation, and examples of applicable guidance and best practices.

It is important to note that this plan is the latest in a growing number of PEV readiness guidance documents created by local governments, regional agencies, and advocacy groups in the Bay Area. It is not intended as an exhaustive guide to every aspect of PEV readiness, but rather a road map that provides local and regional governments and other stakeholders with clear, succinct information on the steps that they should take to become PEV ready. More in-depth information on several aspects of PEV readiness can be found in the documents referred to in the guidance and best practices sections, as well as in previous parts of this Readiness Plan.

11.2. Gaps and Recommendations

Based on the work performed to formulate this plan, areas where the Region is deficient in terms of PEV readiness, were identified and recommendations were made to address those deficiencies. In order for local and regional governments and stakeholders to implement these recommendations, a number of different actions and strategies may be employed. The deficiencies in the Regions' PEV readiness as identified through this Plan, recommendations to address those deficiencies, and suggested actions to implement those recommendations are summarized in Table 29 and expanded on in the discussion below:

Table 29. Summary of PEV Readiness Deficiencies, Preliminary Recommendations, and Suggested Implementation Actions

PEV Readiness Deficiency	Preliminary Recommendations	Suggested Implementation Actions
Building Codes		
• Limited adoption by local governments of PEV readiness building codes	• Adopt standards for EVSE into the building code • Adopt requirements for pre-wiring EVSE into the building code	• BAAQMD and local stakeholders to develop Sample Ordinances and Best Practices document resources • Convene Summit of local elected officials to champion PEV readiness in the Region • Utilize existing county and local government forums to share best practices across jurisdictions • Consider possibility of linking incentives to adoption of PEV readiness plans
Construction Permitting & Inspection		
• Limited Guidelines Outside of Residential (Single-Family Dwelling) Charging • Cumbersome, lengthy and/or relatively high cost to obtain permits in certain municipalities • Limited coordination between all portions of the PEV infrastructure chain (vehicle dealer, vehicle purchaser, utility, local jurisdiction)	• Encourage local governments to adopt streamlined and expedited permitting processes – Evaluate potential of target to issue permits within 24 to 48 hours at a cost of no more than $250 – Consider staffing permitting counters with technical staff – *Alternative:* Issue expedited permits for projects that involve only Level 1 chargers in single-family residences – *Alternative:* Issue expedited permits to certified contractors • Train permitting and inspection officials on EVSE installation • Improve coordination between local government and utilities to create a notification protocol for new EVSE through the permitting process – *Alternative:* Conduct outreach encouraging contractors to notify utilities of new EVSE installations • Create a permitting checklist for PEV owners and contractors • Create cross-jurisdictional opportunities for sharing lessons learned	• BAAQMD, along with PEVC and other stakeholders to develop inspection and permitting checklist templates and materials to help facilitate EV installation in MDUs and workplaces. • Convene Summit of local elected officials to champion PEV readiness in the Region. • Utilize existing county and local forums to share best practices across jurisdictions. • Consider possibility of linking incentives to adoption of PEV readiness plans. • Consider strategies such as making receipt of air quality and transportation grant funding conditional on vehicle dealers, EVSE vendors and property owners using common checklist contained in BAAQMD "local best practices document"

PEV Readiness Deficiency	Preliminary Recommendations	Suggested Implementation Actions
Zoning, Parking, and Local Ordinances		
• Potentially onerous zoning ordinances or inconsistent parking requirements that make it more difficult to install EVSE in certain places • Little available data regarding readiness from local agencies regarding this aspect of the PEV ecosystem. About 80% of surveyed local agencies are not involved in creating zoning and parking ordinances	• Encourage local agencies to adopt a climate action plan, general plan element, or stand-alone plan that encourages deployment of PEVs and EVSE • Encourage local agencies to adopt regulations and enforcement policies for PEV parking spaces • Encourage local agencies to consider specific design guidelines for PEV parking spaces that include requirements such as allowing PEV parking spaces to count toward minimum parking requirements • Encourage local agencies to adopt minimum requirements for PEV parking	• Convene Summit of local elected officials to champion PEV readiness in the Region • Utilize county and regional forums to share best practices across jurisdictions • Continue to work with the PEVC and via grants programs to increase guidance on PEV-friendly zoning and parking requirements • Provide additional guidance that helps to eliminate the barriers associated with EV installation in multi-unit dwellings • Consider possibility of linking incentives to adoption of PEV readiness plans
Stakeholder Education and Training		
• Lack of knowledge in many local jurisdictions regarding PEV infrastructure • Lack of knowledge at the local automotive dealer level regarding PEV infrastructure, notifications and permitting	• Develop schedule for and conduct Stakeholder Training and Outreach	• Seek additional AB 118 funding from CEC to fund training based on assessment • Coordinate local funding from cities and counties and regional agencies to provide training • Convene summit of local elected officials to champion PEV readiness in the Region • Partner with Clean Cities Coalitions and city and county associations to provide information to local jurisdictions on available training • BAAQMD to promote existing available training and education provided via PEV advocacy groups and related organizations

PEV Readiness Deficiency	Preliminary Recommendations	Suggested Implementation Actions
Consumer Education for PEVs		
• Lack of a centralized Region-specific PEV information resource for consumers	• Provide a centralized Region-specific PEV information resource for consumers, local government, fleets, and employers	• MTC to develop Go EV campaign for Bay Area • CEC funding to be used to prepare outreach materials in Monterey Area • BAAQMD to collaborate with PEVC to develop materials at the statewide level that are not already available via existing PEV advocacy organizations and other stakeholders • Work through the EV Strategic Council, MBEVA, and the PEVC to interface with private sector efforts to promote information distribution on PEV
Utility Impacts		
• Potential for local grid impacts caused by PEV clusters • High rates of adoption of PEV could impact the grid at peak levels • Some municipal utilities have yet to adopt time of use (TOU) rates and few have notification systems; these make the grid vulnerable to both clustering and peak impacts	• Further evaluate utility rate structures related to PEVs • Create utility notification protocol • Upgrade distribution infrastructure • Implement consumer outreach programs • Evaluate Smart Grid opportunities • Provide renewable energy options for PEV drivers	• Encourage utilities to consider amending existing tiered rate tariffs to include PEV-friendly programs and to conduct further analysis of Time of Use (TOU) Rates and options for secondary meter • Convene summit of local elected officials to champion PEV readiness in the Region • Create utility notification protocol for local government and EVSE hosts(including residents) • Use Go EV campaign to provide consumers with information on TOU rates and renewable energy options for PEV drivers

11.3. Description of Implementation Actions

Implementation Actions under this plan fall into three categories, as follows:[100]

- Policy Actions
- Coordination Actions
- Funding and Incentives Actions

Policy Actions

As part of the implementation of this Plan, it will be important to galvanize local and regional leadership to implement the recommendations presented as part of this document. This leadership needs to come in the form of policy actions and directives that attempt to standardize and unify, as much as possible, elements such as building codes, parking and zoning ordinances and permitting and inspection across local jurisdictions.

Summit of Local Elected Officials

As research for this document was completed, one of the underlying trends that emerged was the willingness of local jurisdictions to assume leadership in the area of PEV deployment. This is evidenced by the multitude of practices developed in the Region that have been identified via various guideline documents as best practices for the State and nation. However, as is equally evidenced by the surveys conducted as part of this Plan, not all the jurisdictions have moved forward with PEV readiness at the same rate. It is also clear that at least initially, not every local jurisdiction will be impacted by the adoption of PEVs at the same rate, but as the number of PEVs in the Region increases, each jurisdiction will need to deal with all the elements outlined in this planning document.

What is also evident is that the growing strain on local finances makes it difficult for local jurisdictions to take on new work or to implement new policy directions without priority setting and impetus from local leadership. Therefore, in order to present the recommendations of this plan and solicit the support of local elected leadership, a regional summit regarding PEV readiness is recommended. Such a summit could be hosted by regional agencies such as BAAQMD, MTC, ABAG, AMBAG and MUAPCD and be supported by regional organizations such as the EV Council and MBEVA. The purpose of the summit would be to kick start the adoption and sharing of the recommendations included in this plan and the associated "best practices" guidelines. Local jurisdictions already implementing these best practices would be invited to share their experiences with others in the hopes that coordination and cooperation would continue under the direction of elected officials. The goals of the summit would be to elicit commitments from each jurisdiction to adopt PEV readiness plans which seek to implement the recommendations on this document by the close of 2014.

[100] An additional category, Legislative Actions has not been included as an option as part of this Plan but is discussed briefly after we introduce the potential costs of implementation in Section 11.4.

Alternative: Use existing county and local government forums to share PEV information to local government officials.

As an alternative, the regional agencies should explore opportunities for using existing county and local government convening forums such as Mayors Conferences to solicit the policy direction required for the successful implementation of the recommendations in this plan. The smaller meetings, while more labor-intensive, may ultimately be more effective at directly reaching more city and county leadership versus a one-day summit.

Coordination Actions

Another key element with regard to the implementation of the actions recommended in this Plan is continued cooperation between the partners listed in Section 1. The rapidly changing landscape of technologies associated with PEVs, EVSE, and ancillaries will make it necessary for the recommendations in this plan to be flexible in certain areas (e.g., consumer education, grants, etc.) Additionally, significant elements that will lead to mass PEV adoption by consumers are outside of the scope of this planning effort (e.g., reducing the upfront costs of PEV purchase). However, continuing the dialogue and coordination between the private and public sector regarding elements that are within the scope of this Plan is essential.

Recommended Coordination Actions

There are three sets of coordination actions that are necessary for the successful implementation of this plan. These are as follows:

Training

- Partner with the Clean Cities Coalitions and city and county associations to provide information to local jurisdictions and stakeholders on available training. As is evidenced by the research used to prepare this plan, there are extensive amounts and levels of training available in the Region for local jurisdictions, first responders, automotive dealers, fleets, etc. Additionally, a number of the partners involved in the drafting of this plan, the Clean Cities Coalitions and the Association of Bay Area Governments, have extensive links to local governments and fleets that should be leveraged to expand the amount of information available regarding training sessions and types in the region.

Consumer Education

- Use materials developed by the California Plug-in Electric Vehicle Collaborative (PEVC) and PEV industry and advocacy stakeholders to educate consumers in the Region: While the *Go EV Campaign* represents an enormous step forward for the region in terms of coordination of outreach to consumers regarding the benefits of PEV; it should be recognized that additional materials will be developed by other PEV stakeholders that should be leveraged in that process.

  The PEVC is a forum that brings together leading organizations in the State in support of the deployment of PEVs. Many of the organizations represented, such as the utilities, NGOs (Plug-in America, Natural Resource Defense Council), and automotive and EVSE manufacturers, have significant expertise in outreach to consumers. Materials are also

routinely made available in the forum to cover the latest advances in PEV technology and best practices. It is therefore strongly recommended that the *Go EV Campaign* be coordinated with efforts by the PEVC to ensure that consumers receive timely and coherent information. The PEVC is slated to continue as an organization through 2014. As BAAQMD represents the Region on the PEVC, It should be charged with this coordination task.

- *Work through the EV Strategic Council and MBEVA to promote information distribution on PEVs:* Similar to the coordination effort that must be conducted at the State level, it is also important that the two areas within the Region continue to coordinate locally on information being distributed on PEVs. This effort will allow Monterey Bay to leverage items developed via the PEVC and the *Go EV Campaign* and for those entities to remain coordinated with local utilities (PG&E), automotive and EVSC manufacturers, NGOs such as the Bay LEAFs, local chapters of Electric Auto Association, Clean Cities Coalitions and other key PEV stakeholders' efforts to provide information to consumers and fleets on PEVs. This needs to be a collective effort on behalf of the stakeholders in the region via the coordinating councils established as part of this and the CEC planning processes.

Best Practices Guidelines

- *Continue to work via the PEVC to address readiness barriers for multi-family dwelling units (MDUs) and workplaces:* As part of this planning effort and those occurring in other regions of the State under the DOE grant, charging outside of single-family residences remains a challenge for PEV adoption. Even recognizing the substantial efforts being made by San Francisco and Coulomb technologies on a pilot project designed to answer some of the questions about EVSE installation in MDUs, it is likely that incentives (see paragraph below) and additional case studies will be needed to provide best practices in this subject area. Additionally, leveraging existing efforts that are currently focused on finding solutions and identifying opportunities to remove barriers for EVSE installation at MDUs and workplaces that are being developed by the PEVC and BAAQMD will be required.

  In order to augment these efforts, the PEVC has formed two working groups to address the issues of 1) MDUs and 2) workplace charging. These groups have been tasked to examine and expand upon available best practices in both these subject areas and to examine how incentives can be coordinated to increase the diversity and complexity of use cases that are available (especially for MDUs). It is anticipated that this work will continue through 2013 and will provide multiple outputs that should be disseminated (similar to the suggestions on training above) via appropriate Clean Cities Coalitions and government associations throughout the Region. As BAAQMD participates on both of these working groups, it should be tasked with coordinating locally to disseminate information and best practices via these groups to local governments in the Region.

Funding and Incentives Actions

A core strategy of this plan is the use of incentives. This strategy leverages the Region's experience in the deployment of government funding (DOE, CEC BAAQMD, MTC, MBUAPCD and local government funding) which has provided the area with a significant edge in terms of

the data available, EVSE and vehicles deployed to date. As envisioned here, use of future funds can incentivize and ensure the adoption of many of the recommendations in this plan in both private and public sectors. The following two sections discuss the use of current and future incentives in the implementation of this plan:

Incentive Funding Associated with Local Government Readiness

Air District Funding

At present a substantial amount of the funding that goes towards PEV-related projects in the Region comes from Assembly Bill (AB) 434. This bill provides local air districts the ability to assess a $4 DMV fee on vehicles registered within their jurisdictions and to use that funding to reduce criteria pollutants stemming from automobiles by directly funding projects that reduce tailpipe emissions and reduce vehicle miles traveled. In the Bay Area over the past three fiscal years, more than $6 million from AB 434 funds have been devoted to PEV-related projects.

Based on results of this planning effort, additional incentive funding may be needed in a number of areas in order to execute the recommendations of this plan. These are as follows:

- Multi-family Dwelling Units (MDUs): BAAQMD is currently participating in a working group at the PEVC which is developing recommendations on strategies that would align air districts' and state agency's incentive funding to be able to conduct pilot projects at different types of MDUs in order to gather data and information for case studies with the goal of developing "best practices" for MDU property managers, HOA managers and MDU residents.
- Workplace charging: BAAQMD is also funding CALSTART to develop "best practices" for businesses to install and maintain workplace charging. This work will be improved upon by the workgroup's efforts at the PEVC. The workgroup is currently developing case-studies, improved resources for employers, and recommendations that will inform investment of air districts' funding (possibly to expand on the number of use cases) in this area.
- Vehicle incentives: Additionally, the BAAQMD has previously provided grant funding to incentivize the replacement of older, polluting vehicles with new, clean air vehicles (Vehicle Incentive Program). Based on the outcome of this planning effort, the BAAQMD's Board of Directors may consider future recommendations that would similarly provide incentive funding towards the purchase of PEVs for local Bay Area public agencies.

BAAQMD's Board may also consider additional strategies that would incentivize adoption of the PEV-readiness recommendations contained in this Plan at the local government level. This approach coupled with the education, coordination, and training proposed in this Plan is designed to reward local governments who have adopted or pioneered the best practices proposed in the Plan.

Transportation Funding and Incentives

MTC has been actively engaged with BAAQMD and ABAG in the deployment of PEVs and EVSE in the Region. There are several ways in which transportation funding can incentivize local jurisdictions to become PEV ready.

- Funding for local jurisdictions in the Climate Initiatives Program

The Climate Initiatives Program has also funded many PEV-related projects. MTC may consider including funding for local jurisdiction grantees in future Climate Initiatives Programs to help them develop PEV readiness plans.

- Include funding for readiness planning in regional transportation plan

As noted above, MTC intends to set aside approximately $150 million of the funding in the Plan Bay Area to fund local government projects to accelerate PEV deployment. Following the example of MTC's Transportation for Livable Communities program, this funding may be divided into two streams:

  - The majority of funds should go toward local governments for capital projects intended to accelerate deployment of PEVs in the Bay Area. Capital funding should only be available to local governments that have adopted a PEV readiness plan and provide a local match. These plans should have at least a 15 year horizon and should address the steps discussed in the zoning section of this plan (Section 7).
  - The remaining funding should be available to assist local governments to create and implement local PEV readiness plans through both grants and technical assistance programs that offer guidance and promote best practices from local governments around the Bay Area. Funding should be phased so that the majority of planning funds are made available during the early years of the program. This will help to accelerate the development of PEV readiness plans in the early years of the program, ensuring that local governments have identified several potential projects to draw upon when applying for capital funds.

Similar to the recommendation above, the allocation of funds take into account the forecasts for sub-regional PEV demand contained in Section 3 and updated as appropriate as funding becomes available. Funding could be made available in multiple rounds so that MTC can continuously re-evaluate grant requirements and allocation criteria.

In particular, local government PEV readiness plans should consider including the elements listed in Table 30. Each of the elements includes a reference to the section of this plan that offers in-depth guidance on that element.

Table 30. Proposed Local PEV Readiness Plan Elements

Local PEV Readiness Plan Element	Description
Siting Section 4	• Projections of PEV demand and of demand for EV charging stations, broken out by type of charging (i.e. residential, workplace, and public) • A siting plan for the anticipated number of charging stations that takes into account vehicle range and neighborhood-level demand for charging stations
Construction Permitting and Inspection Section 5	• A plan to shift technical staff to the counter or educate permitting staff to facilitate review of EVSE permit applications • A process for notifying utilities about new EVSE installations • A checklist to guide homeowners through the permitting process for EVSE
Zoning, Parking, and Local Ordinances Section 6	• Adopted design guidelines for PEV parking spaces • Adopted regulations for PEV parking spaces addressing restrictions on use, enforcement, time limits, and fees • Adopted minimum parking requirements and/or zoning incentives for PEVs and EV charging stations
Building Codes Section 7	• Adopted building code standards for EVSE
Stakeholder Training and Education Section 8	• Schedule training for local governments
Consumer Education and Outreach Section 9	• Identify ways to coordinate existing consumer education efforts and support consumer outreach efforts including the Go EV campaign a
Grid Utility Impacts Section 10	• Create utility notification protocol as part of permitting or installation process.
Funding Implementation Section 11	• A funding and implementation plan identifying the cost of the different strategies identified in the plan, potential sources of funding, and further changes to city policies and ordinances that will be necessary to remove barriers to installing EVSE.

11.4. Costs of Implementation

The cost of creating a PEV readiness plan is likely to be similar to the cost of creating a climate action plan or bicycle and pedestrian plan. These costs typically range from $50,000 to $150,000, depending upon the size of the jurisdiction, local government progress to date in laying the groundwork for the plan, and the level of environmental review that the plan undergoes.

BAAQMD is currently working with ABAG to estimate the cost of creating the individual elements of the plan listed above. When complete, these costs will be summarized here and discussed in depth under the relevant recommendations in Sections 5-10 of the Readiness Plan.

Incentive Funding Associated with PEV and EVSE Deployment

As was mentioned earlier, BAAQMD is currently evaluating current deployment results and exploring options for future funding cycles. Examples of areas that are being evaluated include funding for EVSE installation in MDUs and employers and funding for the purchase of PEVs for local government agencies. BAAQMD staff through the development of this Plan is also evaluating strategies for having dealers and vendors of qualifying vehicles and EVSE adopt the pre-and post-purchase checklist contained in the local best practices document developed as part of this Plan. This measure is targeted at improving utility notifications, improving customer experiences and assisting customers in getting to permitting and inspection processes at local jurisdictions.

Incentive funding for the Implementation of Training Programs

- Seek additional AB 118 funding from CEC to fund training based on assessment
- **Incentive Funding for Consumer Outreach**
- *Go EV Campaign* for Bay Area
- CEC funding to be used to prepare outreach materials in Monterey Area