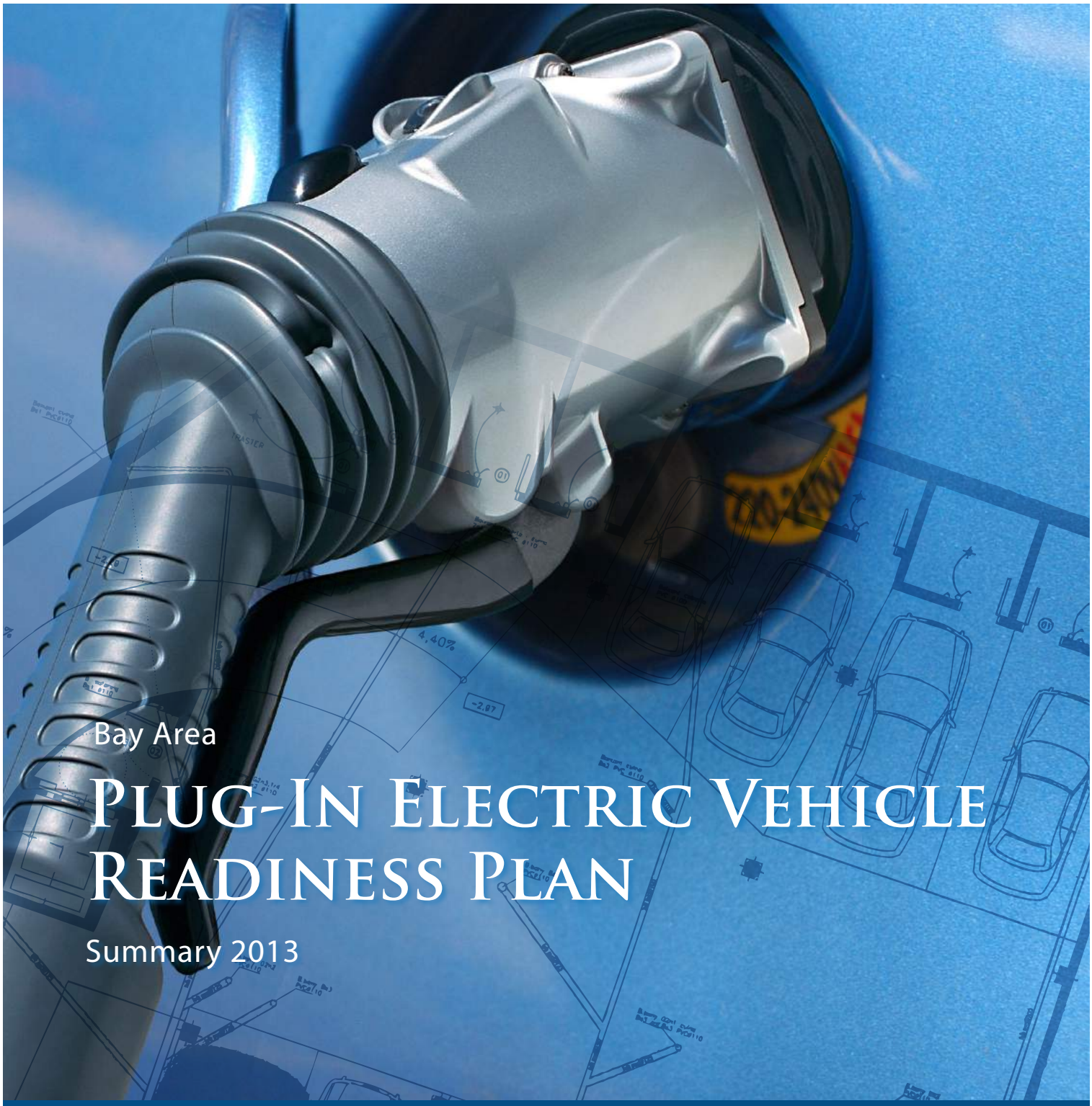

Bay Area

Plug-In Electric Vehicle Readiness Plan

Summary 2013

December 2013

Prepared for

Bay Area Air Quality Management District

In Partnership with

Association of Bay Area Governments

Metropolitan Transportation Commission

Prepared by

ICF International

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Acknowledgements

The Bay Area is fortunate to have a broad and diverse set of contributors working to enable this region to support an accelerated adoption rate of plug-in electric vehicles between now and 2025. Stakeholders contributed to the preparation of this document by conducting targeted outreach and interviews and by providing key data and valuable feedback. Specifically, the Bay Area Air Quality Management District would like to acknowledge the contributions of the staff at the Association of Bay Area Governments; the Metropolitan Transportation Commission; and East Bay, San Francisco, and Silicon Valley Clean Cities Coalitions.

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Executive Summary

The mass deployment of plug-in electric vehicles (PEVs) has the potential to reduce petroleum consumption and greenhouse gas (GHG) emissions while increasing energy independence through the use of locally produced energy. However, the success of long-term transportation electrification will depend on the region's ability to be ready for the influx of these vehicles in a variety of ways, such as helping local governments prepare to meet the new and unique demands that will be placed on their agencies and the near-term availability of a reliable charging infrastructure network. As a result, the Bay Area Air Quality Management District (BAAQMD), in partnership with the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG), developed this Bay Area Plug-in Electric Vehicle Readiness Plan (the Plan) to provide guidance and best-practices to help local and regional government agencies, utilities, and other stakeholders to engage in efforts that can lead to accelerated local adoption of PEVs.

The Plan is the result of a community outreach process and collaboration among local and regional agencies, state and federal funding agencies, members of the California Plug-in Electric Vehicle Coordinating Council, staff from the electric vehicle industry, and other stakeholders that are pursuing numerous avenues to support PEV deployment in the nine-county Bay Area. The Plan highlights strategies and guidance from research, analysis, and public input to help the Bay Area achieve the goal of being "PEV Ready"—that is, well positioned to handle large-scale adoption of PEVs over the next 10 years (2013–2023).

As of November 30, 2013, the Bay Area is home to more than 15,000 light-duty PEVs, representing more than 37% of PEVs sold in California and 11% of the total United States PEV market. Table 1 shows the projected Bay Area PEV forecasts[1] and estimated infrastructure needed to support those forecasts. A listing of the abbreviations used in this table is located in the Glossary.

[1] These forecasts are consistent with the California's Advanced Clean Cars program, which mandates a gradual introduction of zero emission vehicles into the California fleet, and the Bay Area's Clean Air Plan.

Table 1. Bay Area Vehicle Forecasts and Estimated Infrastructure Needed to Support Forecasts

Year	Vehicle Forecasts		Estimated Demand for Level 1 and 2 EVSE			Estimated Demand for DCFC
			ICF Estimates		Estimates Using EPRI Method	
	PHEV	BEV	Low	Mid		
2015	17,600	18,100	7,900	14,200	4,370	75–150 DCFC stations at 35–50 locations
2020	70,000	44,700	13,960	30,960	16,730	
2025	148,000	98,900	20,790	45,190	35,550	

Given these forecasted estimates for Bay Area PEV adoption, the region will benefit from early actions taken to ensure that we are ready to meet increased demands in the future. This Plan includes information about the challenges faced by early PEV adopters and provides a comprehensive review of the types of strategies, incentives, and educational resources that are needed to help the region to support and accelerate PEV adoption.

Strategies to Accelerate PEV Adoption

The Plan covers the following main areas of study:

- A Regional Siting Analysis. The Plan includes a section that discusses the estimated amount and type of infrastructure (level 1, level 2, and DC fast) needed now and over time, to meet the increasing charging demand of PEV drivers. This section also identifies optimal roadway corridors and areas where publicly available EVSE could be located.
- Incentives. This section discusses monetary and non-monetary incentives, and provides guidance on targeting public funds to help grow the PEV market.
- Consumer Education and Outreach. This section provides consumers with information about local, state, and federal incentives, PEV advocacy organizations, and the EV Promotional Campaign. The Bay Area EV Promotional Campaign (led by MTC) will build awareness and demand for PEVs through information and experience sharing, ride-and-drives, and support by prominent individuals.
- Opportunities to Attract and Retain PEV Manufacturing and Services. This section includes the following implementation guidance for public agencies on how they might foster local PEV manufacturing and services:
    - Consider focusing on retention over attraction
    - Consider analyzing existing opportunities in order to generate economic development strategies
    - Consider focusing on prototyping, testing, and demonstration
    - Consider collaborating and convening with other cities/counties
    - Consider offering targeted incentives
    - Consider coordinating regional economic development

- Integration with Plan Bay Area. The Plan contains strategies that are included in Plan Bay Area, adopted by ABAG and MTC in 2013, to reduce GHG emissions by accelerating the deployment of PEVs ahead of expected rates of adoption through three incentive programs:
    - Clean Vehicles Feebate Program
    - Vehicle Buyback and PEV Incentive Program
    - Regional EVSE Network

PEV Readiness Guidance

The Plan provides guidance for local governments, regional agencies, utilities, and other stakeholders, to help them identify and implement local actions that may help grow Bay Area PEV ownership.

Local governments could update building codes to include standards for EVSE and prewiring, expedite and streamline local permitting and inspection process, adopt PEV-friendly zoning, parking rules, and local ordinances to help facilitate the PEV market, and provide specialized training for stakeholders.

- Guidance on Building Codes:
    - Consider adopting standards for EVSE into the building code
    - Consider adopting requirements for pre-wiring EVSE into the building code
- Guidance on Permitting and Inspection:
    - Consider expediting permitting for EVSE in single-family residences
    - Consider creating a permitting guidance and checklist for applicants, and posting the checklist online
    - Consider requiring load calculations for Level 2 EVSE, and working with local utilities to create a notification protocol for new EVSE through the permitting process
    - Consider training permitting and inspection officials in basic EVSE installation
    - Consider ensuring that permitting staff at counter are knowledgeable on EVSE installation
- Guidance on Zoning, Parking Rules, and Local Ordinances:
    - Consider incorporating PEV-readiness policies into climate action plans, general plans, or stand-alone plans
    - Consider creating minimum requirements for PEV parking
    - Consider allowing PEV parking spaces to count toward minimum parking requirements
    - Consider adopting regulations and enforcement policies for PEV parking spaces
    - Consider specifying design guidelines for PEV parking spaces

- Guidance on Stakeholder Training and Education:
    - Consider developing a schedule for stakeholder training and outreach

Utilities can help minimize potential grid utility impacts in the following ways:

- Consider evaluating rate structures and impact on PEVs
- Consider assessing alternatives to tiered rate structures and evaluate TOU rates
- Consider developing automated and efficient utility notification protocol
- Consider upgrading distribution infrastructure
- Consider evaluating smart grid opportunities
- Consider implementing consumer outreach programs and informing customers of renewable energy options for PEV drivers

Regional governments can consider taking the following actions to accelerate PEV readiness across the many different stakeholders in the PEV ecosystem: convene a summit of local official, share PEV information and best practices across local jurisdictions, monitor PEV deployment and local readiness, and develop incentive programs to accelerate PEV adoption.

The guidance on readiness efforts in this Plan is designed to reinforce and complement existing efforts in the Bay Area. To ensure that the Bay Area meets its PEV targets, the BAAQMD will be periodically re-evaluating the assumptions and conclusions contained in this Plan and adapting them to reflect the current and future demand for PEVs.

The Plan also contains a separate supplementary document, referred to as Volume II Background and Analysis, which includes an in-depth review of each of the Plan sections that are summarized here in Volume I.

Bay Area PEV Drivers celebrate National Plug In Day at Crissy Field, part of the Golden Gate Recreational Area in San Francisco on September 23, 2012. Photo credit: Brian Kimball, Kimball Stock Photography.

1 Status of Plug-in Electric Vehicles in the Bay Area

At the core of the PEV ecosystem are the vehicles and charging infrastructure. PEVs (sometimes just referred to as electric vehicles, or EVs) include both plug-in hybrid electric vehicles (PHEVs) such as the Chevrolet Volt and Toyota Prius Plug-In, which can run either on gasoline or on electricity, as well as battery electric vehicles (BEVs) such as the Nissan LEAF and the Ford Focus Electric, which run solely on electricity. Charging infrastructure, also called electric vehicle supply equipment (EVSE), consists of charging hardware and the software that manages charging.

In general, there are three different types of EVSE, each of which uses a different power source and takes a different amount of time to charge a vehicle. Table 2 summarizes the characteristics of each charger type.

Table 2. Power Sources and Estimated Charging Times for Different Types of EVSE

EVSE Type	Power Source	Estimated Time to Achieve a Full Charge			
		Toyota Prius Plug-in	Chevrolet Volt	Nissan LEAF	Tesla Model S
Level 1	Typical wall outlet (120V)	3:00	7:30	15:30	37:30
Level 2	Similar to household electric dryer outlet (240V)	1:20	3:10	6:30	16:00
DC Fast	Specialized power source	n/a	n/a	00:40	00:30

Assumptions: Level 1 charging is 1.4 kW, Level 2 charging is 7.7 kW, and DC fast charging is 50 kW. For DC fast charging, calculations assume the battery is charged to only 80% and the remaining 20% is completed by charging at a slower rate. Note that DC fast charging can deliver power up to 150 kW. Neither the Prius Plug-in nor the Volt has DC fast charging capabilities. The estimates for the Model S assume the basic 60 kWh battery pack.

1.1 Current Conditions

The Bay Area has experienced higher consumer demand for PEVs than any other U.S. metropolitan area. Specifically, the region has the highest Nissan LEAF ownership rate in the country and the highest PEV ownership rate of the 22 areas participating in The EV Project. As of November 30, 2013, the Bay Area is home to more than 15,000 light-duty PEVs.[2] This accounts for 30 percent of the PHEV rebates and 41 percent of the BEV rebates issued statewide, even though the region accounts for approximately 17 percent of the State's population.

[2] According to the California Center for Sustainable Energy, the administrator of the California Air Resources Board's (CARB's) Clean Vehicle Rebate Project (CVRP), and estimates from ICF International.

The growing demand for PEVs has prompted public agencies and electric vehicle service providers (EVSPs) to provide funding for charging infrastructure across the Bay Area, which resulted in residential and publicly available EVSE, most of which are located in highly trafficked locations such as downtowns and retail, entertainment, and employment centers. These publicly funded projects are summarized in Table 3 below.

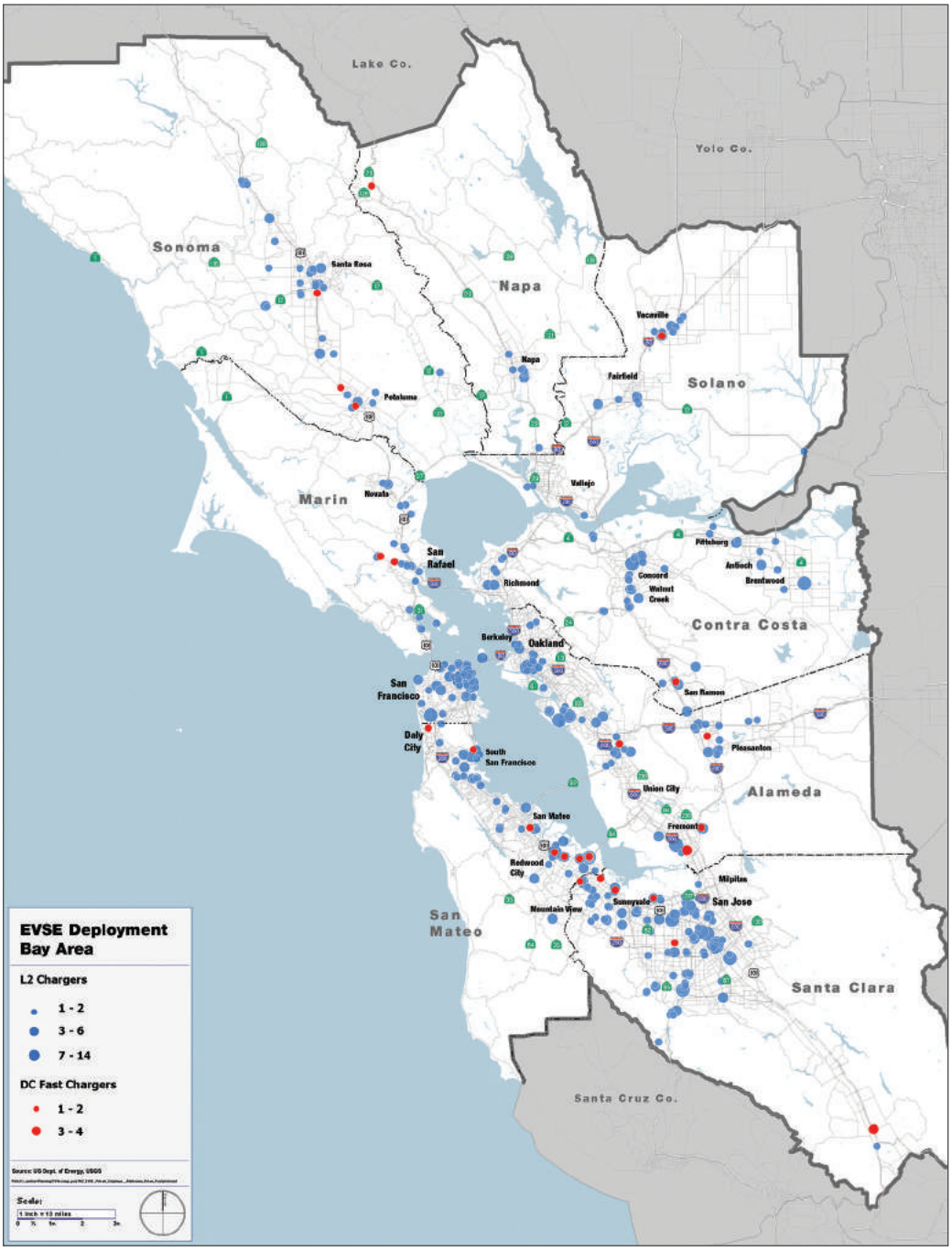
Table 3. Overview of Completed and Active EVSE Deployment Projects in the Bay Area

Project Title	Lead & Support Agencies	Incentive Funding		Match Funding	Charging Stations		
		Source	Amount (Millions)		Residential Level 2	Nonresidential Level 2	DC Fast
EVSE Home Charger Rebate Program (Completed June 2013)	ECOtality	BAAQMD	$2.50	N/A	1,500	–	–
		DOE	$5.00				
ChargePoint America (Completed June 2013)	Coulomb Technologies/ ChargePoint	DOE	$1.17[a]	$1.71[a]	–	330	–
Reconnect California (Completed August 2013)	Clipper Creek	CEC	$2.30	$1.20	–	65	–
Bay Area EV Corridor Project (Completed November 2013)	EV Communities Alliance, ABAG, Local Cities/ Counties	CEC	$1.49	$2.60	–	198[b]	4
		BAAQMD	$0.40		–		
Local Government EV Projects	Multiple	BAAQMD	$0.15	$1.94	–	50	–
		MTC	$2.80		–		
eFleet: Car Sharing Electrified	City CarShare SFCTA	MTC	$1.70	$0.74	–	24[c]	–
		BAAQMD BACAF/RFG	$0.53		–		
Tribal Community Sustainable Transportation	Kashia Band of Pomo Indians	MTC	$0.37	$0.08	–	6	–
Businesses Deploying EV Infrastructure	Best Buy, McDonald's, Etc.	BAAQMD	$0.34	$0.75	–	178	–
DC Fast Charger Program	Various site hosts	BAAQMD	$1.00	Varies by host	–	–	50
Electric Vehicle Charging Station Project	NRG (settlement w/ CPUC)	n/a	–	$25.00[c]	1,650[d] (minimum)		55
				Total (maximum)	2,490	1,511	109

[a] Values are estimates based on the total project funding, match funding, and grant funding. [b] There were also 138 L1 charge points installed as part of this program. [c] City CarShare has been installing EVSE through the ChargePoint America program. These charging stations are not included in the total because they are already accounted for in the ChargePoint America line item. [d] To estimate the match funding for the Bay Area, we assumed about 25% of the settlement would be invested here. For the purposes of our EVSE estimates, we assume that 60% of the Make Readies to be deployed by NRG will ultimately be residential Level 2 EVSE and the other 40% will be nonresidential Level 2 EVSE.

As a result of these projects, as well as widespread private sector interest in providing infrastructure to support the deployment of PEVs, many PEV drivers now have access to charging at various locations in the Bay Area. Figure 1 below shows the current distribution of nonresidential (public and private) EVSE across the Bay Area.

Figure 1. Map of EVSE Deployment in the Bay Area, September 2013



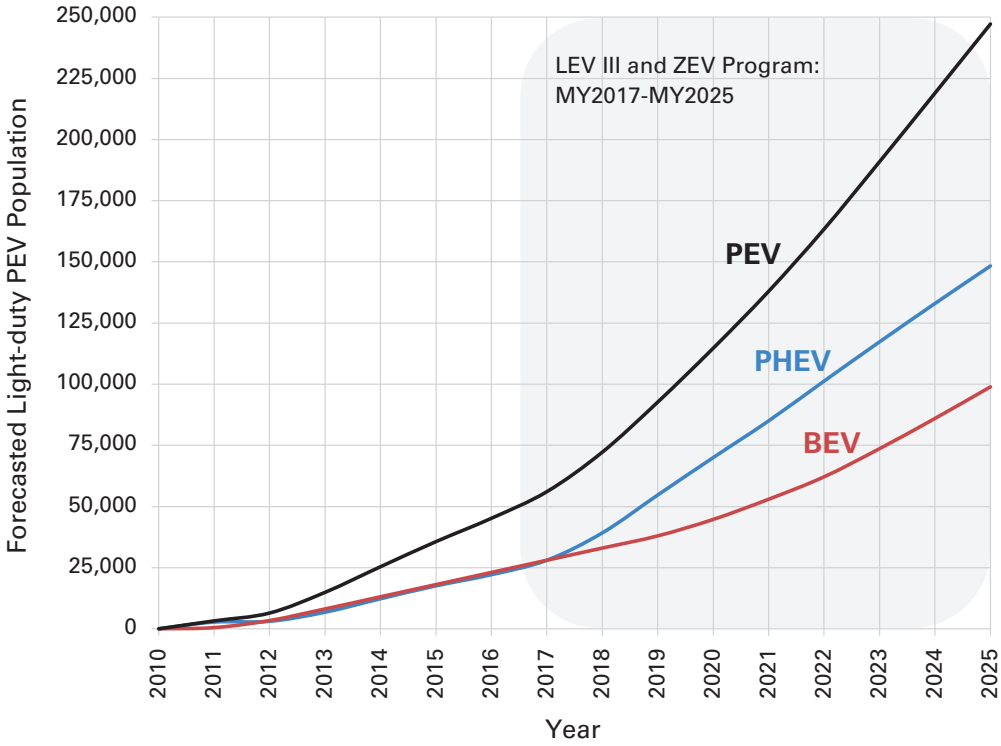
Source: Alternative Fueling Station Locator (accessed September 2013), MTC GIS Unit, ICF

1.2 Forecasts, Trends, and Regional Siting

Vehicle Deployment

Moving forward, strong continued growth in the Bay Area's PEV market is projected for the next 10–15 years, as shown in Figure 2.[3] Market analysts[4] predict current growth rates to continue through 2017, followed by even more rapid growth as regulatory drivers such as the Zero Emission Vehicle (ZEV) Program and the Low Emission Vehicle (LEV) III Program – both part of California's Advanced Clean Cars Program – take effect. Furthermore, battery costs – the most significant driver of PEV costs – are likely to decrease by about 30 percent by 2020, making PEVs more affordable and more accessible to a larger demographic of car buyers.

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



[3] More detail regarding PEV forecasts is available in the supplementary Background and Analysis. Available online at: http://www.bayareapevready.org/

[4] The vehicle forecasts were provided by ICF International. ICF's forecasts were informed by a review of forecasts from the Energy Information Administration (EIA), Citigroup, Morgan Stanley, Boston Consulting Group, EPRI, Gartner Research, Bloomberg, Pike (now part of Navigant Research), and the CEC—all of which show similar growth rates in the period out to 2017.

Infrastructure Deployment

Table 4 shows a range of estimates for the projected demand for level 1 and level 2 EVSE needed to support forecasted PEV population.[5] These estimates are based on factors including vehicle population, the expected nonresidential demand for charging (around 20 percent of total charging), utilization factors (varied by location type), and installed EVSE costs. These figures apply to EVSE located at workplaces and publicly available locations. In addition to these estimates, an estimated 75-150 DC fast charge stations at 35–50 locations will be needed to serve the Bay Area out to 2025, based on projected levels of BEV ownership and charger utilization. These estimates are dependent on parameters such as the price of charging and the rate of technological advances in charging and battery efficiency; the number of EVSE that will actually be needed to support PEV deployment will rise or fall based on these parameters.

Table 4. Estimated Publicly Available Level 1 and 2 EVSE Needed to Support Forecasted PEV Population

Year	Vehicle Forecasts		Estimated Demand for L1 and L2 EVSE			Estimated Demand for DCFC
			ICF Estimates		Estimates Using EPRI Method	
	PHEV	BEV	Low	Mid		
2015	17,600	18,100	7,900	14,200	4,370	75–150 DCFC stations at 35–50 locations
2020	70,000	44,700	13,960	30,960	16,730	
2025	148,000	98,900	20,790	45,190	35,550	

Regional Siting

To help guide investments in charging infrastructure and prevent negative impacts on the electricity grid, this Plan includes a siting analysis to determine optimal areas for EVSE, based on parameters shown in Table 5. The siting of charging infrastructure is a key component of successful PEV deployment and requires considerations of the following factors: location, quantity, level of charging, investment, and payment. Appendix 1 of the supplementary Background and Analysis describes the siting analysis in detail. To ensure that this Plan remains current, the BAAQMD will be periodically re-evaluating the siting plan's assumptions and conclusions and adapting them to reflect the current and future demand, and advances in PEV technology such as increased battery efficiency and increased rate for charging. Section 3 of this Plan discusses metrics that have been identified and recommended for ongoing monitoring. These metrics are the basis for which the siting plan will be updated in the future; note that the methodology for developing siting plans will also be updated and modified as dictated by changes in the market.

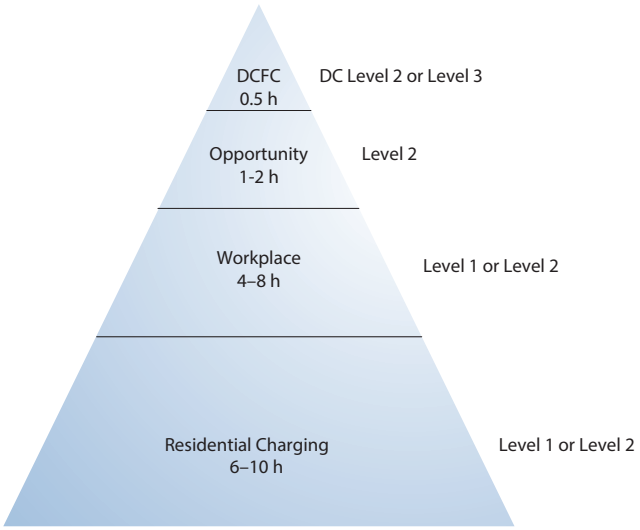
[5] More information is available on these infrastructure estimates in the supplementary Background and Analysis. Available online at: http://www.bayareapevready.org/

Table 5. Parameters Considered when Identifying Suitable Locations for EVSE

Category	Parameter	Brief Explanation
Vehicle Characteristics	Vehicle range	Informs trip distance, vehicle type, and appropriate level of charging.
	Charging time	Affects potential for opportunity charging and appropriate level of charging.
PEV Demand	Vehicle type	Informs forecasts differentiated by PHEVs and BEVs.
	Trip characteristics	Affects charging activity and distance traveled.
	Home charging capability	Affects the likelihood of a driver charging at home, where the vehicle spends a considerable amount of time (e.g., presence of a garage).
Parking Characteristics	Parking lot type	Affects the cost of installing EVSE.
	Ownership status	Affects the feasibility of installing EVSE; installations are more challenging when the property owner does not also own the property.
	Proximity to electricity sources	Affects the cost of installing EVSE.

The siting analysis focuses on four categories of charging and their relative use, as represented in the charging triangle illustrated in Figure 3. The majority of demand will be met by residential charging while vehicles are parked overnight. The next popular category of PEV charging will take place at workplaces, where employees and/or visitors are generally parked long enough to receive a significant charge. Finally, opportunity and DC fast charging at public locations will be needed less often but will, nonetheless, be needed to meet the demand from PEV drivers who need to charge at other away-from-home locations in order to extend the range of their trips.

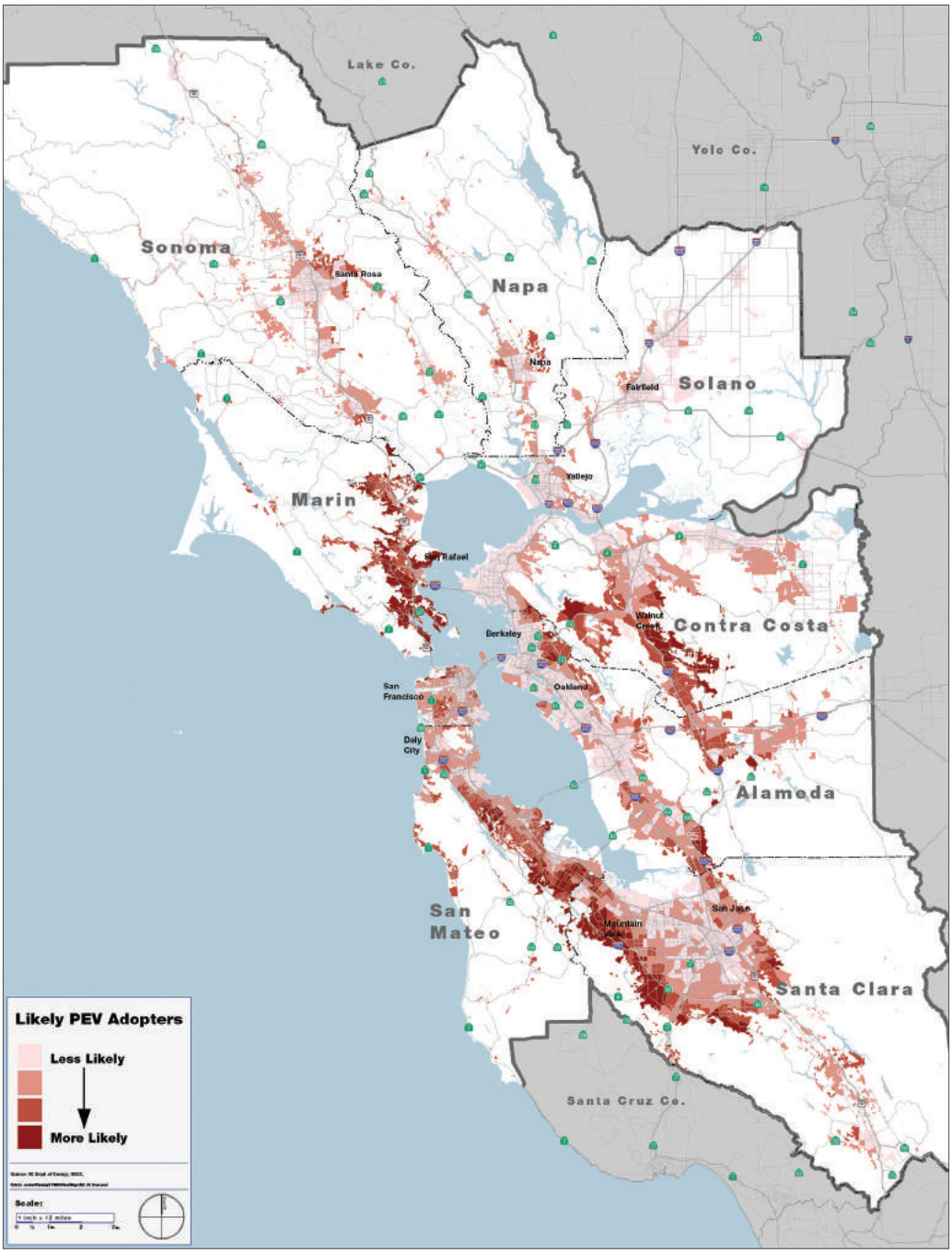
Figure 3. Charging Triangle, By Charging Type and with Charging Level



Residential charging

Figure 4 shows the locations that will likely experience the highest demand for residential charging. Since most charging takes place at home, these are locations in areas where likely PEV adopters live—places that have high levels of PEV and hybrid electric vehicle ownership and have high concentrations of single-family residences with attached garages.

Figure 4. Siting for Residential Charging Level 1 and 2 EVSE: Likelihood of PEV Adoption across the Bay Area

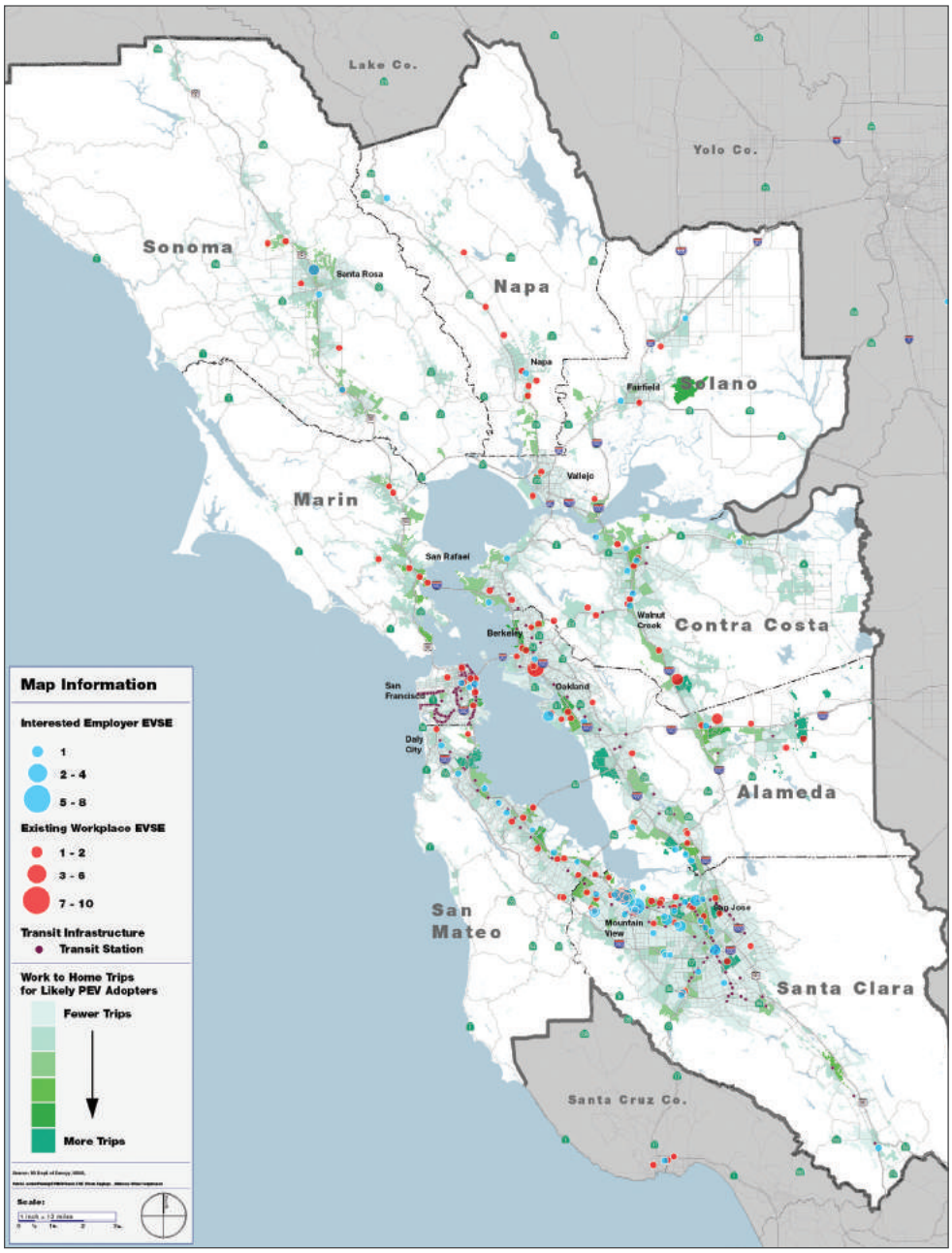


Source: ICF, MTC GIS Unit

Workplace charging

The map in Figure 5 below shows the location of areas that will likely experience relatively high demand for workplace charging—workplace locations with significant numbers of employees who are likely PEV owners and transit stations where vehicles are parked while their owners take transit to work (though not all stations shown have parking lots)—overlaid with areas where owners have already either installed EVSE or are interested in installing EVSE.

Figure 5. Siting for Workplace Charging Level 1 and 2 EVSE



Source: MTC GIS Unit, Fehr&Peers, ICF, BAAQMD

Opportunity charging

Opportunity charging covers a wide range of situations where a PEV driver can charge when they are away from home and work. Unlike residential and workplace charging, where vehicles are parked for long enough to achieve a significant charge even with level 1 charging, opportunity charging takes place at locations where PEVs are parked for varying times, so the level of charging bears much greater consideration. Table 6 shows the recommended charging level based on the length of time that a PEV may be parked (available charging time) at a particular venue.

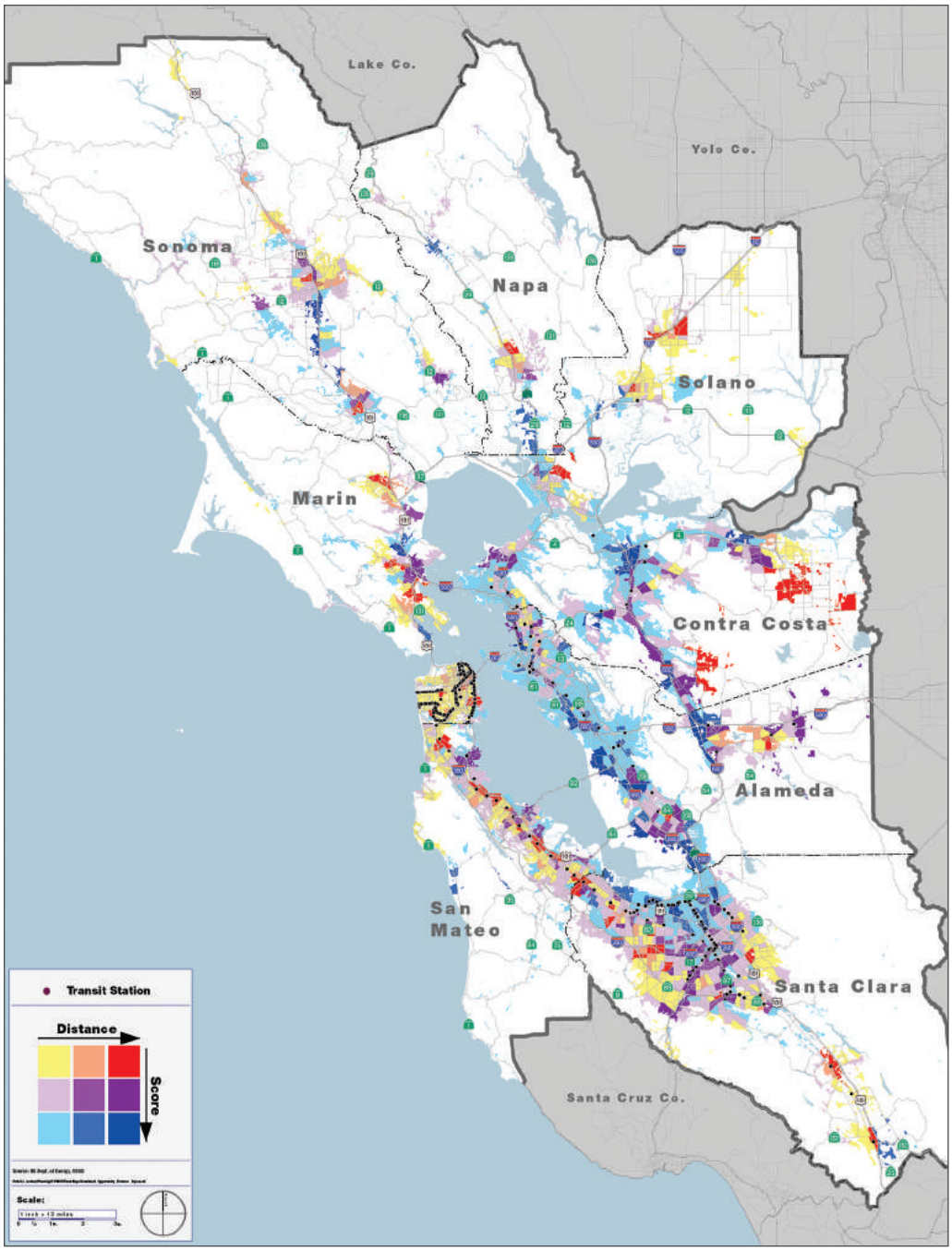
Table 6. Available Charging Time and Recommended Charging Level for Different Venues[6]

Typical Venue	Available Charging Time	Charging Level (Primary / Secondary)
Shopping Centers	0.5 – 2 hours	Level 2 / DC Fast
Airport (short term parking)	< 1 hour	Level 2 / DC Fast
Other	< 1 hour	Level 2 / DC Fast
Parking Garages	2 – 10 hours	Level 2 / Level 1
Cultural and Sports Centers	2 – 5 hours	Level 2 / Level 1
Airports (long term parking)	8 – 72+ hours	Level 1 / Level 2
Hotels/Recreation Sites	4 – 72 hours	Level 2 / Level 1
Interstate Highways	< 0.5 hours	DC Fast
Commuting/Recreation Roads	< 0.5 hours	DC Fast / Level 2

Figure 6 shows the concentration of non-work related trips for likely PEV owners and the average distance of these trips (0–5 miles, 6–10 miles, and 11+ miles). Areas with a high concentration of trips by PEV drivers (shown in light, medium, and dark blue) are likely to see the highest demand for level 1 and 2 EVSE, particularly at the venues, shown in Table 6, where level 1 or 2 charging is appropriate given likely available charging times. Though areas that experience longer-distance trips may see increased demand for charging as PEV drivers seek to extend their range, for the purpose of this analysis, trip distance is not a strong indicator of demand for opportunity charging. Since drivers often combine non-work related trips with commutes or other non-work trips (e.g., errands on the way home from work) PEV drivers may need to make use of opportunity charging, even on a relatively short trip.

[6] Adapted from table that was provided by the SF BayLEAFs, October 24, 2012.

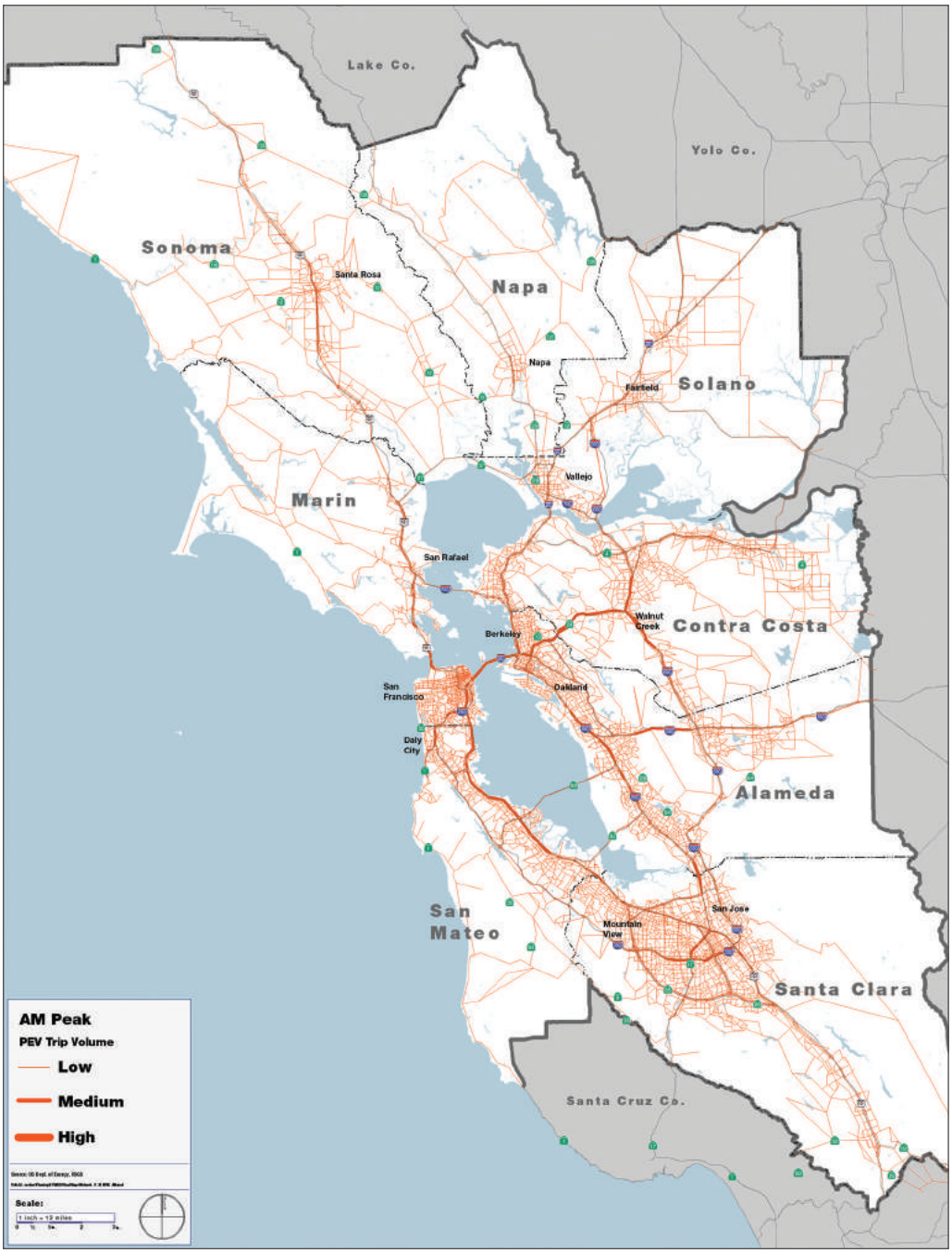
Figure 6. Siting for Opportunity Charging Level 1 and 2 EVSE



Source: MTC GIS Unit, Fehr&Peers, ICF

The need for DC fast charging comes primarily from BEV drivers who need to extend their range and PEV drivers who may not have access to charging at either home or work, keeping in mind that finding suitable sites for DC fast charging is more challenging than for level 1 and 2 EVSE. As Table 6 shows, demand for DC Fast charging will be concentrated alongside high-volume roadways at venues where vehicles are parked for only short periods. Figure 7 shows the corridors that are likely to experience the highest demand for DC fast charging based on the projected volume of PEVs using these roadways.

Figure 7. Siting for Opportunity Charging DC Fast EVSE: Heavy PEV Volume Corridors

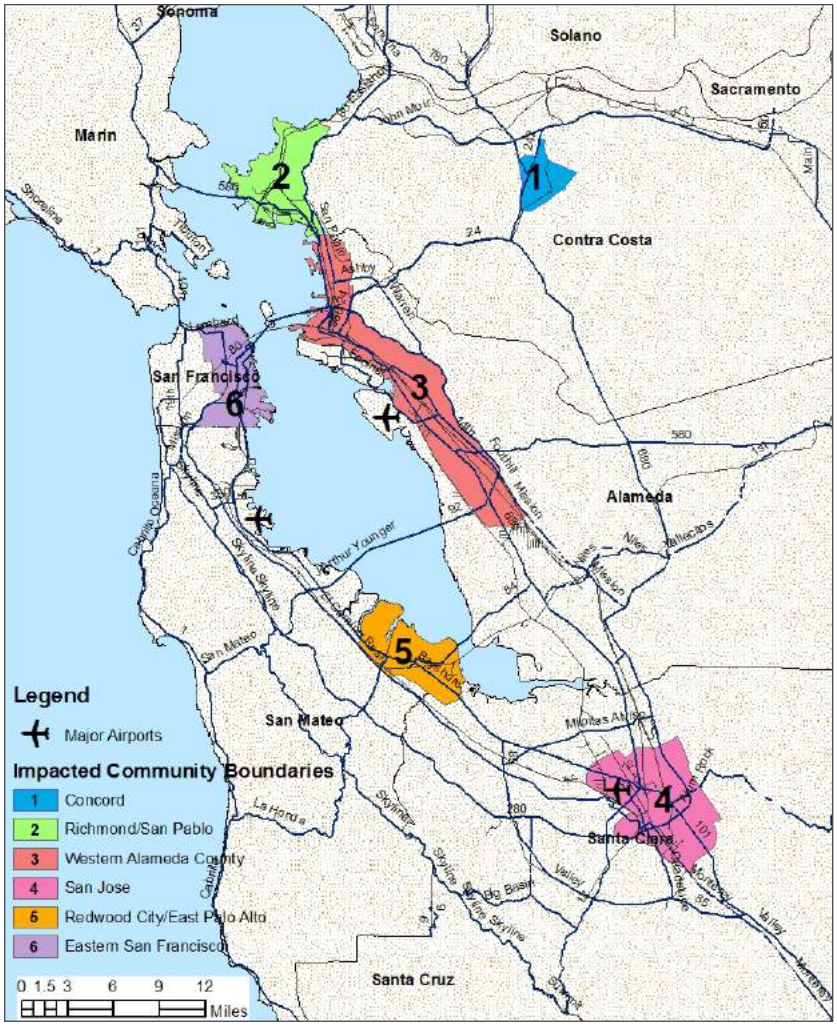


Source: MTC GIS Unit, Fehr&Peers, ICF

Charging in impacted/environmental justice communities

While current research and analysis shows that the uptake of PEVs in Impacted/Environmental Justice communities is likely to occur at a slower pace over the next several years, monitoring and targeting these areas for PEV adoption is important to assist in reducing harmful particulate emissions from both light- and heavy-duty vehicles. Currently, the BAAQMD prioritizes its grant funding towards projects located in the six communities identified in Figure 8 below and this will likely assist in the future deployment of additional EVSE in Impacted/Environmental Justice communities. Also, as part of the NRG settlement identified in Table 3, 20 percent of the DC fast EVSE to be installed as part of that project are required to occur in Impacted/Environmental Justice Communities. Based on the analysis performed in the Plan, deployment will likely provide a sufficient number of EVSE for vehicles located in these communities through at least 2015. The BAAQMD will be monitoring NRG's deployment under this effort to site additional EVSE in the region with NRG and the California Public Utilities Commission.

Figure 8. Impacted Community Boundaries in the Bay Area



Source: BAAQMD, Applied Method for Developing Polygon Boundaries for CARE Impacted Communities, December 2009

2 Strategies for Accelerating Plug-in Electric Vehicle Adoption

Though the Bay Area has seen rapid growth in PEV adoption over the past several years, the relatively higher cost of PEVs has been a primary obstacle to widespread ownership. Seventy percent of consumers say that a vehicle's retail price is the most important factor in deciding whether or not to purchase a PEV,[7] and most expect the purchase price of PEVs to be cost competitive with comparable non-PEV models.[8] As of 2013, this is rarely the case. Table 7 compares manufacturer's suggested retail prices (MSRPs) for three PEVs with comparable conventional vehicles. While the MSRPs for PEVs are still higher than their conventional vehicle counterparts, the purchase and lease price of certain models, such as the Nissan LEAF, are cost competitive with conventional counterparts[9] after federal and state incentives.

Table 7. MSRP Comparisons: PEVs vs. Conventional Vehicles

PEVs		Conventional Vehicles		Price Difference	Federal Tax Credit	California Rebate	Price Difference after Credits
Make/Model	MSRP	Make/Model	MSRP				
Nissan LEAF SV	$28,800	Nissan Versa SL	$18,490	$10,310	$7,500	$2,500	$310
Chevrolet Volt	$39,145	Chevrolet Cruze ECO	$19,325	$19,820	$7,500	$1,500	$10,820
Toyota Prius Plug-In	$32,000	Toyota Prius HEV	$24,000	$8,000	$2,500	$1,500	$4,000

The final price differences shown in Table 7 cover only the purchase price premiums that consumers face in the near-term for PEVs, and do not capture the total cost of ownership, which may be lower for PEV owners than for non-PEV owners. The total cost of ownership for PEVs depends on many factors, such as, the level of charging that consumers opt for, the availability of other monetary incentives (e.g., incentives for residential EVSE), the electrical utility rate that consumers opt for, and the miles traveled. In most cases, incentives and the lower cost of electricity will make the total cost of ownership for PEVs lower than a gasoline-powered vehicle over the lifetime of the vehicle (e.g., 10–12 years). The availability of other non-monetary incentives, such as the popular white and green stickers that allow PEV drivers to use HOV lanes further help support adoption despite the higher retail prices of PEVs.

[7] Deloitte Touche Tohmatsu Ltd, "Gaining Traction: A Customer View of Electric Vehicle Mass Adoption in the U.S. Automotive Market," 2010.

[8] Ibid.

[9] Note that the MSRP for the Nissan Versa SL shown is a bit higher than the entry-level price of around $11,990.

Accelerating the deployment of PEVs requires both creating additional incentives to help offset the incremental costs of PEVs and educating consumers so that they are aware of available incentives and of the long-term benefits of PEV ownership.

2.1 Incentives and Strategies to Accelerate PEV Deployment

There are many incentives currently available to Bay Area consumers of PEVs and EVSE and more are anticipated to become available over the next decade. Table 8 summarizes these incentives and the ways in which individuals and private and public fleet owners can leverage these incentives, as well as other resources, to accelerate PEV deployment. Additionally, a break-even cost analysis of installing and operating level 2 and DC fast chargers was conducted to determine the best use of public funds.[10]

Table 8. Summary of PEV Incentive Programs

Incentive Program	Funder/ Administrator	Available to	Available through	Incentive Available
Incentives for PEV Purchases				
Plug-In Electric Drive Vehicle Credit	Federal (IRS)	Individuals, businesses	TBD	$2,500–7,500, depending upon battery capacity
Clean Vehicle Rebate Program (CVRP)	State (ARB); administered by California Center for Sustainable Energy	Individuals, businesses	2023	$1,500–2,500 for purchases of new, ARB-certified PEVs
Hybrid Truck and Bus Voucher Incentive Program	State (ARB); administered by CALSTART	Businesses, fleet owners	2023	$8,500–65,000 per medium- and heavy-duty vehicle, depending upon vehicle technology, vehicle weight, and amount purchased
Clean Air Vehicle Stickers	State (ARB)	Individuals	2019	Access to carpool lanes through January 1, 2019 for an unlimited number of BEVs and the first 40,000 PHEV applicants
Electric Vehicle Project (EVP) for Residents and Business Fleets	Region (BAAQMD)	Individuals, businesses	Tentative	Approx. $400 (PHEVs) Approx. $700 (BEVs)
EVP for Public Fleets	Region (BAAQMD)	Public agencies	New in 2014	Approx. $1,000 (PHEVs) Approx. $2,000 (BEVs)
Vehicle Buyback and PEV Incentive Program	Region (MTC)	Individuals	New in 2020	Approx. $1,000 (PHEVs)

[10] More information is available on the break-even cost analysis in the supplementary Background and Analysis at http://www.bayareapevready.org/.

Incentive Program	Funder/ Administrator	Available to	Available through	Incentive Available
Incentives for EVSE Purchases				
Tax Credit for Alternative Fuel Vehicle Refueling Property	Federal (IRS)	Individuals, business	2013	Up to $30,000 (businesses) Up to $1,000 (individuals)
Low Carbon Fuel Standard Credits	State (ARB)	Employers, fleet owners	2020	LCFS credits for the electricity used to supply EVSE
Electric Vehicle Infrastructure Project	Region (BAAQMD)	Businesses, property owners	2014	Funding for DC Fast chargers along regional transportation corridors (up to $20,000 per charger) Funding for EVSE in workplaces and multifamily buildings (amount TBD)
Regional EVSE Network	Region (MTC)	Employers, retailers, parking managers	New in 2015	Funding for EVSE along key regional corridors (amount TBD)

Table 9 distinguishes non-traditional incentive options that apply to one or more of the following: commercial fleets (C), government fleets (G), and personally owned vehicles (P). Note that some of these options may be available to only commercial fleets or only government fleets, while some may benefit only personally owned vehicles (i.e., to the general public, therefore each option includes a brief discussion of the potential impact for fleets and, where possible, examples of success stories where PEV adopters were able to obtain savings, increase acquisitions, and reduce emissions.

A Ford Focus Electric charges at City Hall in Santa Rosa, CA.

Table 9. Incentives and Strategies to Accelerate PEV Deployment in Fleets

Program	Description	Example
HOV Lane Access (C G P)	Provides single occupant use of high occupancy vehicle (HOV) lanes to qualifying vehicles, including PHEVs and BEVs.	California already provides this incentive for PHEVs, which qualify for a limited number of green stickers (40,000), and BEVs, which qualify for a white sticker. The California Legislature recently passed a bill that would extend the program to January 1, 2019.
Free Parking (C G P)	California's Vehicle Code does not prohibit local governments from adopting additional parking ordinances, including designating preferential or free parking for PEVs.	The cities of Alameda, San Jose, and St. Helena provide PEVs with free parking; in some cases (e.g., San Jose), there are requirements that the vehicle be registered in the region or purchased from a dealership in the region.
Employer Incentives (C G P)	Private and public employers may provide their employees incentives to help accelerate adoption of PEVs. For instance, some commercial and government fleets offer access to EVSE to their employees driving non-pool vehicles, depending on the charging requirements of the fleet vehicles.	• Evernote in Redwood City provides employees with a $250 monthly allowance toward the lease of a PEV that qualifies for a HOV sticker. • Integrated Archive Systems in Palo Alto provides employees (who have been with the company for at least 12 months) $10,000 (gross) toward the purchase of a qualifying vehicle. • Google Inc., in Mountain View has a Fuel Efficient Vehicle Incentive Program which offers $5,000 toward the purchase or $2,500 toward the lease of a qualifying new vehicle. • Bank of America established a Vehicle Reimbursement Program which provides a $3,000 incentive when eligible associates purchase qualifying hybrid vehicles, compressed natural gas vehicles and highway capable PEVs.[10]
LCFS Credits (C G)	California's LCFS is implemented using a system of credits and deficits, whereby credits have a monetary value. In the case of electricity supplied to a fleet of more than 3 vehicles, the fleet can earn LCFS credits.	More research is needed to determine whether fleets are currently earning LCFS credits under this provision of the regulation; this practice is likely to increase significantly, as PEVs become ubiquitous.
Marketing Incentives (C G)	Marketing opportunities may incentivize fleet investment in PEVs by providing fleets recognition. This recognition can help commercial fleets meet corporate sustainability goals, while helping government fleets meet environmental performance goals.	Contra Costa's Green Fleet program encourages the use of alternative fuels (e.g., compressed natural gas and biodiesel), more efficient vehicles (e.g., hybrids), and "greening" their maintenance facilities. This is part of the County's ongoing efforts to reduce GHG emissions and energy consumption.

[11] Bank of America Energy Benefits, http://makeanimpact.bankofamerica.com/EnergyBenefits.

Program	Description	Example
Utility Demand Response (DR) Programs: PEV Battery Purchase Programs C G P	The basic premise of the battery purchase program is to bring forward the residual value of a vehicle's battery after it is no longer suitable for an automotive application. Rather than having a PEV owner wait until the vehicle's battery is no longer suitable for an automotive application and seeking value in a secondary market, the PEV battery purchase program would provide consumers with a specific dollar value at the point of purchase.	In April 2013, the CPUC approved PG&E's request to implement a Plug-In Electric Vehicle Pilot.[11] The pilot project will study the feasibility, functionality, and benefits of using second-life PEV batteries for DR, as well as the costs of PEV batteries and incentive mechanisms necessary to implement a successful initiative.
Green Vehicle Loans C G P	These loan providers could evaluate the fuel economy or emissions of a vehicle as part of the loan process, offering more attractive rates for more fuel-efficient vehicles. Rather than evaluating a consumer's ability to repay a loan solely based on credit score, the lender would account for lower operating expenses.	Some auto lenders, such as U.S. Bank, provide customers purchasing new or used vehicles in EPA's "Green Vehicle Guide" with a half-percent annual percentage rate discount.[12] By gaining access to lower rates or loan options, more consumers may consider fuel-efficient vehicles, such as PEVs.
Insurance Discounts C G P	Some insurance companies offer discounts on hybrid vehicles have announced plans to offer similar discounts to PEV drivers. Analysts reason that insurance companies are willing to provide discounts because owners of electric vehicles tend to be safer drivers.[13]	Hartford Financial Services offers an electric vehicle discount of five percent,[14] while Admiral Insurance in the UK offers a 10 percent discount for PEV models such as the Nissan Leaf and Mitsubishi i-MiEV.[15]
Restricting Insurance Surcharge C G P	Prohibits insurance companies from charging a surcharge on insurance for electric vehicles.	In 2011, Florida enacted a statute restricting insurers from adding surcharges based on factors such as new technology and materials.[16]
Extended Financing Period C G	Extends the financing period of a vehicle to reflect the average life of vehicles, while providing fleets additional time to amortize their investment.	PG&E worked with commercial financial firms to develop a cost structure that reduces the upfront burden of the PEV premium.[17]

[12] State of California Public Utilities Commission, Advice Letter 4077-E-B, April 2, 2013, http://www.pge.com/nots/rates/tariffs/tm2/pdf/ELEC_4077-E-B.pdf.

[13] Ibid.

[14] USA Today, "Owners of costly electric cars save money on insurance," May 21, 2012, http://content.usatoday.com/communities/driveon/post/2012/05/owners-of-costly-electric-cars-save-money-on-insurance/1#.UZ5LAdj1V4k.

[15] The Hartford, "The Hartford Offers Electric Vehicle Discount," available online: http://newsroom.thehartford.com/News-Releases/The-Hartford-Offers-Electric-Vehicle-Discount-4c9.aspx.

[16] Admiral, "New insurance discount offered for electric cars," available online: http://www.admiral.com/press-releases/15052013/new-insurance-discount-offered-for-electric-cars/.

[17] State of Florida, "Florida Statute 627.06535," available online: http://www.flsenate.gov/Laws/Statutes/2011/627.06535.

[18] Electrification Coalition, "PG&E: It's Electrifying: Positive Returns in PEV Deployment," available online: http://www.fleetanswers.com/sites/default/files/PGE%20case%20study%20Final.pdf.

Program	Description	Example
Technical Assistance C G	Information sharing encourages investment in PEVs among fleets. A McKinsey study indicated that education may be an extremely effective incentive – potentially more so than financial incentives in the long-term.[18] Fleets often require more assistance navigating and weighing the various considerations associated with PEV ownership as compared to conventional vehicle ownership.	The Western Washington Clean Cities Coalition, in partnership with the Puget Sound Clean Air Agency, offers the Evergreen Fleets program, a comprehensive greening plan and certification system for fleets.[19] The Plugged-in Fleets Initiative 100 based in the UK provides fleets with advice and analysis of how PEVs could be used in their fleets.[20]
Leverage Fleet Purchasing Power C G	Fleets can leverage their relationships with other organizations to coordinate a multi-fleet effort to purchase PEVs. Joint procurement refers to the combined purchasing power of multiple entities in a single purchasing effort to achieve economies of scale; pooled knowledge and skills of the participating agencies; and reduced duplicative research and administrative effort.	The cities of San Jose, Mill Valley, Los Gatos, and Campbell recently announced that they have entered into an agreement with Mitsubishi, Active International, and Mike Albert Fleet Solutions to deploy a total of 50 iMiEVs. San Jose reports that the cars will be leased at little or no cost.
Vehicle Right-Sizing C G	Fleets can work with OEMs to help influence vehicle and battery design, particularly for PEVs. Typically, this type of interaction between fleets and OEMs occurs for only larger fleet purchases.	FedEx worked to negotiate a smaller battery pack for their trucks that travel only 15 to 20 miles per day, which reduced the cost of the vehicles.[21] OEMs typically include battery packs capable of ranges of 100 miles or more. By "right-sizing" the batteries, FedEx was able to reduce costs while also increasing space in their trucks.
Government Lease Programs G	Allow public entities to make use of the $7,500 federal tax credit which reduces the upfront cost of the vehicle. Lease programs also can help spread out the price of the vehicle over multiple years, minimizing budget strain, and freeing capital for other projects.	Nissan is offering a municipal lease program to public entities.[22]
Front of Line Privileges C	This incentive allows taxicab drivers the opportunity to receive head-of-the-line privileges at airports and other popular transit hubs.	Dedicated compressed natural gas (CNG) taxicabs authorized to operate at the Dallas Love Field airport receive "head of the line" privileges and advance to the front of a holding or dispatch area ahead of other taxicabs.[23]

[19] Russell Hensley, Stefan Knupfer, and Axel Krieger. "The fast lane to the adoption of electric cars," McKinsey, February, 2011.

[20] Evergreen Fleets, available online: http://www.evergreenfleets.org/.

[21] Energy Saving Trust, "Plugged-in Fleets Initiative 100," available online: http://www.energysavingtrust.org.uk/Organisations/Transport/Products-and-services/Fleet-advice/Plugged-in-Fleets-Initiative-100.

[22] Electrification Coalition, "FedEx: The Electric Drive Bellweather?," available online: http://www.fleetanswers.com/sites/default/files/FedEx_case_study.pdf.

[23] Center for Climate and Energy Solutions, "Deploy Fleet Vehicles," available online: http://www.c2es.org/pev-action-tool/action-3-1.

[24] City of Dallas, "Ordinance No. 27831," available online: http://www.greendallas.net/pdfs/TaxisOrdinance.pdf.

2.2 Consumer Education and Outreach

There are many stakeholders in the region engaged in the deployment of PEVs and EVSE, including public and private actors who have greatly contributed to making the Bay Area a market leader in PEV and EVSE deployment. With a market that includes more than 5 million light-duty vehicles registered in the Bay Area and more than 250,000 new light-duty vehicles sold annually, a local, well-coordinated PEV educational campaign that specifically targets consumers is needed in order to successfully capture the attention and acceptance of the broader public. The key regional stakeholders – led by MTC in collaboration with ABAG and BAAQMD – have responded to that need and are developing an EV Promotional Campaign that will target potential consumers in the region.

EV Promotional Campaign for the Bay Area

The EV Promotional Campaign will be aimed at building awareness and demand for PEVs (including both BEVs and PHEVs) in the Bay Area along with helping to stimulate additional supportive actions for infrastructure development. The objectives of the campaign are 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 the following:

- Change behavior of Bay Area drivers to purchase PEVs or otherwise use PEVs;
- Develop core messages that create awareness to communicate PEV benefits;
- Continue to promote the Bay Area identity as a center for high tech, green culture, and the EV capital of the US;
- Educate Bay Area residents about PEVs;
- Demonstrate PEVs for potential consumers through targeted outreach;
- Identify prominent individuals/organizations to deliver campaign messages; and
- Motivate individuals to reduce their contribution to Bay Area GHG emissions.

The one-year campaign will be launched in Spring 2014. It will include several ride-and-drive events throughout targeted locations of the Bay Area and will use social media to promote the events and the driver experience. MTC and its regional partners will be evaluating the campaign activities for direct impact on purchase, lease, and usage of PEVs.

2.3 Opportunities to Attract/Retain PEV Manufacturing and Services

The PEV industry provides an opportunity for local governments to spur economic growth and create jobs, as well as augment the existing high-tech culture in the Bay Area. A study commissioned by CalETC[25] projects that if PEV market share of new vehicles increases in compliance with the ZEV Program, this shift would confer new economic growth via long-term energy fuel savings, adding about $5 billion to Gross

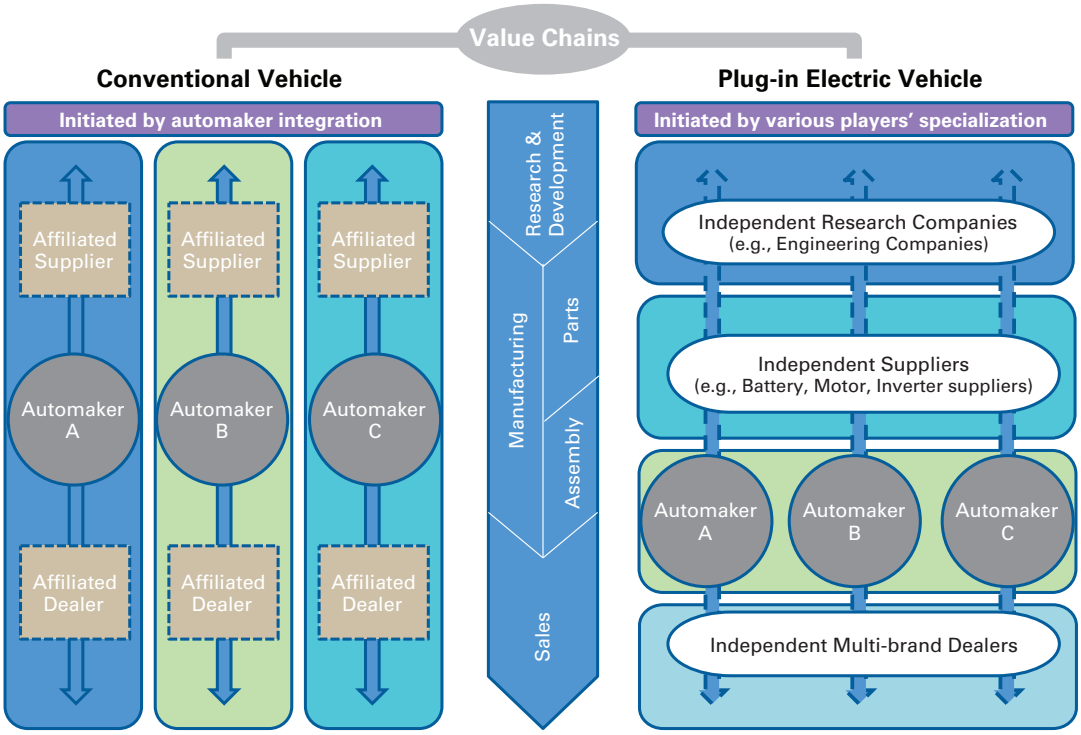
[25] Plug-In Electric Vehicle Deployment in California: An Economic Assessment, Department of Agricultural and Resource Economics, UC Berkeley, September 2012.

State Product (GSP) and about 50,000 more jobs by 2030.[26] However, the performance of individual companies within the PEV ecosystem has so far been mixed, with some companies exceeding expectations and others falling short. Government efforts to pursue PEV-related economic development could be part of a diversified, multi-sector economic development strategy that takes account of both market realities and local competitive advantages and disadvantages.

Overview of the PEV Industry

In contrast to the rest of the automotive industry, the PEV industry supply chain is more horizontally structured (see Figure 9).[27] PEVs use fewer components and typically require less collaboration between parts/component manufacturers and vehicle manufacturers, which means that parts manufacturers can be less specialized and that they can produce generic products to be used by many actors in the supply chain.

Figure 9. Differences Between the Supply Chains of Conventional Vehicles and BEVs



Source: Adjusted from Zhou et al. 2010

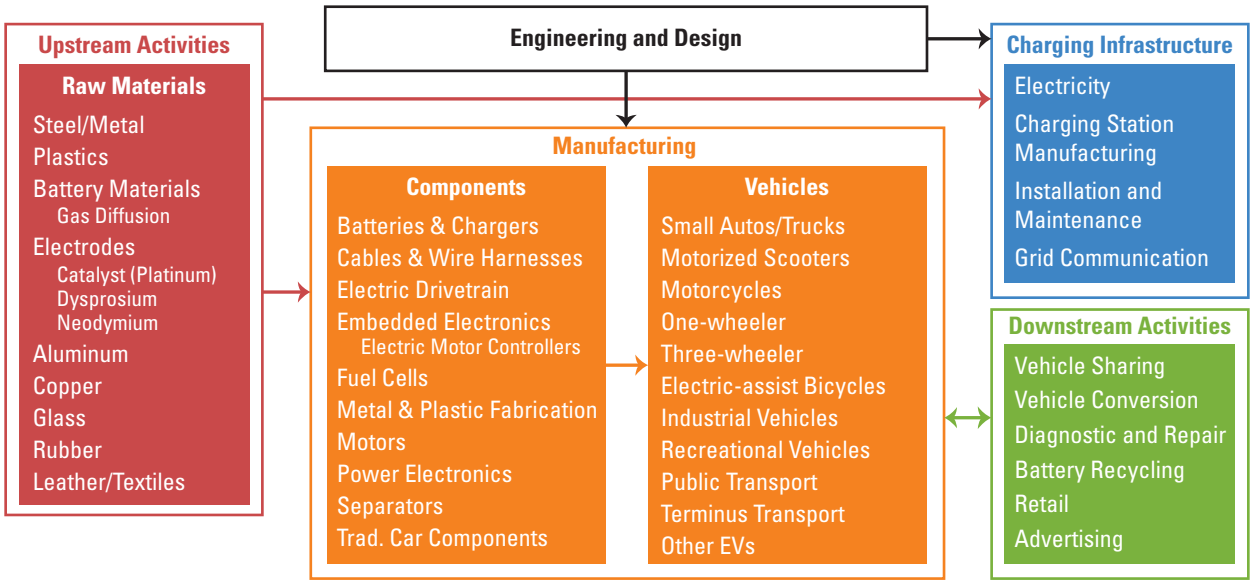
The implication of this comparatively horizontal structure is that there are lower barriers to entry for firms along the entire PEV supply chain. Many of the Bay Area's competitive advantages—including its existing high-tech and cleantech industries, experienced managers and engineers, skilled workforce, supportive public policies, and venture capital resources—create opportunities to develop new businesses and retain growing companies entering the PEV ecosystem.

[26] The study also projected that a more aggressive PEV deployment—45%of new vehicle market share by 2040—would add $8 billion in real GSP and about 100,000 jobs.

[27] Zhou, Lei, J. W. Watts, M. Sase, and A. Miyata. 2010. "Charging Ahead: Battery Electric Vehicles and Transformation of an Industry."

Figure 10 summarizes the PEV industry cluster; below we discuss growth opportunities in the Bay Area for each sector shown in the figure.

Figure 10. PEV Industry Cluster



Source: Adapted from NERC 2013

- Upstream activities include extraction and production of the raw materials that go into PEV manufacturing, such as plastics, metals, and leather. This sector does not represent a significant opportunity for the Bay Area.
- Engineering and design supports PEV product development. Many companies in the PEV ecosystem have been created in the Bay Area, and many major auto manufacturers also have research and development facilities in the region. The Bay Area is a leader in high tech engineering and design, and this sector could remain a strong focus for the Bay Area.
- Vehicle manufacturing involves assembly and production of finished PEVs. As of 2013, Tesla is the only vehicle manufacturer that has a vehicle manufacturing facility located in the Bay Area, while the majority of U.S. PEV manufacturing occurs in states that have lower costs associated with labor, land, and taxation. Therefore, this Plan suggests that the Bay Area's PEV-related economic development efforts related to PEVs should focus on retaining existing manufacturing facilities.
- Component/part manufacturing firms supply vehicle drivetrains, electric motor controllers, batteries, and other components to PEV manufacturers. The Bay Area is home to Mission Motors, which has received recognition as a supplier of advanced electric powertrain technology. However, since firms that make components tend to locate in proximity to vehicle manufacturers, this sector may not constitute as strong of an opportunity in the Bay Area.
- Charging infrastructure includes a wide array of manufacturers/vendors of EVSE and the software used to control it. Local EVSE firms include ChargePoint and Clipper Creek. Given the Bay Area's existing businesses in this industry, opportunities exist

for the region to further develop this market segment. This Plan suggests that economic development assistance for EVSE companies should be highly targeted, given the likely consolidation of this industry.

- Downstream activities include PEV retail sales, PEV maintenance and repair, battery recycling, and vehicle sharing. It is expected that most of these will expand as PEV sales increase, and that these do not warrant targeted strategies to attract these businesses.

Local and State Economic Development Case Studies

Michigan: Restructuring an industry

The automotive industry, with Michigan at its epicenter, suffered the impacts of the Great Recession acutely. Michigan responded by laying out an aggressive plan to attract new industries and recover from its losses, with a focus on batteries and PEVs. In 2009, companies with plants in Michigan were awarded $1.35 billion from the American Recovery and Reinvestment Act (ARRA). Furthermore, Michigan dedicated approximately $1 billion in business, property, and brownfield tax credits to companies that manufacture batteries, electronic components for PEVs, and vehicles.

Michigan was successful in its near-term efforts to secure stimulus funding and support growth in the PEV and battery manufacturing sector, but it remains to be seen whether the state's investment will pay off in the long term. In particular, battery manufacturing in 2013 is projected to outstrip global demand; this over-supply has already led to the bankruptcy of one high-profile battery manufacturing firm that received funding and tax credits from Michigan, and there is likely to be further consolidation in the next several years. Michigan's experience illustrates the potential pitfalls of focusing economic development efforts too narrowly. With such a strong focus on batteries, PEV components, and PEV manufacturing, the payoff of Michigan's investments are tied strongly to the adoption of PEVs in the marketplace.

Tennessee: Working with Nissan to attract manufacturing

Tennessee also has received attention for its success in developing in-state PEV manufacturing at Nissan's production facility in Smyrna, TN. This effort required considerable time and expense on the state's part, and was not part of a greater strategy to attract PEV manufacturing. Rather, it was the result of a strong existing relationship with Nissan—Tennessee has had a Nissan manufacturing plant in the town of Smyrna since the 1980s—and a substantial investment to attract traditional auto manufacturing jobs to the state.

In total, Tennessee offered almost $200 million in incentives to Nissan, including relocation fees and job tax credits, to move its North American headquarters in 2006. By contrast, California, which was previously Nissan's North American home, could offer only $25 million worth of incentives. Nissan's relocation resulted in an estimated direct loss of 1,300 jobs in California and another 1,500 indirect jobs. Originally, all of the

manufacturing workers employed by Nissan were producing conventional automobiles, but in 2007, the DOE established its Advanced Technology Vehicles Manufacturing Loan Program and awarded $1.6 billion to Nissan to modify their Smyrna, TN manufacturing facility to accommodate production of the LEAF and to construct an adjacent battery plant. As of 2012, the Smyrna EV plant reported that 300 new jobs have been created, with plans of creating 1,000 more.

San Jose: A multifaceted strategy for business retention

The City of San Jose has been active in supporting the development and retention of its PEV cluster through a combination of political leadership and economic development strategies. These efforts are part of the city's Green Vision, a larger strategy to attract and retain clean technology businesses. The first goal of the Green Vision is to attract 25,000 cleantech jobs, including jobs related to the production of PEVs. Other goals support PEV deployment by calling for a reduction in per capita energy use and the use of alternative fuels throughout the city's fleet. San Jose has adopted specific targets for each goal and tracks progress on an annual basis,[28] and the city's mayor has engaged the private sector by publicly issuing challenges to implement key aspects of the Green Vision.

San Jose has also worked to catalyze the development of PEV technologies through demonstration projects. These include working with ChargePoint (formerly Coulomb Technologies) to install its first charging station across from City Hall. In 2011, San Jose adopted a policy[29] that encouraged partnership with private companies on demonstration projects by making city property available for these projects and allowing the city council to allocate funding to or lift requirements on demonstration projects. San Jose has applied for funding from the Department of Commerce to create a central facility on city property for innovative firms to test and deploy new technologies, including new vehicle technologies.[30]

In addition to these broad strategies, San Jose's Office of Economic Development (OED) has conducted studies that help it to better understand its position within the PEV supply chain and to identify targets for economic development efforts. The OED found that 95 percent of new jobs came from new company formation or expansion of existing local firms, rather than by attracting established companies. As a result, San Jose's economic development strategies focus on retaining those firms where the city sees the most potential for job creation—typically companies with 50–300 employees that have experienced continuous growth over a 5-year period. Retention strategies include the creation of an enterprise zone and incentives focused on drawing cleantech companies to the zone, including:

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[28] More information available online at http://www.sanjoseca.gov/index.aspx?nid=2737.

[29] More information available online at: http://www.sanjoseca.gov/DocumentCenter/View/1343.

[30] More information is available in a Memorandum to the Community and Economic Development Committee, available online at http://www3.sanjoseca.gov/clerk/CommitteeAgenda/CED/20111024/CED20111024_d2.pdf.

- Hiring tax credits of up to $37,440 per employee over 5 years.
- Business expense deductions of up to $20,000 for qualified property.
- Net operating loss carryovers that reduce taxable income in future years.
- State tax credits equal to the amount of sales and use tax paid on manufacturing and data processing equipment.
- Expedited permitting for tenant improvements and industrial tool installations.
- Retaining third-party manufacturing companies that support growth among mid-size cleantech firms.
- Convening players from across the PEV cluster, including researchers, investors, manufacturers, regulators, and policy professionals, to identify opportunities for collaboration.

Fremont: A recovery strategy

In 1984, Toyota and General Motors initiated a first of its kind joint venture in the Bay Area: New United Motor Manufacturing Inc. (NUMMI), an automobile manufacturing plant in Fremont. The NUMMI plant survived for about 25 years before closing its doors in 2010, resulting in the loss of about 4,500 jobs. However, just months after the NUMMI plant produced its last car (March 2010), Tesla agreed to purchase a portion of the facility, and Fremont continues to work to recover the jobs lost during the closing of the NUMMI plant by attracting other businesses in the PEV sector, aided by a $333,000 grant from the U.S. Economic Development Administration.

Staff training is a key component of Fremont's recovery plan. Fremont staff attended the ARPA-E conference, which showcased new technologies, to help staff keep abreast of market developments and new companies that may be seeking support. Staff also works with Tesla to identify opportunities for the city to support Tesla's growth. Like San Jose, Fremont has been working to develop demonstration projects, such as an evolving partnership with Oorja Protonics to demonstrate direct methanol fuel cells, which can serve as a range extender for electric vehicles, in the city's fleet.

Fremont offers the following incentives to attract cleantech firms:

- Business license tax exemptions that waive business license tax fees for new companies for five years and existing companies for two years. Fremont values the tax exemption program at $20,000 or less, which is a modest impact, but demonstrates the city's commitment to attracting innovative firms.
- Development fee reductions for companies that are building facilities that achieve LEED Platinum status.
- Marketing innovation districts, such as the Warm Springs Area in South Fremont, where the majority of new cleantech firms are expected to locate, by promoting existing business opportunities and activities in these areas and organizing cleantech events.

Implementation Guidance

The case studies in the call-out boxes illustrate several lessons that could apply to local government efforts to attract businesses along the PEV supply chain, and are the basis for the implementation guidance below.

Consider focusing on retention over attraction

Many states and national governments are offering large incentive packages to attract manufacturing facilities at a scale that cannot be matched by local governments, making retention a more promising strategy for local governments looking to foster businesses along the PEV supply chain. A number of studies have shown that more jobs are created by expanding existing businesses in the community than by attracting new firms from outside the community. When prioritizing economic development programs for funding, local and regional governments could consider placing business retention efforts ahead of business attraction. Incentives could also be made available to existing firms as well as to new companies.[31]

Consider analyzing existing opportunities to generate economic development strategies

Cities and counties can consider conducting an analysis of their competitive position and local opportunities and then identify opportunities to apply this analysis to businesses along the PEV supply chain. In particular, there may be opportunities for Bay Area cities and counties to focus on attracting and retaining businesses that make vehicle components, conduct research and development, and manufacture or manage EVSE. Given high local costs and aggressive incentive programs in other states with existing manufacturing capabilities, attracting additional large-scale manufacturing plants may be exceedingly difficult for the region.

Consider focusing on prototyping, testing, and demonstration

With its strong universities and existing high tech industries, the Bay Area has advantages in terms of innovation, technology development, and engineering. Local governments could consider leveraging these advantages by creating demonstration opportunities that showcase applications of new technology and that attract further investment.

Consider collaborating and convening

Businesses along the PEV supply chain often have common needs even though they may work in different sectors or locations within the Bay Area. Local governments could consider helping to identify and meet these needs by collaborating with local firms on developing PEV related policies and broader economic development strategies. Local governments could also consider collaborating with other cities or counties to pursue mutually beneficial regional PEV industry development strategies.

[31] A. Macpherson and M. Ziolkowski, "The Role of University-Based Industrial Extension Services in the Business Performance of Small Manufacturing Firms: Case Study Evidence from Western New York," Entrepreneurship and Regional Development 17, no. 6 (2005): 431–447.

Consider offering targeted incentives

A local government could also consider reviewing incentives that are available at the regional, state, and federal level, publicizing them, and developing supplementary local incentives. These can include business tax credits and business expense deductions. Even modest incentives can make a critical difference in business development, particularly when attracting and incubating growing firms.

Consider coordinating regional economic development

Governor Brown recently signed into law AB 93[32] and SB 90,[33] both of which will reform what were previously referred to as enterprise zones. Although incentives and tax credits will change significantly when these laws go into effect, there will still be opportunities for local governments to attract and retain businesses, particularly manufacturing companies, through tax credits and other incentives.

2.4 Integrate PEVs into Plan Bay Area

Introduction

The Sustainable Communities and Climate Protection Act of 2008 (SB 375, Steinberg, Statues of 2008) requires California's metropolitan planning organizations (MPOs) to prepare a sustainable communities strategy (SCS) to demonstrate how each region will meet its regional GHG reduction target established by ARB. For the Bay Area, the target is a 7% per capita reduction by 2020 and a 15% per capita reduction by 2035 from a baseline year of 2005. In response to SB 375, MTC, in partnership with ABAG has developed Plan Bay Area, an integrated long-range transportation and land-use/housing plan that will support a growing economy, provide more housing and transportation choices, and reduce transportation-related pollution in the San Francisco Bay Area.

Plan Bay Area was adopted with the following goals: climate protection, adequate housing, healthy and safe communities, open space and agricultural preservation, equitable access, economic vitality, and transportation system effectiveness. Plan Bay Area focuses on the adopted performance target regarding GHG emission reductions from cars and light-duty trucks and lays out a strategy to achieve GHG reductions mainly from reduced vehicle miles traveled (VMT) via a combination of housing/land-use planning and transportation investments. To achieve the aggressive 2020 and 2035 emission targets, the Bay Area will have to seek complementary strategies to the multimodal transportation network and land use plan. Plan Bay Area also authorizes $630 million in funding for investments in technology advancements and incentives for alternative travel under the Climate Program Initiatives that are highlighted in Table 10.

[32] More information available online at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB93.

[33] More information available online at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140SB90.

Table 10. Summary of Climate Program Initiatives

No.	Policy Initiative	Cost ($ millions)	Per Capita Emission Reductions
1	Commuter Benefit Ordinance	$0	0.3%
2	Car Sharing	$13	2.8%
3	Vanpool Incentives	$6	0.4%
4	Clean Vehicles Feebate Program*	$25	0.7%
5	Smart Driving Strategy	$160	1.6%
6	Vehicle Buyback & PEV Purchase Incentive*	$120	0.5%
7	Regional EVSE Network*	$80	0.3%
8	Climate Initiatives Innovative Grants	$226	TBD
	Total	$630	6.6%

*Program initiatives 4, 6, and 7 are the key aspects of integrating PEVs into Plan Bay Area.

SB 375 is largely silent on how reductions can be achieved; each region must simply have its sustainable community strategy reviewed and approved by ARB. Thus, Plan Bay Area makes the following assumptions on how to reduce emissions by integrating PEVs:

- Implement a program that accelerates PEV adoption.
- Implement a program that increases charging opportunities, thereby increasing the amount of electricity that displaces gasoline (particularly in PHEVs).

Accelerating PEV adoption

One of the barriers of accelerating PEV adoption is the high purchase price of PEVs. Currently, a combination of the federal tax credit and the California state rebate helps to reduce the purchase price of vehicles significantly; however, the long-term availability of these programs has yet to be determined. For instance, the current federal tax credit is phased out by manufacturer once that manufacturer reaches a threshold of 200,000 in qualified PEV sales. This federal tax credit is projected to phase out for the major automobile manufacturers starting in 2018. Furthermore, the California Clean Vehicle Rebate Project (CVRP), which is funded via AB 118 was set to expire at the end of 2015, but was recently extended through 2023 via AB 8 (Perea, 2013).[34]

Therefore, by 2020, there will likely be fewer purchasing incentives available for PEV consumers. Depending on vehicle pricing, this may be an opportunity for regional governments to offer more modest incentives that help continue the acceleration of PEV purchases in the middle- and low-income brackets.

[34] More information is available online at: http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB8.

Some industry observers believe that increased availability of DC fast charging EVSE will accelerate the deployment of PEVs, particularly BEVs. The thinking is that the limited accessibility to at-home charging for residents in multi-family housing may be restricting PEV adoption in the Bay Area and that DC fast charging could serve as a solution to the challenge of deploying EVSE at multi-family housing units.

In developing Plan Bay Area and incorporating PEVs, DC fast charging EVSE and EVSE for residents in multi-family housing were not considered. Moving forward, however, regional stakeholders will re-assess the PEV and EVSE market to incorporate these opportunities as needed.

Increasing charging opportunities

The limited range of BEVs (typically 50–100 miles, except for high-priced models with large battery packs) is generally identified by members of the public as a barrier to vehicle purchasing. PHEVs generally have a lower all-electric range; however, with the hybridized power train, the vehicles can travel the same long distances that a conventional vehicle would by relying in part on a gasoline-powered engine.

The GHG emission reduction benefits attributable to BEVs and PHEVs are a function of many variables; most notably, VMT in all-electric range. Determining electric VMT for BEVs and PHEVs differs. For BEVs, analysts often assume lower overall VMT based on vehicle range; for PHEVs, analysts make assumptions on percentages of total VMT that is all-electric. By increasing opportunities to charge PEVs through an incentive infrastructure program, a region can maximize emission reduction benefits of PEVs by displacing petroleum with electricity. Most PEV drivers are expected to charge their vehicles at home. Hence, the best opportunity to increase charging opportunities to those who have limited access to home charging would be at workplaces and recreational destinations (e.g., retail shopping centers).

Clean Vehicles Feebate Program

Originally coined in the 1990s, feebate programs have typically been used to shift buying habits in the transportation and energy sectors. The feebate program in Plan Bay Area will incentivize consumers to scrap older vehicles and purchase higher performing, cleaner vehicles. A feebate program uses a combination of fees and rebates to change consumer behavior. Consumers purchasing a vehicle that emit more CO_2 on a gram per mile basis than a defined standard are assessed a fee at the point of purchase. These fees are used to provide rebates to consumers who purchase vehicles that emit less CO_2 on a gram per mile basis than the defined standard.

Feebates have been used with some success in other countries, including Denmark, France, the Netherlands, and Norway. The structure of a feebate program for California was studied in considerable detail for the ARB.[35] In fact, California has come close to implementing a statewide feebate program on multiple occasions through legislative efforts – the first time in the early 1990s and more recently in 2008. In California, feebate programs have been proposed as a legislative initiative (e.g., AB 493

[35] Greene, David L. & Bunch, David S., "Potential design, implementation, and benefits of a feebate program for new passenger vehicles in California", Prepared for the California Air Resources Board, Contract UCD 08-312, February 2011.

Ruskin in 2007), whereby the implementation authority would be delegated to ARB and the State Board of Equalization. Moving forward, MTC will have to engage with ARB and BAAQMD to determine how the program would be implemented. Ultimately, it is conceivable that MTC would need to seek action via the Legislature to approve of a regional feebate initiative. A feebate program is similar to the fee that was approved by the Legislature via AB 434 (Sher, Chapter 807, Statutes of 1991) establishing the Transportation Fund for Clean Air (TFCA) program.

Although the feebate program, as proposed by MTC, would focus on deploying conventional gasoline vehicles that have lower emissions on a per mile basis, PEVs would be eligible for the rebate. The program is proposed to start in 2020 and would be designed to be revenue neutral, accounting for the maximum rebate amount; however, the program would have estimated administrative costs of $25 million over a 15-year period. After scaling the results of a statewide feebate program analysis conducted for ARB[36] to the Bay Area, MTC reports that a 0.6% per capita GHG reduction will be achieved in 2035 relative to the 2005 baseline[37] as a result of the regional feebate program.[38]

Vehicle Buyback and PEV Incentive Program

This program consists of a combination of incentives to purchase PEVs and to buy back older vehicles to extend the market for PEVs into a broader range of income classes and to accelerate fleet turnover. Most analysts agree that the first adopters of PEVs will be higher income individuals who own their homes; and in many cases, own or have owned a hybrid electric vehicle (e.g., Toyota Prius). Since older and wealthier individuals tend to buy more new vehicles and more frequently than other cross-sections of the population. Furthermore, recent research has shown that owners of both new and used vehicles are holding on to their vehicles longer.[39] Specifically, as indicated in similar surveys conducted in 2001, Americans are holding on to their cars for nearly two years longer than they have in the past. This will impact the turnover of the fleet significantly and may slow the purchase of new vehicles, including PEVs. Depending on the fuel economy threshold set by the program, the combination of vehicle buyback and incentives is intended to induce demand in middle- and lower-income brackets that might otherwise delay car purchasing, purchase a new conventional vehicle, or purchase a used vehicle.

Given the uncertainty of the medium- to long-term availability of incentives for PEV purchasing, and the potential interest of adopters in the middle- to low-income brackets, this vehicle buyback program (scheduled to start in 2020) will be designed as a trade-in for older vehicles that meet a certain fuel economy threshold (as measured via miles per gallon, mpg). The consumer would be eligible for only the trade-in if the

[36] Ibid.

[37] As noted previously, the SCS reduction targets are measured against the 2005 baseline.

[38] For the purposes of the analysis estimating the GHG emission reductions for the feebate program, a maximum rebate of $1,000 for PEVs was assumed.

[39] Americans are Holding their Vehicles Longer … is it Good for Loyalty? Blog post by L Miller at Polk, December 17, 2012. Available online at: http://blog.polk.com/blog/blog-posts-by-lonnie-miller/americans-are-holding-their-vehicles-longeris-it-good-for-loyalty.

new vehicle being purchased is a PHEV or BEV. The incentive amount will vary with the fuel economy of the vehicle being traded in (measured in mpg) as well as the vehicle type being purchased (e.g., PHEV or BEV).

The objective of this vehicle buyback program is to provide an opportunity for consumers to trade-in an older, less efficient vehicle for a new PHEV or BEV. As it is currently proposed, the program will provide a $1,000 incentive for PHEVs and a $2,000 incentive for BEVs. Initial estimates for the program indicate that at these incentive levels, and after accounting for modest administration costs (5% of the total program value), a $120 million program will help deploy nearly 50,000 vehicles and achieve a 0.5% reduction in daily per capita emissions in 2035 compared to the 2005 baseline.

Regional EVSE Network

The focus of the regional charging network strategy is to expand charging opportunities for PHEVs, and thus displacing gasoline with electricity. PHEVs have what is referred to as an all-electric range (when in charge depleting mode) of about 10–40 miles. For instance, the Toyota Prius Plug-in has an all-electric range of 11 miles; the Ford C-MAX Energi has an all-electric range of 21 miles; and the Chevrolet Volt has an all-electric range of 38 miles. A general assumption is that most PEV owners will charge their vehicles at home. Although at-home charging provides the most convenient and perhaps the most affordable form of charging, by providing PEV drivers access to EVSE at workplaces, commuter hubs, and other destinations, the all-electric range of their vehicles can be extended. Miles traveled using electricity yield a larger GHG benefit for PHEVs than they would otherwise achieve.

In 2010, the average work commute distance for Bay Area commuters was 13 miles or 26 miles round trip. In some cases, (e.g., with the Chevrolet Volt), there may be sufficient range to make these trips entirely using electricity. However, with increases in the PHEV sales with less than 25 miles of range, and several more PHEV models with similar ranges hitting the market soon, there is significant potential to extend the all-electric miles traveled in the Bay Area.

The objective of this program is to establish a regional publicly accessible network of EVSE for PHEVs. Based on research conducted for this Plan, there is some interest at workplaces and other areas to deploy EVSE; however, the costs are often prohibitive and there are other barriers (e.g., on-site electrical capacity) that may limit the potential for deploying EVSE at workplace. This program will be designed to help overcome some of those barriers by providing financial assistance to interested employers, retailers, parking management companies, and others that qualify.

MTC currently plans to launch the Regional EVSE Network Incentive Program by 2015. In the interim years, MTC will outline the administrative aspects and update the objectives of the proposed program based on the evolution of the market for PEVs and EVSE in the Bay Area. There are several ongoing initiatives—including the initial efforts to deploy infrastructure (see Table 3) that agencies such as BAAQMD and CEC have funded, as well as NRG's progress towards the deployment of EVSE and EVSE pre-installations per their settlement with the CPUC—which may impact the design and implementation of the EVSE program.

As currently outlined, the Regional EVSE Network will provide incentives of $250 for level 1 EVSE and $2,100 for level 2 EVSE. Without assuming any shifts in the light-duty vehicle fleet as a result of the network (i.e., it was not assumed that the availability of EVSE would accelerate PEV deployment in the Bay Area), an investment of $80 million will reduce per capita GHG emissions by 0.1% and 0.3% in 2020 and 2035, respectively, compared to the 2005 baseline. The specifics of this program, however, have not been finalized. Other financing options for the EVSE network may be developed prior to its 2015 start date.

PEV drivers charge up at ChargePoint stations during Game 2 of the World Series at AT&T Park, home of the 2012 World Champion San Francisco Giants.

3 Guidance for Plug-in Electric Vehicle Readiness

The following sub-sections provide a roadmap and summary of critical steps that local governments, regional governments, and utilities in the Bay Area can take over the next decade to assist the region in becoming PEV ready. This guidance, case studies, and examples of best practices are discussed in more depth throughout the Plan.

3.1 Short-, Medium-, and Long-Term Readiness Guidance

Figure 11 summarizes the Plan's key PEV readiness guidance for regional agencies, local governments, and utilities over the next 10 years, organized into possible short-term, medium-term, and long-term actions.

The timeline shown in Figure 11 represents suggested goals for implementation of these strategies across the nine-county Bay Area. However, PEV readiness requires a comprehensive suite of actions, and there are often opportunities to implement some strategies ahead of others. This Plan recognizes that many local governments and stakeholders have already completed or made substantial progress toward completing some of the suggested actions shown in Figure 11 ahead of schedule, and that proactive stakeholders may want to look ahead to future suggested actions in order to begin laying the groundwork for longer-term PEV readiness.

Level 2 charging is available at Napa Premium Outlets.

Figure 11. Timeline of Possible Key Short-, Medium-, and Long-Term PEV Readiness Actions, by Implementing Stakeholder

Regional Agencies

- Prioritize grant funding for quick charge network; incentives for PEV purchases; and EVSE in MDUs, workplaces
- Develop incentive programs and systems to monitor PEV deployment, local PEV readiness, and uptake of medium- and heavy-duty PEVs in fleets
- Convene EV readiness summit of local elected officials
- Implement EV Promotional Campaign
- Develop schedule for stakeholder training and outreach
- Monitor EVSE usage
- Monitor uptake of PEVs in Impacted/ Environmental Justice Communities
- Coordinate on statewide efforts: develop statewide readiness guidelines, MDU charging guidelines, and workplace charging guidelines; convene roundtable of CEOs; develop cost of ownership business calculator and report on incentives for employees

Regional Agencies

- Provide PEV incentives through vehicle buybacks & feebates
- Monitor PEV deployment and local government PEV readiness

Local Governments

- Adopt EVSE requirements into building/zoning code
- Allow PEV parking to count toward minimum requirements
- Incorporate PEV readiness policies into general plans, climate action plans, or adopt as stand-alone plans

Utilities

- Evaluate smart grid opportunities for PEVs
- Provide renewable energy options for PEV drivers

Short-term (1-2 years) | **Medium-term (3-5 years)** | **Long-term (6-10 years)**

2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023

Local Governments

- Adopt building code standards for EVSE
- Develop process to expedite EVSE permitting in single-family residences
- Create a residential EVSE permitting checklist
- Train permitting and inspection officials in basic EVSE installation
- Share best practices

Utilities

- Evaluate impact of rate structures on PEVs
- Create notification protocol for PEVs and EVSE

Regional Agencies

- Update EVSE design guidelines
- Develop Regional Public Charger Network
- Monitor PEV deployment, local government PEV readiness, and uptake of PEVs in Impacted/Environmental Justice Communities

Local Governments

- Adopt PEV parking design guidelines
- Adopt PEV parking regulations and enforcement policies
- Ensure that permitting staff at counter are knowledgeable on EVSE installation

Utilities

- Evaluate and upgrade distribution infrastructure
- Implement consumer outreach programs

The following sections offer overviews of the recommended short-, medium-, and long-term PEV readiness guidance.

Short-term (1–2 year) Guidance

During the next two years, the number of PEVs forecasted will increase from over 15,000 PEVs in 2013 to 36,000 PEVs by 2015 under a business-as-usual case scenario. This critical period will depend on Bay Area local governments, regional agencies, and utilities laying the groundwork for successful PEV deployment by working to remove barriers to EVSE installations and by incentivizing EVSE and PEV purchases. The Plan suggests that this effort may include:

- Reviewing regulations and procedures to remove conflicts with and provide guidance for EVSE installations
- Creating systems to track the region's PEV readiness
- Collaborating on outreach and training efforts
- Allocating incentives for EVSE and PEV purchases

Table 11 summarizes the short-term PEV readiness guidance in this Plan.

Table 11. Short-Term PEV Readiness Guidance and Suggested Stakeholders

Guidance	Suggested Stakeholders
Prioritize grant funding for: • Quick charge network of DC fast chargers • Level 1[39] and 2 EVSE in MDUs, workplaces • Individuals, fleets, businesses, and government agencies to purchase light-duty PEVs	BAAQMD, CEC, and ARB
Develop incentive programs and systems to monitor PEV deployment, local government PEV readiness, and uptake of medium- and heavy duty PEVs in fleets	BAAQMD, MTC, and ABAG
Convene PEV readiness summit of local elected officials	BAAQMD, MTC, and ABAG
Implement EV Promotional Campaign	MTC, with support from BAAQMD and ABAG
Develop schedule for stakeholder training and outreach on EVSE installations	Clean Cities Coalitions and EVITP, with support from BAAQMD, MTC, ABAG, and utilities
Monitor EVSE usage to inform siting analysis and prioritize incentive funding	BAAQMD, MTC
Monitor uptake of PEVs in Impacted/Environmental Justice Communities and consider additional incentives for EVSE deployment in those areas if necessary	BAAQMD, MTC, and ABAG
Coordinate on statewide efforts: develop statewide readiness guidelines, MDU charging guidelines, and workplace charging guidelines; convene roundtable of CEOs; develop cost of ownership business calculator and report on incentives for employees	BAAQMD, California PEV Collaborative
Adopt California Building Code standards for EVSE into local building codes	All local governments

[40] Low power level 2 EVSE can also be considered in lieu of level 1.

Guidance	Suggested Stakeholders
Create a residential EVSE permitting checklist for residents and contractors	All local governments
Develop process to expedite permitting for EVSE in single-family residences	All local governments
Train permitting and inspection officials in basic EVSE installation	All local governments
Create cross-jurisdictional opportunities for sharing lessons learned	Local governments, with support from TUCC, ABAG, and Clean Cities Coalitions
Evaluate rate structures (tiered rates, time of use rates, secondary meters) and their impact on PEVs	Utilities
Create utility notification protocol for PEV purchases and EVSE installations	Utilities

Regional agencies

Over the short term, regional agencies, including BAAQMD, MTC, and ABAG, will be allocating incentives for PEV purchases and EVSE installations, tracking the region's PEV readiness, and implementing several outreach and training efforts. From 2009–2012, BAAQMD allocated over $6 million in incentives to fund residential and public EVSE installations. For 2013–2015, BAAQMD has prioritized an additional $6.25 million in grant funding for:

- A network of publicly available DC fast chargers at major transportation corridors throughout the Bay Area to provide opportunities to charge away from home or work.
- EVSE in MDUs and workplaces in order to provide incentives for property owners to install chargers in challenging, high-priority locations.
- Incentives for individuals, fleets, businesses, and government agencies to purchase PEVs.

In addition to providing incentives, BAAQMD, in partnership with ABAG and MTC, is working to develop a system to monitor the region's PEV readiness by tracking PEV purchases, EVSE installations, and local implementation of the actions shown in Table 11 above. BAAQMD will also monitor PEV deployment in heavy-duty fleets, in Impacted/Environmental Justice Communities, and consider additional incentives as necessary.

Furthermore, regional agencies will collaborate on several training and outreach efforts related to PEV readiness, including:

- EV Promotional Campaign: MTC, in collaboration with ABAG and BAAQMD, will launch the EV Promotional Campaign in Spring 2014. The campaign is designed to encourage Bay Area residents to purchase PEVs through strategic communication of PEV benefits, education, and vehicle demonstrations.
- Regional PEV Readiness Summit: BAAQMD, in collaboration with ABAG, MTC, and organizations such as the EV Council, will hold a summit of local elected officials to share the guidance for local governments outlined in this Plan and solicit feedback

on additional steps that the region can take to encourage local PEV readiness. As an alternative to organizing a summit, regional agencies may share this information through existing local forums such as the Mayors' Conference.

- Schedule for Stakeholder Outreach and Training: In order to streamline and minimize the cost of training local permitting officials, the East Bay, San Francisco and Silicon Valley Clean Cities Coalitions are encouraged to work with organizations such as the Electric Vehicle Infrastructure Training Program (EVITP) to organize training sessions on EVSE installations and outreach sessions for sharing local best practices among staff. Regional agencies will work to create a region-wide schedule of training and outreach events so that stakeholders can stay apprised of opportunities across the region.

In addition, BAAQMD will continue working on several statewide initiatives through the California PEV Collaborative, including:

- California ZEV Readiness Guidebook[41]: BAAQMD and five other agencies produced regional PEV readiness plans for their respective regions. Completed in October 2013, the Governor's Office of Planning and Research compiled these six regional plans into a statewide PEV readiness guidebook. This document serves as a resource for local communities in California to support the mass deployment of PEVs.
- Statewide PEV Infrastructure Plan: This plan, developed by the National Renewable Energy Laboratory (NREL), will inform the CEC's investment plan and programs, will provide guidance to local communities and regions, will guide state level policy, and will convey public infrastructure plans.
- Multi-family Dwelling Units (MDUs) Charging Guidelines[42]: Completed in October 2013, this guidelines document provides information, resources, case studies, and tools that will guide residents, homeowner associations, and property owners/managers through the installation and decision-making process of installing EVSE at MDUs. The Collaborative will continue to conduct outreach to make these resources accessible and available.
- Workplace Charging Guidelines[43]: Completed in October 2013, this guidelines document provides case studies, examples of internal business policies, a decision-making guide, steps to install EVSE, and a resource list of employers to contact about workplace charging. In addition, BAAQMD funded CALSTART to lead a workplace-charging forum and to develop best practices for workplace charging, which was completed in September 2013.
- Convene a roundtable of CEOs: The Drive the Dream event convened California business CEOs in September 2013. The goal of this event was to have CEOs commit to initiatives that support accelerated PEV deployment such as providing more workplace charging, increasing the number of PEVs in their corporate fleet, and/or providing incentives to increase the number of PEVs purchased by employees. Governor Brown and over 50 corporations attended the event.

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[41] More information is available at: http://www.opr.ca.gov/ZEV.

[42] More information is available online at: http://www.driveclean.ca.gov/pev/Charging/Home_Charging/Multi-unit_Dwellings.php.

[43] More information is available online at: http://www.pevcollaborative.org/workplace-charging.

- Cost of Ownership Business Calculator and Report on Incentives for Employees: As part of the California Fleets and Workplace Alternative Fuels Project, a statewide project aimed at accelerating alternative fuel vehicle adoption, CALSTART will develop a comprehensive total cost of ownership business calculator that can be used to address the uncertainty end users have when considering the purchase of PEVs. In addition, CALSTART will develop a report that contains options for monetary and non-monetary incentives that companies can implement to encourage employees to purchase and to use PEVs.

BAAQMD will act as a conduit to foster and coordinate these activities at the local level by disseminating information through outreach and local forums. In cooperation with its partner regional and local agencies, BAAQMD will make best practices available to government, local businesses, and property owners to continue to advance the region's readiness preparations.

Local governments

Over the next two years, local governments in the Bay Area encouraged to consider the following PEV ready actions:

- Clarify guidance and regulations on permitting and installing EVSE in private residences by updating building codes to include new California Building Code requirements for EVSE in residential buildings.
- Develop process to expedite permitting for EVSE in single-family residents, and create permitting checklists for residential EVSE installations.
- Train permitting staff in basic EVSE installation through programs such as the EVITP to help staff process permits more efficiently and provide property owners with additional information about safety and process of installing EVSE.

Local governments can accomplish these steps with minimal effort and costs by drawing on best practices from many other local governments in the Bay Area that have already taken steps to expedite permitting or create guidance on residential EVSE installations. These best practices are discussed in Section 3.3. Local governments can also engage in the 2013 update to the California Building Code and review any proposed changes related to EVSE to ensure that these changes match with local PEV readiness goals. Finally, local governments can reduce the cost of trainings by coordinating with other local governments, Clean Cities Coalitions, or organizations such as the International Code Council to jointly organize and fund training sessions. Coordination will also provide opportunities for local governments to share best practices in PEV readiness. Though regional agencies will also play a convening role, additional collaboration among local governments will create additional opportunities for cities and counties to learn from peers that are pursuing similar PEV readiness strategies in different contexts.

Utilities

This Plan recommends that between now and 2015, utilities continue the process of refining rate structures to ensure that rates fairly recognize the benefits of off-peak charging and develop notification protocols for PEV owners. Utilities are encouraged to evaluate the cost impacts of different rate structures, time-of-use rates and identify which rates offer the most affordable charging while balancing the need to protect the grid. Local utility providers are also encouraged to establish an automated notification protocol for PEV and EVSE purchases so that they can identify potential impacts on transmission and distribution infrastructure. PG&E has developed a notification protocol that other utilities can use as an example, and PG&E can continue to refine and promote this protocol so that it gets the best possible data.

Medium-term (3–5 year) Guidance

During the medium term (3-5 years), forecasted PEV adoption in the Bay Area will grow from 36,000 PEVs in 2015 to 72,000 PEVs by 2018 under a business-as-usual scenario. This Plan anticipates that PEV readiness efforts in the region will shift from focusing primarily on residential EVSE installations to providing increased workplace and opportunity charging. Table 12 summarizes the medium-term guidance in the plan.

Table 12. Medium-Term PEV Readiness Guidance and Suggested Stakeholders

Guidance	Suggested Stakeholders
Monitor PEV deployment, market opportunities and local government PEV readiness and allocate additional incentives as necessary	BAAQMD, MTC, and ABAG
Update design guidelines for EVSE in public locations, commercial properties, and MDUs based on a survey of existing PEV charging spaces	BAAQMD, MTC, and ABAG
Update siting plan and allocate funding for the Regional Public Charger Network	MTC
Consider allocating additional Climate Incentive Program funding to support PEV readiness	MTC
Specify or adopt design guidelines for PEV parking spaces	All local governments
Ensure permitting staff at counter are knowledgeable on EVSE installation	All local governments
Adopt regulations and enforcement policies for PEV parking spaces	All local governments
Work with local utilities to create a notification protocol for new EVSE through the permitting process	Local governments in areas with publicly-owned utility service
Upgrade distribution infrastructure and evaluate needs	Utilities
Implement consumer outreach programs for special PEV charging rates and EVSE installations	Utilities

Regional agencies

In the three- to five-year time frame, the Bay Area's regional agencies will continue to monitor the uptake of PEVs to determine which of the medium-term PEV readiness guidance to implement and the appropriate level of additional funding that is needed to achieve PEV adoption targets. As part of that assessment, the regional partners will be evaluating the need and options for augmenting the network of nonresidential charging. As needed, the Regional Public EVSE Network funded by MTC through Plan Bay Area and the BAAQMD's TFCA funding program will be used for making targeted investments in public charging at key locations to increase the electric range of PEVs. To guide this effort, as well as to assist local governments with creating design guidelines for PEV parking spaces, MTC, ABAG, and BAAQMD should also consider conducting a survey of existing charging spaces in order to identify best design practices. Though several design guidelines for PEV parking spaces exist, many charging spaces in the Bay Area do not conform to these guidelines because of cost or contextual constraints, and this survey will help to identify the most practical solutions to these constraints. Regional agencies will also monitor PEV deployment and local PEV readiness and, based on the results, will consider additional incentives for EVSE installations or vehicle purchases.

Local governments

Over the medium term, this Plan suggests that local governments consider adopting guidance and regulations to support further expansion of workplace and opportunity charging. In particular, it is important for local governments to consider adopting or creating design guidelines for PEV parking spaces that address issues such as the dimension and configuration of parking spaces, signage, location relative to different land uses, clearances surrounding PEV parking spaces and EVSE, and accessibility. The Governor's Office of Planning and Research released draft accessibility guidelines and best practices in 2013,[44] which complement the information provided and resources identified in this Plan. Organizations such as Sonoma County and the PEV Collaborative have also produced design guidelines that local governments can use as resources. However, cities and counties should exercise care in applying these guidelines locally to ensure that they do not conflict with other local parking regulations or place undue burdens on property owners looking to install EVSE. In addition to design guidelines, local governments can also consider adopting regulations and enforcement policies for PEV parking spaces to ensure that PEVs have unobstructed access to charging. Examples of these regulations and of local design guidelines can be found in Section 3.4.

As an increased number of workplaces, MDUs, and other locations (where it is more complex to install EVSE) apply for permits, having staff trained in EVSE at the permitting counter will help ensure that these installations are both streamlined and safe.

Over the long term, utilities will likely have more reliable information on EVSE installations that they can get from local permitting departments than from consumers. Though local governments are not currently allowed to share residents' information with investor-

[44] Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices, Governor's Office of Planning and Research, available online: http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf.

owned utilities, local governments in areas with publicly owned utility service can consider collaborating with utilities to create EVSE notification protocols that may serve as a model for more widespread notification over the long term.

Utilities

As more data becomes available on PEV deployment and charging demand in the Bay Area, utilities should identify areas where it will be necessary to upgrade distribution infrastructure in order to meet increased demand for electricity. If utilities successfully develop new rate structures for PEV owners over the short term, they should follow up by conducting outreach to promote these rate structures to consumers.

Long-term (6–10 year) Guidance

Most of the guidance in this Plan focuses on the short- and medium-term in order to meet the rapidly growing demand for PEVs in the Bay Area and build on the momentum of many current local and regional PEV readiness efforts. The long-term guidance shown in Table 13 is designed to continue the current PEV adoption trajectory that has established the Bay Area as a leading PEV ready region by continuing to provide incentives to help offset the price premium associated with purchasing a PEV, by requesting that new developments include access to vehicle charging, and by pairing residential EVSE installations with innovative technologies. During this period, forecasted PEV adoption will continue to increase from 72,000 PEVs in 2018 to 191,000 PEVs by 2023 under a business-as-usual case scenario.

Table 13. Long-Term PEV Readiness Guidance and Suggested Stakeholders

Guidance	Suggested Stakeholders
Design and implement vehicle buyback and feebate programs as specified in the SCS	MTC, with support from BAAQMD
Monitor PEV deployment and local government PEV readiness	BAAQMD, MTC, and ABAG
Adopt requirements for pre-wiring EVSE into the building code and/or minimum requirements for PEV parking spaces in zoning code	All local governments
Adopt a climate action plan, general plan element, or stand-alone plan that encourages deployment of PEVs and EVSE	All local governments
Allow PEV parking spaces to count toward minimum parking requirements	All local governments
Evaluate smart grid opportunities for PEVs	Utilities
Provide renewable energy options for PEV drivers	Utilities

Regional agencies

Over the long term, regional agencies will be providing regional funding for PEV purchases through two key incentive programs led by MTC, that are included in Plan Bay Area: the Vehicle Buyback and PEV Incentives program and the Clean Vehicles Feebate program. Together, these two programs will help reduce the price premium of purchasing a PEV instead of a conventional vehicle.

Regional agencies will also continue to monitor PEV adoption and local PEV readiness and may allocate additional funding accordingly.

Local governments

Over the long term, this Plan anticipates that some local governments will move from producing guidance and regulations to support EVSE installations to requiring these installations at certain land uses. Local governments can consider creating requirements in their building or zoning codes so that a certain percentage of parking spaces at different land uses contain chargers or be pre-wired for EVSE. This Plan presents examples of local governments that have already implemented these requirements, as well as suggested parking requirements based on current best practices and an analysis of regional data, in Section 3.4. In addition, local governments will likely have more quantitative information on which to base parking requirements as regional agencies continue to monitor PEV purchases.

As local governments amend their parking requirements to accommodate increased numbers of PEVs, they should also consider allowing charging spaces to count toward overall minimum parking requirements. In order to make these changes, local governments may first need to adopt a broader PEV readiness policy through their general plans, climate action plans, or a stand-alone plan. In addition to laying the groundwork for more targeted actions to increase PEV readiness, this can give local governments a basis for requiring EVSE installations in new construction under appropriate circumstances through discretionary review.

Utilities

Over the long term, utilities should continue to explore the potential integration of other technologies with EVSE installations. Smart grid technology, which would allow EVSE and other appliances to communicate with the grid, can help mitigate the impacts of increased PEV charging on the grid by moderating the rate at which vehicles charge during periods of peak demand. In addition, vehicle-to-home or vehicle-to-grid technology could allow vehicles to distribute power back to the grid during peak periods, which would further reduce grid impacts and could even provide further incentives for consumers to purchase PEVs if utilities buy back energy stored in vehicles from PEV owners.

As more drivers purchase PEVs, utilities can also mitigate the environmental impacts of increased electricity demand by allowing PEV owners to charge their vehicles using renewable energy. This can be accomplished through coupling EVSE with residential solar installations, or by allowing consumers to purchase electricity from renewable sources through green pricing programs. Utilities can further investigate the potential to offer these options to PEV owners.

The anticipated growth in PEV deployment discussed in Section 1.2 represents a substantial change in the way that Bay Area drivers travel. Though much of this growth will be driven by consumer demand, stakeholders in the PEV ecosystem—including local governments, utilities, and advocacy groups—play a key role in preparing for this growth. These stakeholders can work together to develop charging opportunities where they are needed most; attract PEV-related businesses to the Bay Area; and ensure that new EVSE is safely installed. The following subsections detail specific actions that stakeholders can consider taking to prepare for the growing PEV demand. The accompanying Background and Analysis contains in-depth discussions of the guidance discussed below, as well as specific examples of best practices. Also, statistics on local government readiness were completed from a self-reported survey conducted of Bay Area local government agencies in 2012.

3.2 Building Codes

Building codes contain safety standards and specifications that guide new construction and renovations. There are two major opportunities for building codes to support PEV deployment. The first is to specify standards for EVSE in the building code to ensure that any EVSE installations are safe and accessible. The second is to require pre-wiring for EVSE to lower the cost of future EVSE installations. "Pre-wiring" refers to the practice of providing sufficient basic infrastructure, such as conduits, junction boxes, outlets serving garages and parking spaces, adequate wall or lot space for future EVSE, and adequate electrical panel and circuitry capacity, to meet anticipated future demand for EVSE.

Electricity use in commercial buildings and MDUs is much higher than in single-family residences, and the level of demand for EVSE is often difficult to estimate. As a result, a greater number of local governments have established requirements related to EVSE for single-family homes than have done so for commercial buildings and MDUs.

Both California's Building Code and Electrical Code contain specifications related to EVSE, and these codes apply in all cities and counties unless local governments have taken action to adopt their own codes. Thus, many local governments in California already have standards for EVSE in place. As of June 2012, a minority (19 percent) of Bay Area local government agencies have adopted building codes specific to EVSE installations, and slightly less than half have begun to consider EVSE-related building code changes or are seeking more information (see supplementary Background and Analysis for additional information).

Guidance

Building codes are the appropriate place for local governments to specify the technical requirements for EVSE, and also provide an opportunity to require installation or pre-wiring for EVSE in new construction. This section contains guidance for the Bay Area's local government agencies to consider. The supplementary Background and Analysis contains further analysis of the results from the survey of local governments regarding building codes.

Consider adopting standards for EVSE into the building code

Implementing this guidance is relatively straightforward as the California Building Standards Code already contains standards for EVSE. Local governments that adopt the Building Standards Code therefore have standards for EVSE in place, while those that use their own building codes can simply adopt the relevant sections of the state code. If local governments wish to instead adapt or create their own building code standards for EVSE, they should be sure to address the issues of EVSE location relative to vehicles and electrical panels, electrical and technical standards for EVSE, signage and marking, proper ventilation, and accessibility requirements.

Consider adopting requirements for pre-wiring EVSE into the building code

Adopting building code standards enables the installation of EVSE, but requiring pre-wiring removes a key barrier by dramatically lowering the costs of installing EVSE in the future. Alternatively, local governments can adopt pre-wiring requirements through parking requirements in the zoning code, as discussed in Section 3.4. Table 14 in Section 3.4 summarizes PEV charging requirements contained in California state and local codes.

If local governments choose to amend both the building and zoning codes to create pre-wiring requirements for EVSE, the requirements in the two codes should be consistent with one another. Future updates to the California Building Code may include pre-wiring requirements. If this is the case, local governments that do not plan on adopting their own building codes may soon have requirements for EVSE in place without any additional effort.

3.3 Permitting & Inspection

Since the majority of demand for EVSE is likely to be at privately owned residence and workplaces, local governments can support successful large-scale deployment of PEVs by being prepared to handle high volumes of permit requests for EVSE installations in an efficient and safe manner. The challenges associated with permitting and inspection of EVSE installations vary depending on the type of property at which the EVSE is located; whether it is at a single-family residence (SFR), at a MDU, or at a commercial property.

PEV owners living in SFRs are typically both the property owners and the users of the EVSE, which streamlines decision-making about EVSE installations. Many SFR owners will likely seek certified contractors to install the EVSE, but some will seek to install the equipment themselves, creating potential safety risks if installations are conducted incorrectly. Also, there may be impacts to the utility grid if a significant number of homes in the same area install EVSE without notifying utilities.

Installing EVSEs at MDUs and at commercial properties is slightly more complicated since demand for EVSE will come from residents and workers, but homeowner associations (HOAs) or property managers may have ultimate say over EVSE installations. HOAs or property managers often have questions about the costs of installation, how to manage payment for use, and how to regulate use of EVSE and associated parking spots.

More than half of local governments in the Bay Area currently issue same-day permits for EVSEs in SFRs, and 80 percent charge applicants under $250 for these permits (see supplementary Background and Analysis for additional information). Twenty-two percent of jurisdictions either have adopted or are in the process of adopting additional practices to support expedited and low-cost permits for installations at SFRs, MDUs or commercial properties. While many local jurisdictions have taken steps to remove barriers for permit applicants in SFRs, there are additional opportunities to streamline permitting for SFRs and to expedite permitting for MDUs and commercial properties.

Guidance

As local governments explore options for expediting and streamlining the permitting process, they will need to seek to balance between convenience and quality control. PEV charging stations, particularly level 2 EVSE, may consume more electricity than other residential appliances—and in some cases 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. This section contains guidance to help local governments remove barriers to installing EVSE without sacrificing safety and quality control.

Consider expediting permitting for EVSE in single-family residences

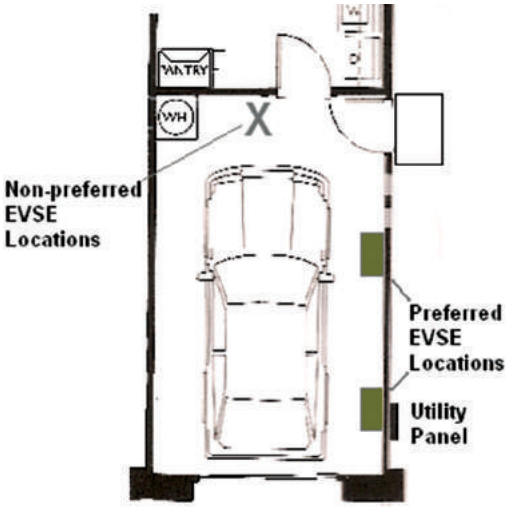
In order to encourage EVSE installations, local governments should consider implementing the following practices:

- Issuing permits in under 48 hours;
- Levying fees between $100 and $250;
- Making permits available online or over-the-counter; and
- Minimizing inspections and requirements for supporting materials such as site plans.

Consider creating a permitting checklist for EVSE permit applicants, and post guidance online

Regardless of permitting requirements, it is a best practice to combine requirements and guidance into a single document that can guide PEV owners through the installation process. This document should be available online for easy access by applicants, such as property owners and contractors. Many of the checklists available include illustrations that show potential configurations for EVSE installations, as shown in Figure 12.

Figure 12. Tri-chapter Uniform Code Committee Diagram of Potential EVSE Locations in a Single-Car Garage[45]



Consider requiring load calculations for level 2 EVSE, and work with local utilities to create a notification protocol for new EVSE through the permitting process

In order to help utilities identify and address potential grid impacts due to new EVSE installations, it is a best practice for local governments to require that permit applications for level 2 EVSE, as well as for DC fast chargers and other new fast charging technologies that become available, contain load calculations, and work to create a protocol for sharing this information with utilities.

Consider training permitting and inspection officials in basic EVSE installation

Local governments that anticipate a significant number of EVSE installations should consider having electrical inspection officials be certified in EVSE installation through the Electric Vehicle Infrastructure Training Program (EVITP) or a similar educational program that includes hands-on installation, instruction in relevant electric codes, and load calculation testing.

Consider ensuring that permitting staff at counter are knowledgeable on EVSE installation

In order for a local government to expedite permitting, 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.

[45] ICC Tri-Chapter Uniform Code Committee (TUCC), Policy 18: Commercial or Multi-Family Electric Vehicle (EV) charging station, June 9, 2011, http://www.calstart.org/Libraries/EV_Infrastructure_Documents/TUCC_EV_SFR_policy_12_2010.sflb.ashx.

3.4 Zoning, Parking Rules, and Local Ordinances

ChargePoint charging stations in the City of Sonoma, with signage and an ADA accessible parking spot.

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 to zoning and parking ordinances that regulate the physical form of streets, buildings, and public spaces. At every step of the planning 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.

As of June 2012, only 14 percent of local governments in the Bay Area have adopted or are in the process of adopting zoning and parking policies related to PEVs and EVSE (see supplementary Background and Analysis for further information). These policies vary widely between jurisdictions.

Guidance

This section contains guidance for local government agencies to consider in order to ensure that adequate charging opportunities are available for PEVs and that these charging spaces are designed to accommodate PEVs as efficiently as possible.

Consider incorporating PEV readiness policies into Climate Action Plans, General Plans, or stand-alone plans

Local governments have found that including policies and strategies in comprehensive plans is a critical first step in building consensus among policymakers and the public in support of more specific implementation measures. This also makes it easier to allocate funding toward PEV plans and projects.

Consider creating minimum requirements for PEV parking

Over the long term, one of the most effective ways to ensure that there is adequate PEV charging infrastructure to support increased adoption of PEVs is for local governments to consider adopting minimum requirements for the number of PEV parking spaces (spaces that either include EVSE or are pre-wired to reduce the cost of installing EVSE in the future) at different land uses. As an alternative, local governments can offer incentives, such as density or floor-area-ratio (FAR) bonuses, for developers to include EVSE.

When creating requirements, the key question is "how much is enough?" Requiring more pre-wired spaces or charging stations creates more opportunities for PEV charging, but setting requirements too high may drive up the cost of new development or lead to under-utilized EVSE. In order to assist local governments, this Plan presents two resources.

This section contains two tables (Tables 14 & 15) to assist local governments with setting their own requirements.

Table 14. PEV Charging Requirements from California State and Municipal Codes

Source	Building or Land Use Type	Number/Percent of Spaces Dedicated to PEV Charging	Requirements for PEV Charging Spaces	Voluntary/ Required
CALGreen	One- and two-family dwellings	1 per dwelling unit	Listed raceway to accommodate a branch circuit for Level 2 EVSE	Voluntary
CALGreen	Multi-family dwellings	3% of all spaces; at least one space	Listed raceway to accommodate a branch circuit for Level 2 EVSE	Voluntary
CALGreen	Nonresidential	~2% (varies by size of lot)	Pre-wiring for Level 1 and 2 charging	Voluntary
CALGreen	Nonresidential	~10–12% (varies by tier and size of lot)	Designated parking for fuel efficient vehicles	Voluntary
City of Sunnyvale Building Code	Single-family dwellings	1 per dwelling unit	Pre-wiring for Level 2 charging	Required
City of Sunnyvale Building Code	Residential developments with common shared parking	12.5% of all spaces	Pre-wiring for Level 2 charging	Required
City of Los Angeles Green Building Code	One- and two-family dwellings	1 per dwelling unit	Pre-wiring for Level 2 charging	Required
City of Los Angeles Green Building Code	Residential developments with common shared parking	5% of all spaces	Pre-wiring for Level 2 charging	Required
City of Emeryville Planning and Zoning Code	Multi-unit residential and lodging with 17+ parking spaces	3% of all spaces	Charging stations	Required

In addition, Table 15 provides guidance on suggested minimum parking requirements based on this Plan's analysis of likely demand for different types of charging across the Bay Area.

Table 15. Suggested Minimum Requirements for PEV Charging

County	Multifamily Residential		Workplaces		Opportunity Charging Locations	
	EVSE	Pre-wired	EVSE	Pre-wired	EVSE	Pre-wired
Alameda	0.5%	4%	0.5%	1%	0.5%	0.5%
Contra Costa	0.5%	3%	0.5%	0.5%	0.5%	0.5%
Marin	0.5%	7%	0.5%	1.5%	0.5%	0.5%
Napa	0.5%	3.5%	0.5%	0.5%	0.5%	0.5%
San Francisco	0.5%	5%	0.5%	1%	0.5%	0.5%
San Mateo	0.5%	4%	0.5%	1%	0.5%	0.5%
Santa Clara	0.5%	4%	0.5%	1%	0.5%	0.5%
Solano	0.5%	2%	0.5%	0.5%	0.5%	0.5%
Sonoma	0.5%	3.5%	0.5%	0.5%	0.5%	0.5%

When implementing parking requirements, local governments can also consider following the additional guidance below to ensure that these spaces are affordable to developers, well-managed, and well-designed.

Consider allowing 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. Amending the zoning or parking code to allow PEV parking to count toward these requirements allows developers to provide PEV parking without increasing the total number of parking spaces required.

Consider adopting regulations and enforcement policies for PEV parking spaces

Regulations and enforcement policies can ensure that PEVs have unobstructed access to PEV charging, can create incentives for drivers to purchase PEVs, and can help local governments recoup the costs of publicly available charging.

Consider specifying design guidelines for PEV parking spaces

Local governments could also adopt design guidelines that address the many unique considerations associated with PEV parking spaces in order to guide property owners through the process of creating these spaces. Among other factors, these guidelines should address dimensions, configuration, signage, and accessibility for PEV parking spaces. Several existing resources discuss design guidelines; Figure 13 and Figure 14 show examples.

Figure 13. Sonoma County Illustration of a Single Charging Space in Perpendicular Parking[46]

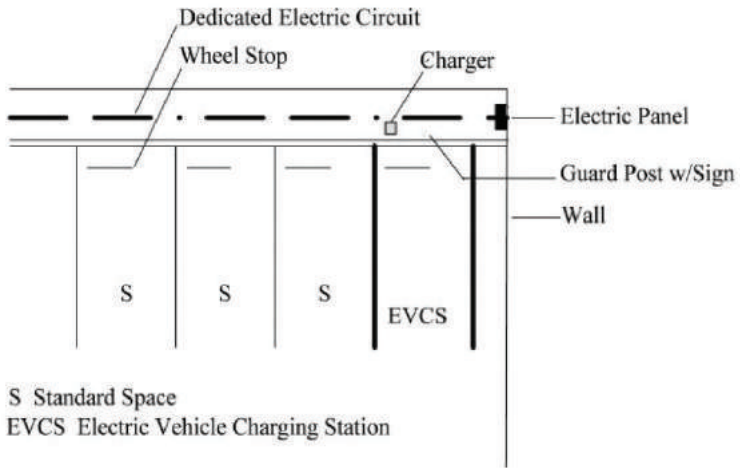
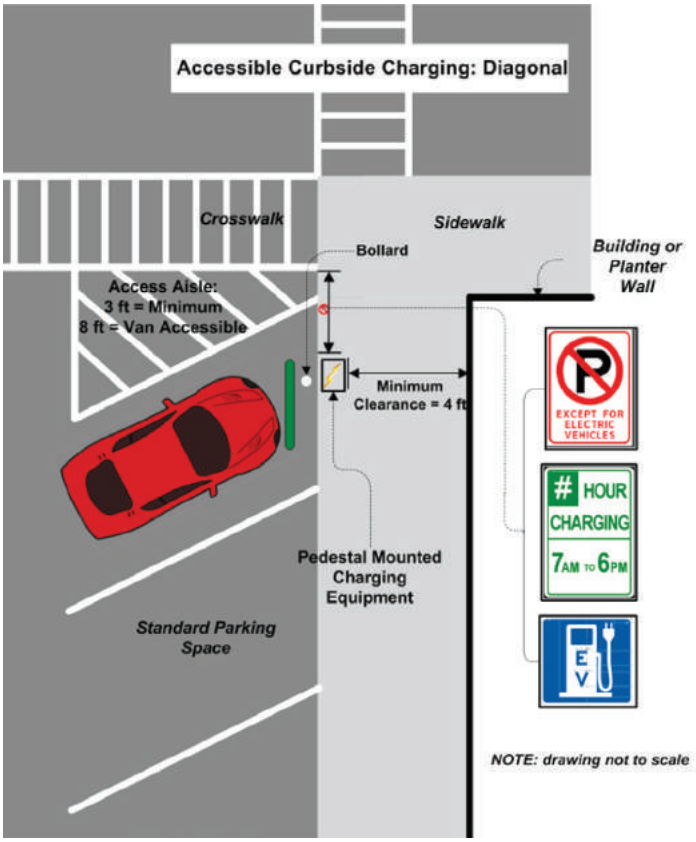


Figure 14. Plug-in Electric Vehicle Collaborative Illustration of Accessible PEV Charging in Diagonal Parking[47]



[46] Electric Vehicle Charging Station Program and Installation Guidelines, County of Sonoma, Department of General Services, July 2011.

[47] Accessibility and Signage for Plug-in Electric Vehicle Charging Infrastructure: Report and Recommendations, California Plug-in Electric Vehicle Collaborative, May 2012.

3.5 Stakeholder Training and Education

Transitioning the Bay Area's fleet over to PEVs will require extensive marketing, outreach, training, and education relating to vehicles, charging services, and infrastructure. 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, automotive repair shop owners, first responders, and other safety officials. Table 16 below highlights some of the efforts that provide training opportunities in the Bay Area.

Table 16. Organizations Engaged in Stakeholder Training and Education in the Bay Area

Organization	Brief Description
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.
Clean Cities	Clean Cities has developed a 30-minute online presentation for electrical contractors and inspectors regarding EVSE residential charging installation and local chapters conduct public outreach and education.
California Plug-in Electric Vehicle Collaborative	The PEV Collaborative has launched a PEV Resource Center that provides tools and resources on workplace and MDU charging.
Advanced Transportation Technology & Energy (ATTE) Initiative	The ATTE Initiative helps 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.
Green Transportation Workforce Development (GTWD)	GTWD teaches a series of green transportation technical classes in collaboration with The Green Team. The target audience for the workforce development training is fleet technicians, automotive shop employees, returning veterans, and hobbyists.

This listing is likely to grow over time as more local and regional agencies seek to educate themselves about the PEV ecosystem.

Guidance

Consider developing a 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 are necessary. 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 17.

Table 17. 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, ABAG, DOE, CEC, Utilities	• Co-funding and logistical support • Advertising and outreach to promote events • Utilities could conceivably use revenue from Low Carbon Fuel Standard credits to help co-fund training
EVITP	• Training instructor

For municipal planning, permitting, and inspection staff, a 6 to 8 hour training session is suggested, focusing on codes, safety, standards, site assessments, electric load calculations, permitting processes, and utility notification. Based on a survey of local governments (see Appendix B of the Background and Analysis), between 250 and 370 local government staff will require some training. These staff could be trained by the end of 2014, which would require roughly 8-15 training sessions depending on the number of participants in each session.

3.6 Minimizing Grid Utility Impacts

One of the primary concerns associated with PEV deployment for electric utilities in the region is the potential negative impact from increased load on the local grid. The degree of impact depends on parameters such as PEV penetration rates, the current condition of local distribution infrastructure, and strategies used by the electric utility to manage additional load. Through the use of tariff structures and incentives, utilities are actively seeking solutions that maximize PEV charging during periods of lower electrical demand, such as off-peak hours, to help mitigate grid impacts.

The utilities in the Bay Area include:

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

These utilities are at various stages of developing PEV programs in their service territories, such as special rate programs, supporting efforts for charging infrastructure development, and public education programs.

Key issues to address in order to prevent increased PEV deployment from having adverse effects on the grid include the following:

- Clustering: Though the generation and transmission capacity may be sufficient to serve a uniform statewide PEV adoption rate to a certain extent, areas where city or neighborhood adoption rates are much higher can overload the local distribution grid and cause premature degradation of infrastructure, such as pole-top transformers, and decreased reliability. The clustering of PEV loads may be one of most immediate threats to utilities in the region, and accordingly each utility should consider examining the structure and condition of the local distribution grid as it relates to the potential for localized PEV clusters.
- Limited capacity: Even if utilities in the region are able to overcome the barrier of localized 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. Although shifting PEV loads to off-peak hours through pricing or education will help mitigate this to a certain extent, additional capacity is may be necessary as the market grows.
- Municipal utility gaps: With assistance from PG&E's leadership in developing PEV programs, other utilities serving communities in the Bay Area will also 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. If not already done, these utilities should consider adopting time-of-use rates to encourage off-peak charging, comparable to those outlined by PG&E.

Guidance

Consider evaluating rate structures and impact on PEVs

Utilities in the region should consider evaluating their rate structures in the context of the potential impact on PEV consumers, including alternatives to tiered rate structures, time of use rates, and secondary meters as discussed below.

Consider assessing alternatives for tiered rate structures

California has used a tiered rate 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 move a consumer into a more expensive tiered rate. Utilities should consider amending existing tiered rate structures to include PEV-friendly programs, such as:

- A PEV rate structure comparable to a medical baseline program, which bumps up the baseline level for qualified residential customer requiring the use of at-home medical equipment. A similar program could be made available to qualifying PEV owners.
- A PEV discount rate based on gross vehicle weight or battery size with certain requirements, such as charging during off-peak hours, justified by the grid capacity utilization benefits that can be provided.
- Alternatives to tiered rate structures for PEV drivers.

Consider evaluating time-of-use rates

Time-of-use (TOU) rates can be an effective tool to mitigate grid impacts by encouraging consumers to charge during certain periods. Utilities should consider TOU rate options that preserve fairness to other ratepayers, allow for secondary metering at low cost to the customer, and do not include demand charges for commercial customers.

Consider reviewing options for secondary meter

A secondary meter, or in some cases a sub-meter, would provide a number of added benefits to both the consumer and the utility. The consumer could save money on the potential cost of upgrading household circuits and maintain a lower electricity rate. The utility could analyze the merits of load management and demand response programs, obtain data for necessary local grid upgrades, and improve accounting for GHG emission reductions. Utilities may want to consider implementing a rebate program to supplement the consumer's cost of installing the secondary meter or pro-rate the cost of the secondary meter over a period of time. Utilities should also consider working with OEMs on the potential for vehicle-based sub-metering that the utilities and CPUC can agree is "revenue-grade" with regard to accuracy.

Consider creating utility notification protocol

To minimize the potential grid impacts of EVSE, particularly among residential customers, utilities would benefit from notification of where vehicles are being deployed and how they are being charged (e.g., Level 1 vs. Level 2). Utility notification protocols could include standards for data collection, prerequisites for the timeliness of notification (e.g., prior to the installation of EVSE), granularity of the EVSE location (e.g., street address instead of zip code), standards for automated data collection protocols (e.g., online forms), and strategies to reduce overhead and program costs.

Consider upgrading distribution infrastructure and evaluate needs

When making upgrades or adding distribution infrastructure, utilities, regulators, and planners should consider including the potential for PEV charging impacts as part of the analysis and, where possible, make strategic and cost-effective investments. Despite low PEV adoption rates in some areas, utilities should consider exploring vulnerable infrastructure, particularly in areas more likely to experience PEV clustering and large public infrastructure projects.

Consider implementing consumer outreach programs

Utilities should consider taking necessary steps to ensure consumers have accurate information regarding utility rates, utility incentives, and programs. A variety of tools could be provided, such as PEV rate calculators, to help customers select the best rate option for their lifestyle. Customers want to know about the availability and benefits of PEV rates, vehicle fueling costs, charging, and the utility role in the installation process. Information can be presented through a wide variety of media, including bill inserts, brochures, public events and presentations, online material, videos, school curriculum, emails, and other media.

Consider evaluating smart grid opportunities

As PEVs become more popular, networking EVSE and ensuring grid interoperability, particularly through smart grid technologies, will become a more predominant issue. In order to mitigate potential impacts of PEV deployment, utilities should consider investigating opportunities for smart grid technologies, particularly as a technique to monitor and control charge events. As part of this planning effort, methods for ensuring the charging infrastructure and vehicles are compatible with smart grid technologies could be explored.

Consider providing renewable energy options for PEV drivers

Some early PEV adopters identify 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. The two least-cost pathways for consumers to pursue renewable energy are through Green Pricing Programs, which allows customers to voluntarily pay a premium for renewable energy, and Community Choice Aggregators (CCAs), which are third party providers of renewable energy. PEV rate programs should seamlessly integrate with renewable energy programs. Utilities may also explore options to market PEV incentives to existing renewable energy customers.

3.7 Regional Actions in Support of PEV Readiness

In addition to offering incentives for PEV and EVSE purchases, regional agencies in the Bay Area can take the following actions to accelerate PEV readiness across the many different stakeholders in the PEV ecosystem.

Policy and Planning Actions

As part of the implementation of this Plan, it will be important to galvanize local and regional leadership to implement the guidance 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.

Provide resources to local governments for EVSE deployment

Regional agencies in the Bay Area – BAAQMD, MTC, and ABAG – should continue to make resources available to local governments that will support them in the deployment of EVSE. It is important to recognize that the marketplace and associated needs of PEVs and EVSE will likely change. Regional agencies can help local governments remain flexible and responsive to the changing needs of the market. The Plan represents the first step in the process towards helping the region get PEV ready. Moving forward, the regional agencies in each area should continue to provide resources such as modified or updated installation checklists, updated PEV projections, and any updates to the siting analysis.

Convene a 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 Bay Area increases, each jurisdiction will need to deal with all the elements outlined in this Plan.

As part of the development of this Plan, a considerable amount of outreach was conducted with local governments and stakeholders. One of the key messages from this outreach was that the growing strain on local finances would make 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 guidance of the 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, and ABAG and be supported by regional organizations such as the EV Council. The purpose of the summit would be to kick start the adoption and sharing of the guidance included in the Plan. 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 goal of the summit would be to elicit commitments from each jurisdiction to adopt PEV readiness plans by the close of 2014, implementing the guidance from this document and including additional municipality-specific information.

Alternative: Use existing local government forums to share PEV information across government agencies

As an alternative, the regional agencies should explore opportunities for using existing local government convening forums such as Mayors' Conferences to solicit the policy direction required for the successful implementation of the guidance in the 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.

Create updated design guidelines for EVSE in public locations, commercial properties, and MDUs based on a survey of existing PEV charging spaces

Several references to resources contained in the Plan include design guidelines for PEV charging spaces in locations other than single-family residences. However, these guidelines are generally based on input from local stakeholders, manufacturers, and installers, and focus primarily on new construction. They often reflect best-case scenarios in which property owners are able to balance the many design constraints placed on PEV charging spaces by the site layout, proximity to electrical infrastructure, accessibility requirements, installation costs, and, in the case of EVSE at existing construction, the current parking configuration. In reality, property owners often face trade-offs between these constraints, and many of the PEV charging spaces in the Bay Area do not conform to design guidelines as a result. This hodgepodge of designs can make it confusing for PEV owners to locate charging, but it also provides the opportunity for planners to examine usage patterns at EVSE throughout the region

and identify best design practices, especially at existing developments and in locations where overlapping constraints force trade-offs between meeting the different constraints listed above.

Monitor the success of near-term and long-term actions and incentives to determine progress on PEV readiness

An additional key policy action that will be required from the regional agencies is the monitoring of progress towards PEV readiness under the Plan. This can be done by measuring the success of local governments in meeting the near- and long-term objectives identified in Figure 11, utilizing the methodologies that have been used in the development of this Plan (surveys, interviews, site visits etc.). Additionally, the regional agencies will as a requirement of their own planning efforts (the BAAQMD Clean Air Plan and the MTC/ABAG Sustainable Communities Strategy planning) need to monitor the uptake and deployment of PEVs in the region to meet air quality and greenhouse gas targets. Based on the results of this monitoring, additional actions (incentives and legislation) may be required to ensure that the Bay Area continues on its path to PEV readiness.

Coordination Actions

The rapidly changing landscape of technologies associated with PEVs and EVSE will make it necessary for the guidance in the Plan to be flexible in certain areas (e.g., consumer education or grants). To help maintain flexibility moving forward, it is essential to continue the dialogue and coordination between the private and public sectors regarding elements that are within the scope of this Plan.

Coordinate stakeholder training and education of local government staff

As noted previously, regional agencies can play an important role by coordinating the training and education of local government staff on issues related to PEVs and EVSE. The coordinated schedule will help chart a path for local governments to train staff by the end of 2014, while also providing consistent and reliable information to local governments.

Implement EV Promotional Campaign

As noted previously, MTC will implement the EV Promotional Campaign. BAAQMD and ABAG will continue to provide support for the campaign. As the regional agencies assess the needs for consumer outreach and education and the impacts of the campaign, the resources dedicated to the campaign should be modified as necessary.

Create cross-jurisdictional opportunities for sharing lessons learned

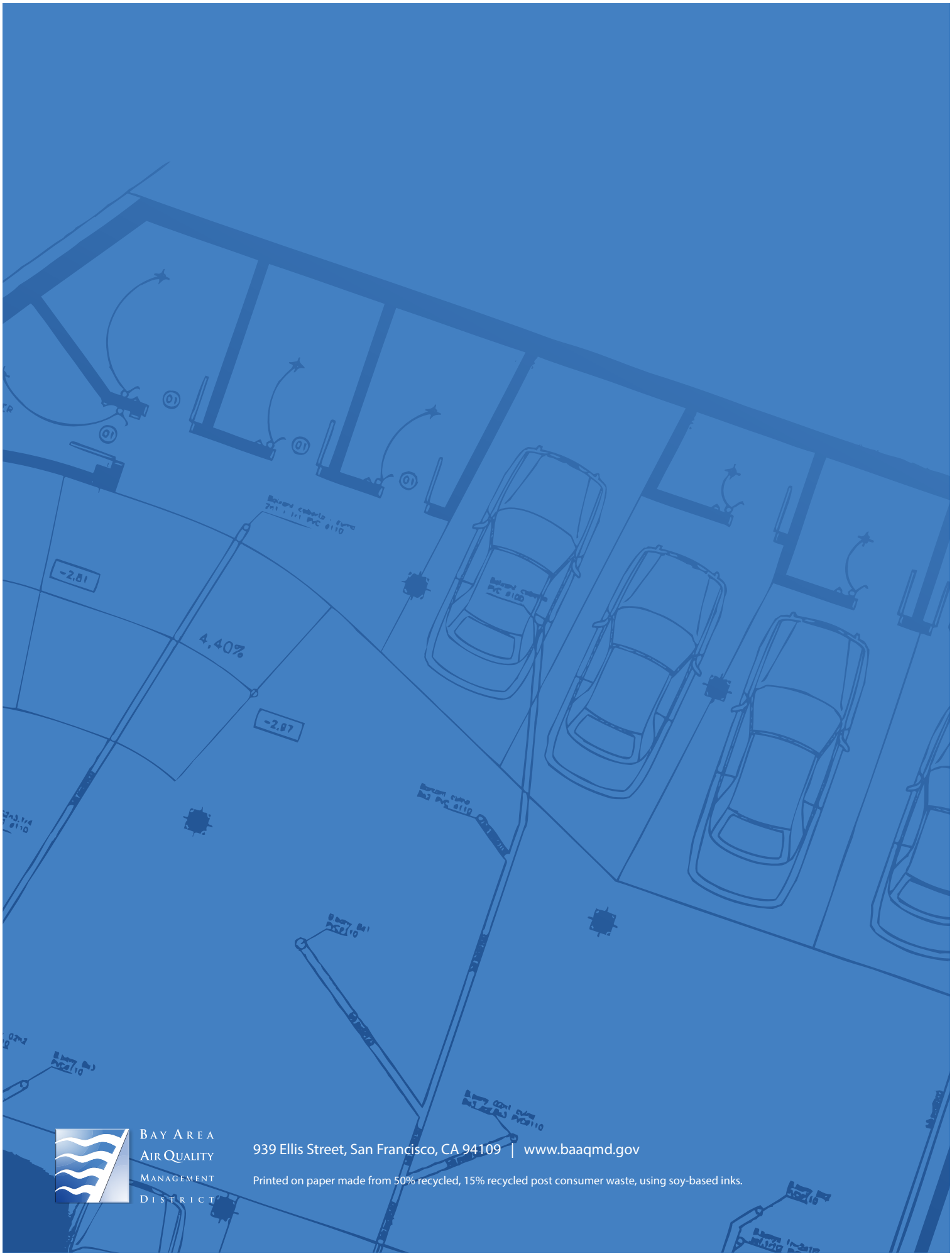
Unlike building codes and zoning, changes to the permitting process are not adopted through new code language, and instead depend heavily on the internal organization and staff capacity of a local government. Local governments should consider coordinating through the TUCC, ABAG, Clean Cities Coalitions, BAAMQD, and other organizations to share and offer solutions to common PEV installation issues, and make recommendations regarding local permitting practices based on past experience.

Glossary

AB	Assembly Bill
ABAG	Association of Bay Area Governments
ADA	Americans with Disabilities Act
ARB	California Air Resources Board
ARRA	American Recovery and Reinvestment Act
ATTE	Advanced Transportation Technology and Energy
BAAQMD	Bay Area Air Quality Management District
BEV	Battery electric vehicle: Any vehicle that operates exclusively on electrical energy from an off-board source that is stored in the vehicle's batteries and produces zero tailpipe emissions or pollution when stationary or operating. A BEV is a subcategory of plug-in electric vehicle (see "Plug-in Electric Vehicle, PEV").
CalETC	California Electric Transportation Coalition
CALGreen	California Green Building standards
CAP	Climate Action Plan
CCA	Community Choice Aggregation
CCR, Title 24	California Code of Regulations, Title 24: Commonly known as the California Building Standards Code.
CEC	California Energy Commission
charger	An electrical component assembly or cluster of component assemblies designed specifically to charge batteries or other energy storage devices within electric vehicles. Chargers include standardized indicators of electrical force, or voltage (see "charging levels") and may charge batteries by conductive or inductive means.
charging level	Standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged and referred to as Level 1, Level 2, and Level 3 (or DC/AC Fast Charging).

CNG	Compressed natural gas
CPUC	California Public Utilities Commission
CVRP	California Air Resource Board's Clean Vehicle Rebate Project
DC	Direct current: Electric current that moves in one direction from anode to cathode.
DOE	US Department of Energy
EPRI	Electric Power Research Institute
EV Council	Bay Area EV Strategic Council
EVITP	Electric Vehicle Infrastructure Training Program
EVP	The EV Project, managed by ECOtality
EVSE	Electric vehicle supply equipment: Inclusive of all of the components for electric vehicle charging stations, including: the conductors; the ungrounded, grounded, and equipment grounding conductors; electric vehicle connectors; attachment plugs, and; all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the grid to an electric vehicle.
EVSP	Electric vehicle service providers
GHG	Greenhouse gas: Any of the gases (e.g., carbon dioxide, methane, ozone, and fluorocarbons) emitted that contribute to the greenhouse effect by absorbing solar radiation once in the atmosphere.
HEV	Hybrid electric vehicle: A motor vehicle that is powered by both an electric propulsion system with a conventional internal combustion propulsion system and meets the applicable federal motor vehicle safety standards and state registration requirements. A hybrid electric vehicle does not plug into an off-board electrical source.
HOV	High occupancy vehicle
ICC	International Code Council
ICE	Internal combustion engine: An engine which combusts petroleum-based fuel as a means of delivering power.
J1772	Industry-wide standard EV connector for Level 2 charging.
kW	Kilowatt: A unit of power equal to 1,000 watts.
kWh	Kilowatt hour: A unit of energy commonly used for measuring the energy capacity of a battery. This is the normal quantity used for metering and billing electricity customers.
LCFS	Low Carbon Fuel Standard

LEV	Low emission vehicle
MDU	Multi-family dwelling units
MTC	Metropolitan Transportation Commission
NREL	National Renewable Energy Laboratory
OEM	Original equipment manufacturer
PEV	Plug-in electric vehicle: Any motor vehicle for on-road use that is capable of operating solely on the power of a rechargeable battery or battery pack (or other storage device that receives electricity from an external source, such as a charger) and meets the applicable federal motor vehicle safety standards and California State registration requirements. PEVs include, but are not limited to: all-electric vehicles (e.g., BEVs), plug-in hybrid electric vehicles, neighborhood electric vehicles, and electric motorcycles.
PEVC	California Plug-in Electric Vehicle Collaborative
PG&E	Pacific Gas and Electric
PHEV	Plug-in hybrid electric vehicle: A type of plug-in electric vehicle (see "Plug-in Electric Vehicle") that is powered by an internal combustion engine, as well as an electric motor, and is capable of being powered solely by electricity. PHEV batteries are primarily charged by connecting to the grid or another off-board electrical source but may also be able to sustain battery charge using an on-board internal-combustion-driven generator.
Plan	Plug-in Electric Vehicle (PEV) Readiness Plan
pre-wiring	The practice of providing sufficient basic infrastructure, such as conduits, junction boxes, outlets serving garages and parking spaces, adequate wall or lot space for future EVSE, and adequate electrical panel and circuitry capacity, to meet anticipated future demand for EVSE.
SCAQMD	South Coast Air Quality Management District
SCS	Sustainable communities strategy
TOU	Time-of-use: An electricity billing method with rates based upon the time of usage during the day.
TUCC	Tri-Chapter Uniform Code Committee
VMT	Vehicle miles traveled
ZEV	Zero emission vehicle: A vehicle that emits no tailpipe pollutants from the onboard source of power.



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