CALIFORNIA ENERGY COMMISSION

California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Coachella Valley Plug-in Electric Vehicle Readiness Plan

Prepared for: California Energy Commission

Prepared by: ICF International

Gavin Newsom, Governor

March 2021 | CEC-600-2021-020

California Energy Commission

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ACKNOWLEDGEMENTS

The Coachella Valley is excited about the prospects for plug-in electric vehicles in the region. Many stakeholders in the Coachella Valley made invaluable contributions in the preparation of this document. The Coachella Valley Association of Governments would like to acknowledge the following committees, stakeholders, and individuals that provided input and feedback during the preparation of this document:

- Coachella Valley Association of Governments Executive Committee
- Coachella Valley Plug-in Electric Vehicle Coordinating Council
- Coachella Valley Association of Governments Transportation Committee
- Coachella Valley Association of Governments Technical Advisory Committee
- Technical Working Group
- Tom Kirk, Executive Director
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- Michael Shoberg, Transportation Program Manager
- Zhongbo Li, GIS Analyst
- Clean Cities Coachella Valley Region

PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-10-602 to provide funding opportunities under the ARFVT Program for regional plans to support plug-in electric vehicle readiness. In response to PON-10-602, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards September 26th, 2011 and the agreement was executed as ARV-11-011 on June 15th, 2012.

ABSTRACT

The deployment of plug-in electric vehicles has the potential to reduce petroleum consumption and greenhouse gas emissions dramatically and increase energy independence through the utilization of locally produced energy. However, the success of long-term transportation electrification will depend in part on the near-term deployment of charging infrastructure. As a result, the Coachella Valley Association of Governments has developed this Coachella Valley Plug-in Electric Vehicle Readiness Plan to help support and accelerate the mass deployment of plug-in electric vehicles in the region. The plan reviews the readiness elements associated with key actors in the plug-in electric vehicle ecosystem–namely, local and regional governments, plug-in electric vehicle drivers (inclusive of consumers and fleets), and utilities. The readiness elements on which this plan focuses include the following categories: Plans, Policies, and Parking Regulations, Building Codes, Permitting and Inspection, Attracting plug-in electric vehicle-related enterprise to the Coachella Valley, Integrating plug-in electric vehicles into the region's Sustainable Community Strategy, Stakeholder Training, Coordinated Regional Policy and Planning Activities, and Utility Impacts.

Keywords: California Energy Commission, Coachella Valley, plug-in electric vehicle readiness, EV charging infrastructure, transportation planning

Please use the following citation for this report:

Sheehy, Philip, Eliot Rose, James Choe, Jubran Kanaan. (ICF International). 2021. *Coachella Valley Plug-in Electric Vehicle Readiness Plan.* California Energy Commission. Publication Number: CEC-600-2021-020.

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The Coachella Valley Plug-in Electric Vehicle Readiness 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 stakeholder groups that are pursuing numerous avenues to support plug-in electric vehicle deployment in the Coachella Valley. The Coachella Valley Plug-in Electric Vehicle Readiness Plan highlights strategies and actions from research, analysis, and public input to help the Coachella Valley achieve the goal of being "plug-in electric vehicle ready;" that is, well positioned to handle large-scale adoption of plug-in electric vehicles over the next 10 years.

The Coachella Valley Plug-in Electric Vehicle Readiness Plan includes an introduction to plug-in electric vehicles—with a focus on plug-in hybrid electric vehicles and battery electric vehicles—and the associated charging infrastructure, referred to as electric vehicle supply equipment. Although there are only a modest number of plug-in electric vehicles on the road in the Coachella Valley today, forecasts for this plan indicate that as many as 8,000-10,000 plug-in electric vehicles will be on the road in 2022. This level of deployment will require as many as 2,000 electric vehicle supply equipment to be deployed in the Coachella Valley to support plug-in electric vehicle owners.

The remainder of the Coachella Valley Plug-in Electric Vehicle Readiness Plan reviews the readiness elements associated with key actors in the plug-in electric vehicle ecosystem—namely, local and regional governments, plug-in electric vehicle drivers (inclusive of consumers and fleets), and utilities. The readiness elements on which this plan focuses include the following, with key recommendations included for each element:

- Plans, Policies and Parking Regulations
    - Adopt a Climate Action Plan, General Plan update, or stand-alone plan that encourages deployment of plug-in electric vehicles and electric vehicle supply equipment.
    - Create minimum requirements for plug-in electric vehicle parking.
    - Allow plug-in electric vehicle parking spaces to count toward minimum parking requirements.
    - Adopt regulations and enforcement policies for plug-in electric vehicle parking spaces.
    - Specify design guidelines for plug-in electric vehicle parking spaces.
- Building Codes
    - Adopt standards for electric vehicle supply equipment into the building code.

    - Adopt requirements for pre-wiring electric vehicle supply equipment into the building code.
- Permitting and Inspection
    - Expedite permitting for electric vehicle supply equipment in single-family residences.
    - Create a permitting checklist for electric vehicle supply equipment permit applicants, and post guidance online.
    - Require load calculations for Level 2 electric vehicle supply equipment, and work with local utilities to create a notification protocol for new electric vehicle supply equipment through the permitting process.

The Coachella Valley Plug-in Electric Vehicle Readiness Plan also includes recommendations related to plug-in electric vehicles in the following areas:

- Attracting plug-in electric vehicle-related enterprise to the Coachella Valley.
    - Focus on retention more than attraction.
    - Analysis informs strategy.
- Integrating plug-in electric vehicles into the region's Sustainable Community Strategy.
    - Accelerate plug-in electric vehicle adoption.
    - Increase charging opportunities to increase electric vehicle miles traveled.
- Stakeholder training.
- Coordinated regional policy and planning activities.
    - Provide resources to local governments for electric vehicle supply equipment deployment.
    - Coordinate with Southern California Association of Governments to incorporate Coachella Valley into the Sustainable Community Strategy.
    - Create updated design guidelines for electric vehicle supply equipment in public locations, commercial properties, and multi-family dwelling units based on a survey of existing plug-in electric vehicle charging spaces.
    - Monitor the success of near-term and long-terms actions and incentives to determine progress on plug-in electric vehicle readiness.
    - Create cross-jurisdictional opportunities for sharing lessons learned.

For plug-in electric vehicle drivers, the plan reviews available incentives, a review of incentives that local and regional stakeholders can consider offering, and education and outreach efforts.

For electric utility providers in the Coachella Valley, the following recommendations are provided:

- Create utility notification protocol.
- Upgrade distribution infrastructure and evaluate needs.
- Implement consumer outreach programs.
- Assess alternatives for tiered rate structures.
- Review options for secondary meter.
- Evaluate smart grid opportunities.
- Provide renewable energy options for plug-in electric vehicle drivers.

CHAPTER 1:
Plug-in Electric Vehicles in the Coachella Valley – Today and Tomorrow

At the core of the plug-in electric vehicle (PEV) ecosystem are the vehicles and charging infrastructure. PEVs (generally referred to as electric vehicles, or EVs) include both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs).

- Plug-in hybrid electric vehicles: PHEVs can use gasoline or electricity. PHEVs are generally distinguished by the all-electric range of the battery before the vehicle starts to use gasoline. Some common examples of PHEVs include the Chevrolet Volt (~40 miles all-electric range), Ford C-Max Energi (~20 miles of all-electric range), and the Toyota Prius Plug-in (~10 miles of all-electric range).
- Battery electric vehicles: BEVs only use electricity. Generally, BEVs have a shorter range than vehicles that use gasoline because of the limitations of battery technology. For instance, the Nissan LEAF and Ford Focus Electric have an estimated range of about 75 miles. The standard version of the Tesla Model S, however, has a range of more than 200 miles. The larger battery on the Model S provides the superior range, but it also increases the cost of the vehicle significantly.

The higher cost of PEVs relative to conventional vehicles remains an obstacle to more 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,[1] and most expect the purchase price of PEVs to be cost-competitive with comparable non-PEV models.[2] The purchase and lease prices of the Nissan LEAF are actually cost competitive with its conventional counterpart[3]; however, in most cases with PEVs, federal and state incentives are not enough to offset completely higher retail costs. Table 1 compares manufacturer's suggested retail prices (MSRPs) for four PEVs with comparable conventional vehicles. The MSRPs for PEVs are 33 to more than 100 percent higher than conventional gasoline vehicle counterparts.

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

2 Ibid.

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

Table 1: 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	$29,980	Nissan Versa SL	$18,490	$10,310	$7,500	$2,500	$490
Chevrolet Volt	$34,185	Chevrolet Cruze ECO	$19,325	$19,820	$7,500	$1,500	$5,860
Ford C-Max Energi	$32,920	Ford C-Max HEV	$25,170	$7,750	$4,007	$1,500	$2,243
Toyota Prius Plug-In	$29,990	Toyota Prius HEV	$24,000	$8,000	$2,500	$1,500	$1,990

Source: Manufacturer websites – Nissan, Chevrolet, Ford, and Toyota; Internal Revenue Service Plug-In Electric Drive Vehicle Credit; California Clean Vehicle Rebate Project

The values shown in Table 1 are limited to the purchase price premiums that consumers might face in the near-term for PEVs; however, the table does not capture the total cost of ownership. The total cost of ownership for PEVs depends on many variables such as the level of charging that consumers opt for, the availability of other incentives (e.g., incentives for residential EVSE), the type of electrical utility rate that consumers are paying, and the miles traveled. In most cases, the availability of 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 (i.e., 10–12 years).

The charging infrastructure for PEVs is referred to as electric vehicle supply equipment (EVSE) that consists of charging hardware, the software that manages charging, and, in some cases, payments for 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, including Level 1, Level 2 and Direct Current (DC).

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	1:40	00:45

Source: Calculations performed by ICF International
Assumptions: Level 1 charging at 1.4 kW, Level 2 is 7.7 kW, and DC fast charging is 50kW. For DC fast charging, calculations assume the battery is charged to 80% and remaining 20% is completed by charging at a slower rate. DC fast charging can deliver power up to 150 kW. Prius Plug-in and Volt do not have DC fast charging abilities.

The following subsections review current and forecasted vehicle deployment and EVSE deployment in the Coachella Valley.

Conditions and Trends: Vehicle Deployment

The Coachella Valley has experienced modest deployment of PEVs to date. Based on ICF International's (ICF) analysis of vehicle registration data from Polk, the Coachella Valley has just over 220 PEVs on the road—148 PHEVs and 76 BEVs—as of July 2013. For the sake of reference, there are about 350,000 vehicles in the entire Coachella Valley.

Despite the limited deployment of PEVs to date, the trends for hybrid electric vehicle (HEV) ownership—generally considered a good indicator for interest in PEVs—in the Coachella Valley have been good in the last several years. Furthermore, there are regulatory drivers, such as the Zero Emission Vehicle Program, that will lead to increased PEV adoption in the mid-term future.

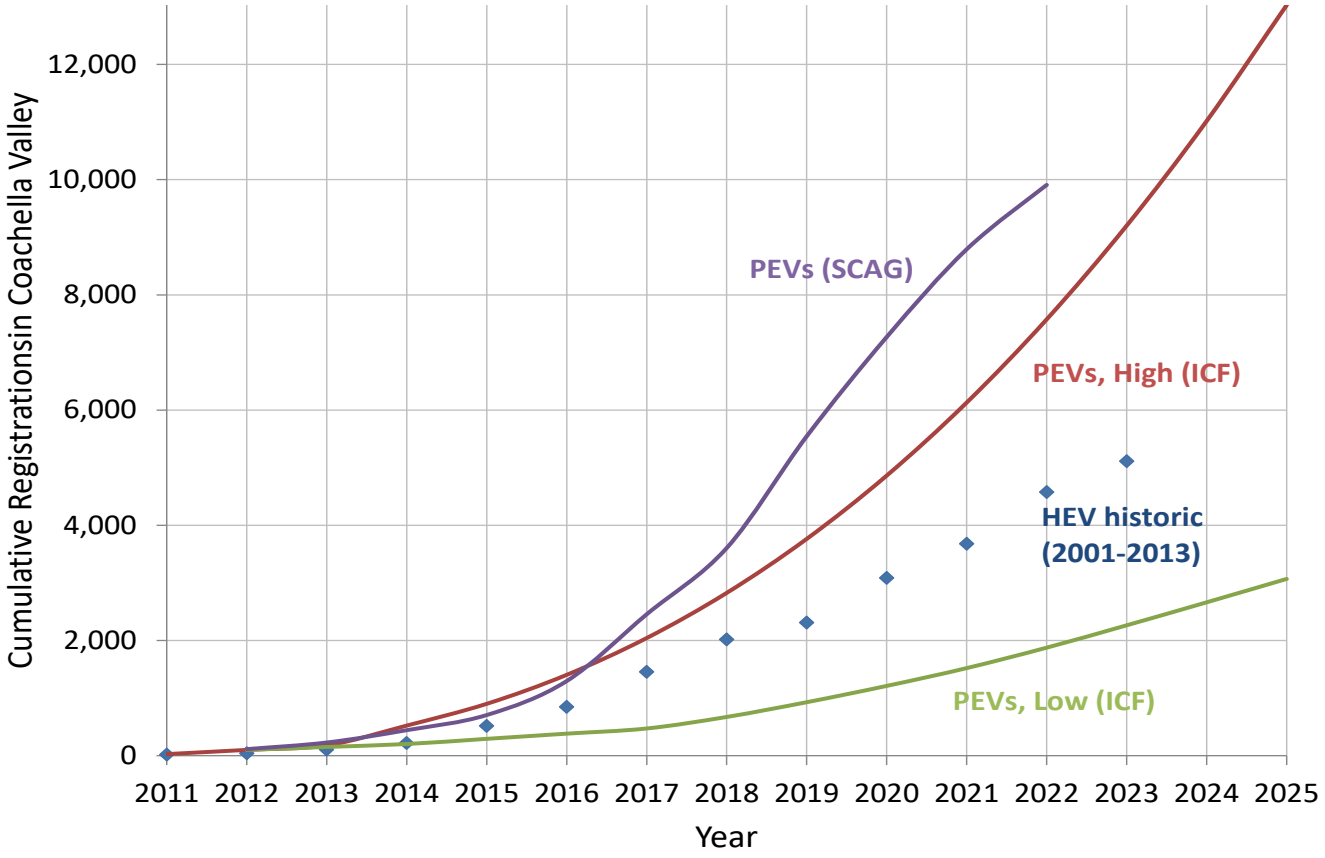
ICF initiated PEV forecasts by considering the Zero Emission Vehicle (ZEV) regulation, which requires the sale of vehicles such as PEVs. The ZEV regulation includes transitional zero emission vehicles (TZEVs), BEVs, and hydrogen fuel cell vehicles (FCVs). Vehicle manufacturers (OEMs) are required to meet the ZEV regulation by deploying zero tailpipe emission vehicles in California. The ZEV regulation calls for about 15 percent of new light-duty vehicle sales to be a combination of TZEVs, BEVs, and FCVs by 2025. As part of the rulemaking process, California Air Resources Board (ARB) developed an expected compliance scenario,[4] a mix of TZEVs, BEVs, and hydrogen FCVs. For the purposes of this analysis, TZEVs are considered equivalent PHEVs—this assumption has been vetted by ARB staff. ICF also considered market drivers such as hybrid electric vehicle ownership in the Valley. One of the primary reasons that ICF expects some lag in PEV adoption in the Coachella Valley and Riverside County more generally is due to a lower than state average uptake of hybrid electric vehicles based on a review of registration data from Polk. ICF assumed that about two-thirds of PEVs would be PHEVs and the other third would be BEVs, which is consistent with current sales in the Valley and projected sales at the state and national level.

Figure 1 shows ICF's low and high PEV forecasts for the Coachella Valley (green and red line, respectively) along with several other reference points:

- Hybrid electric vehicle ownership in the Coachella Valley for 2001-2013 (overlaid on years 2011-2013 on the graph)
- Forecasts from Southern California's Readiness Plan Prepared for the Southern California Association of Governments (SCAG).

4 CARB, Advanced Clean Cars, 2012 Proposed Amendments to the California Zero Emission Vehicle Program Regulations, Staff Report: ISOR, December 2011. available online at http://www.arb.ca.gov/regact/2012/zev2012/zevisor.pdf

Figure 1: Forecasted PEV Populations (in the light-duty sector) for the Coachella Valley



Source: ICF International

The PEV forecasts in the Southern California PEV Readiness Plan were developed by starting with an inventory of all PHEVs, BEVs and neighborhood electric vehicles (NEVs) in each region and applying an annual percentage increase based on Toyota Prius hybrid sales from 2000 to 2010[5]. These projections should be considered as an upper limit for the potential for PEV adoption in the Coachella Valley as they are considerably higher than other market projections.

There are provisions in the ZEV regulations for OEMs to comply via the sale of NEVs. This is an important regulatory driver for NEV sales in the Coachella Valley to complement the Coachella Valley Link – a proposed mixed use cross-valley pathway for pedestrians, bicyclists, and small electric vehicles. As of July 2013, there were approximately 480 personally-owned and registered NEVs on the road in the Coachella Valley – more than double the number of PEVs. However, based on ICF's analysis of Polk vehicle registration data, the number of personally owned NEVs in Coachella Valley has been stagnant since the early 2000s, when approximately 450 NEVs were on the road.[6]

5 Southern California PEV Readiness Plan located at: http://164.67.121.27/files/Downloads/luskincenter/ev/PEV_Readiness_Plan.pdf

6 Note that these counts only account for vehicles that are registered with California's Department of Motor Vehicles (DMV). NEVs and golf carts that are used in gated communities or at golf courses that do not leave the grounds of these facilities are generally not registered with the DMV.

Conditions and Trends: Charging Infrastructure Deployment

The limited number of PEVs on the road in the Coachella Valley has limited demand for publicly available charging. The location of charging infrastructure in the Valley is listed in Table 3.

Table 3: EVSE Locations in the Coachella Valley, November 2013

Host	Location	Number of EVSE	
		Level 1	Level 2
Hilton Palm Springs	Palm Springs	—	1
Palm Springs Nissan	Cathedral City	—	1
Torre Nissan	La Quinta	—	1
Renaissance Esmeralda Indian Wells Resort & Spa	Indian Wells	—	2
JW Marriott Desert Springs Resort & Spa	Palm Desert	6	2
Best Western Date Tree Hotel	Indio	1	—
City of Palm Desert	City Hall	—	4
	Park View Building	—	1
City of Palm Springs	Accelerator Park	—	1
	City Hall	—	2
	Coachella Valley Economic Partnership	—	2
	Downtown Parking Structure	—	2
	Fleet Maintenance Yard	—	1
	International Airport	—	1
	Library	—	1

Source: Alternative Fueling Station Locator, available at http://www.afdc.energy.gov/locator/stations/

As more PEVs are deployed in the Valley, additional publicly available infrastructure will be required. The market is in the early stages of vehicle adoption and our understanding of driver behavior and optimal EVSE deployment is evolving. ICF conducted its own analysis to estimate publicly available and workplace charging requirements for the Valley, and included estimates based on research from the Electric Power Research Institute (EPRI).

EPRI conducted research on how much electric vehicle charging is needed, with a focus on workplace and public usage.[7] EPRI reviewed the impacts of free charging and a benefits-tested scenario on usage as a measure of charging stations per vehicle. EPRI's analysis yields a benefits-tested scenario in which the charging station-to-vehicle ratio ranged from 0.01 to 0.15 for BEVs and PHEVs.

7 D. Bowermaster, EPRI. How Much Electric Vehicle Charging is Needed? California Plug-in Electric Vehicle Collaborative Meeting, August 2012.

ICF developed an EVSE deployment model that decreases the demand for EVSE over time to account for potential market saturation and the benefits of increased station utilization. Table 4 compares ICF's estimates for Level 1 and 2 EVSE with the estimates from EPRI's research and also shows the projected number of EVSE that may be needed to support the projected number of PEVs at all types of away-from-home locations, including workplaces.

Table 4: Estimated Non-residential Level 1 and 2 EVSE to Support Forecasted PEV Populations in the Coachella Valley

Year	Vehicle Forecasts		Estimated demand for L1 and L2 EVSE		
	PHEV	BEV	ICF estimates		Estimates using EPRI method
			Low	Mid	
2015	197–604	97–298	54–167	137–420	46–142
2020	812–3,258	400–1,605	152–609	383–1,534	191–767
2025	2,057–8,729	1,013–4,300	260–1,105	656–2,783	484–2,054

Source: ICF International

The range of EVSE that is likely required to support the PEV forecasts is large; however, this is a reflection of the uncertainty related to the future need for non-residential charging. Regardless, it is clear that additional infrastructure will be required to support PEVs in the Coachella Valley. The level of investment necessary to develop and maintain the forecasted PEV populations for the Valley is difficult to estimate for many reasons, the most significant of which are:

- It is unclear what the split between Level 1 and Level 2 charging needs will be as the market develops and expands. There is increasing interest in Level 1 charging at workplaces—and electric vehicle service providers are starting to respond to this demand. As a result, there are several Level 1 options available today that were not available previously.
- The cost of installation will vary considerably based on site characteristics; and c) the level of charging that will be required or requested is uncertain. For instance, trenching and cutting costs can increase the installation costs by upwards of $3,000-$5,000 for Level 2 EVSE installations. These costs apply to installing EVSE at existing buildings or parking lots; whereas introducing EVSE as part of new construction is much easier because the costs can be amortized as part of a much higher capital investment.

It is also important to note that Level 1 and Level 2 AC charging will have to compete with DC fast charging and other emerging charging technologies. These technologies may put downward pressure on the price and need for Level 1 and Level 2 charging.

Siting Analysis

To help guide and coordinate investments in charging infrastructure and prevent negative impacts on the electricity grid, this Plan includes a siting analysis to determine potential locations for EVSE in the Coachella Valley, based on parameters shown in Table 5. The siting of charging infrastructure is a key component of successful PEV deployment and requires consideration of the following factors: location, quantity, level of charging, investment, and payment.

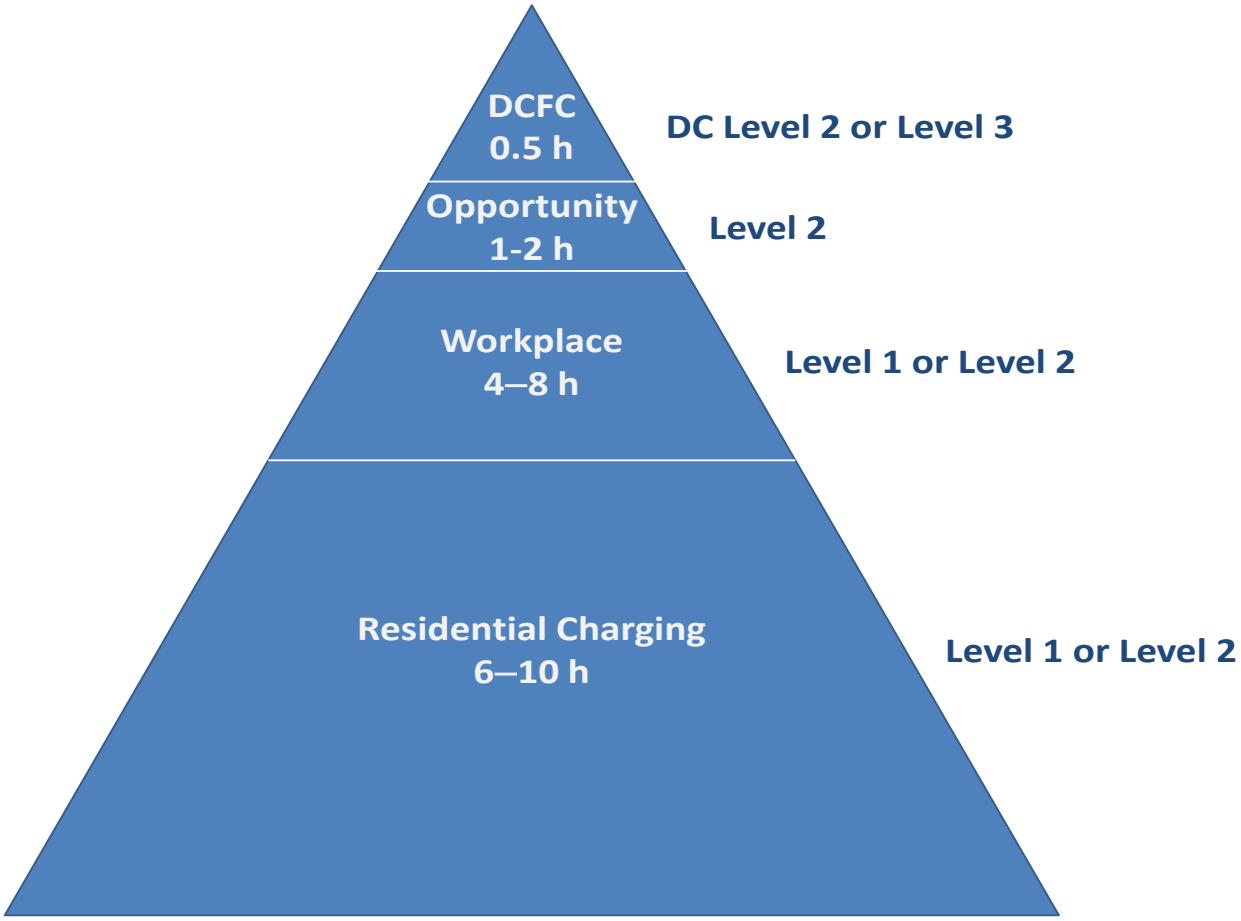
Table 5: Parameters Considered in the Identification of Suitable Locations for EVSE

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	Forecasts are differentiated by PHEVs and BEVs.
	Trip characteristics	Affects charging activity and distance traveled.
	Home charging capability	Presence of a garage affects the likelihood of a driver charging at home, where the vehicle spends a considerable amount of time.
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.

Source: ICF International

Figure 2 illustrates the four categories of charging and their relative use on which the siting analysis focuses. The majority of demand will be for residential charging as vehicle owners seek to charge their vehicles as they are parked overnight. The remainder of demand will mostly be at workplaces, where employees and/or visitors are generally parked long enough to receive a significant charge. Finally, DC fast charging and opportunity charging at public locations will see a relatively small share of demand from PEV drivers who take the opportunity to charge at convenient locations in order to extend the range of their trips.

Figure 2: Charging Triangle, By Charging Type and Charging Level



Source: ICF International

Residential Charging

ICF initiated a siting analysis by identifying where PEVs are likely to be deployed, which required identifying the most likely PEV adopters. Table 6 reviews the information available regarding the characteristics of initial PEV buyers from various surveys.

Table 6: Overview of Research on Early Adopters of PEVs

Data Source	Income	Home Ownership	Dwelling Type	Household Vehicles	Hybrid ownership
2012 California PEV survey —vehicles: LEAFs —region: California [1]	54%, $150k + 25%, $100k-$150k 18%, $50k-$100k 3%, <$50k	n/a	91% in single family w/ an attached garage, 6% single family, detached garage, 3% in apartment <1% other	n/a	n/a
2013 California PEV survey —vehicles: LEAFs, Volt, Prius Plug-in —region: California [2]	50%, $150k + 18% $100k-$150k 10%, $50k-$100k 2%, <$50k 20%, Unknown	93% own their home	88% in a single-family detached home, 7% in single-family attached home, 4% in an apartment/ condominium, 1% in other dwellings	n/a	n/a
Bay Area LEAF survey —vehicles: all LEAFs —region: SF Bay Area, CA [3]	n/a	n/a	n/a	nearly all households have at least 1 other vehicle 30% have more than 2 vehicles	34% had a HEV in their home
Tal *et al*, California Survey —vehicles: mostly LEAFs —region: California [4]	46%, $150k + 37%, $100k-150k 16%, declined	96% own their home	96%, single family house		32% owned a HEV before they purchased PEV 11% replaced a HEV w/ a PEV 25% own HEV and PEV
Chevrolet information [5]	average income, $170k	n/a	n/a	n/a	7% of buyers replaced a Toyota Prius HEV with the Volt
Nissan Information [6]	household income, $159k	home value of $640k			

Source: California Center for Sustainable Energy, Bay Area Air Quality Management District, G. Tal et al., General Motors and Nissan

Based on surveys of initial adopters, ICF identified the key indicators for PEV ownership. ICF used these key indicators to develop a scoring methodology for assessing the likelihood of PEV adoption in a given block group. The following parameters were selected for further consideration, with corresponding weighting factors highlighted below:[8]

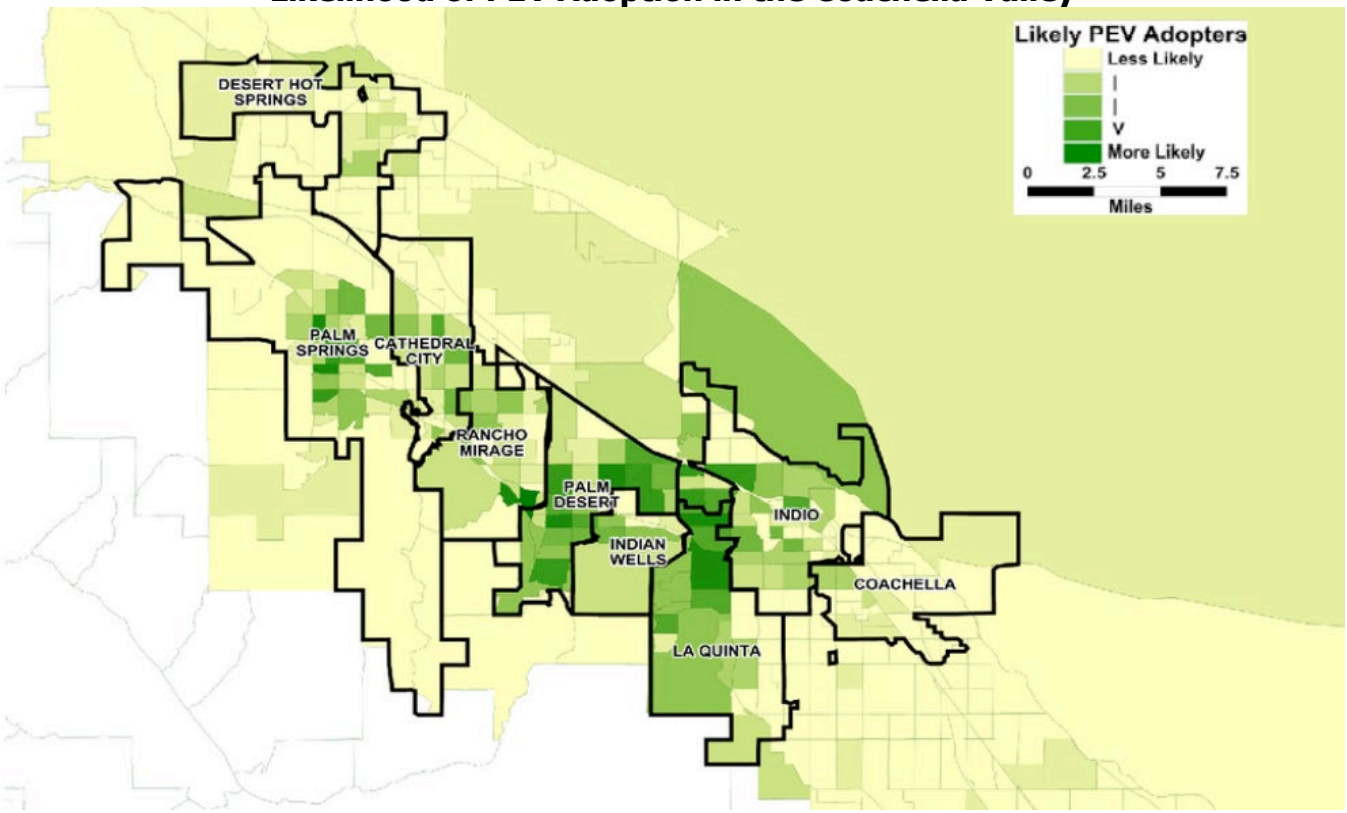
- Income: The most significant indicator for PEV ownership is and will continue to be income. For the purposes of this exercise, ICF established a floor of income of $100,000 and weighted the likelihood of PEV ownership towards higher incomes. This analysis weighted income at 60 percent of the score for a census block group.
- HEV ownership: Based on survey results, ICF gave HEV ownership a significant weighting factor. In addition to correlating with income, HEV ownership correlates well with influencing factors such as environmental stewardship and price sensitivity to gasoline, both of which are assumed to play a significant role in the level of interest in PEVs. ICF's analysis weighted HEV ownership at 30%.
- Home Ownership: The influence of home ownership will likely change considerably by 2020; however, in the near-term future, it will likely be a significant driver. There is already some correlation between home ownership and income, so the weighting for this parameter is designed to distinguish between census block groups that are already likely to include PEV adopters based on the income profile. ICF only considered census block groups that had both an income greater than median income for the region and home ownership greater than the median level of home ownership for the region. This parameter was weighted at 5 percent.
- Dwelling Type: Dwelling type is an important parameter because drivers are expected to charge their vehicles at home. Many BEV and PHEV buyers are likely to install Level 2 EVSE at their homes. Only census block groups that were above the median income and above the median percentages of single-family residences were considered for this analysis. The barriers to installation of Level 2 EVSE at multi-family residences are not expected to persist out of 202. As a result, this parameter was weighted at 5%.

ICF used census data from the American Community Survey (ACS), an ongoing statistical survey that samples a percentage of the population every year. For the purposes of this exercise, ICF determined that the most complete dataset for block groups was the 5-year estimates; ICF used data for years 2006-2010. ICF extracted demographic data on income, home ownership, and dwelling type in the Coachella Valley. ICF analyzed vehicle registration data from Polk for HEV ownership.

Figure 3 shows the results of the analysis: These are the areas in the Valley that will likely experience high demand for residential charging. Since residential charging takes place at home, these are locations in areas where likely PEV adopters live weighted by the number of trips taken from these areas.

8 ICF also considered access to other vehicles because current PEV owners are likely to own at least 1 other vehicle. ICF anticipates that this pattern will persist out to 2020 for PEV buyers, especially for BEV buyers. It is conceivable, however, that households shift to only owning a PHEV. Data for access to other vehicles were only available at the census tract level and were not used in this analysis.

Figure 3: Siting for Residential Charging:
Likelihood of PEV Adoption in the Coachella Valley



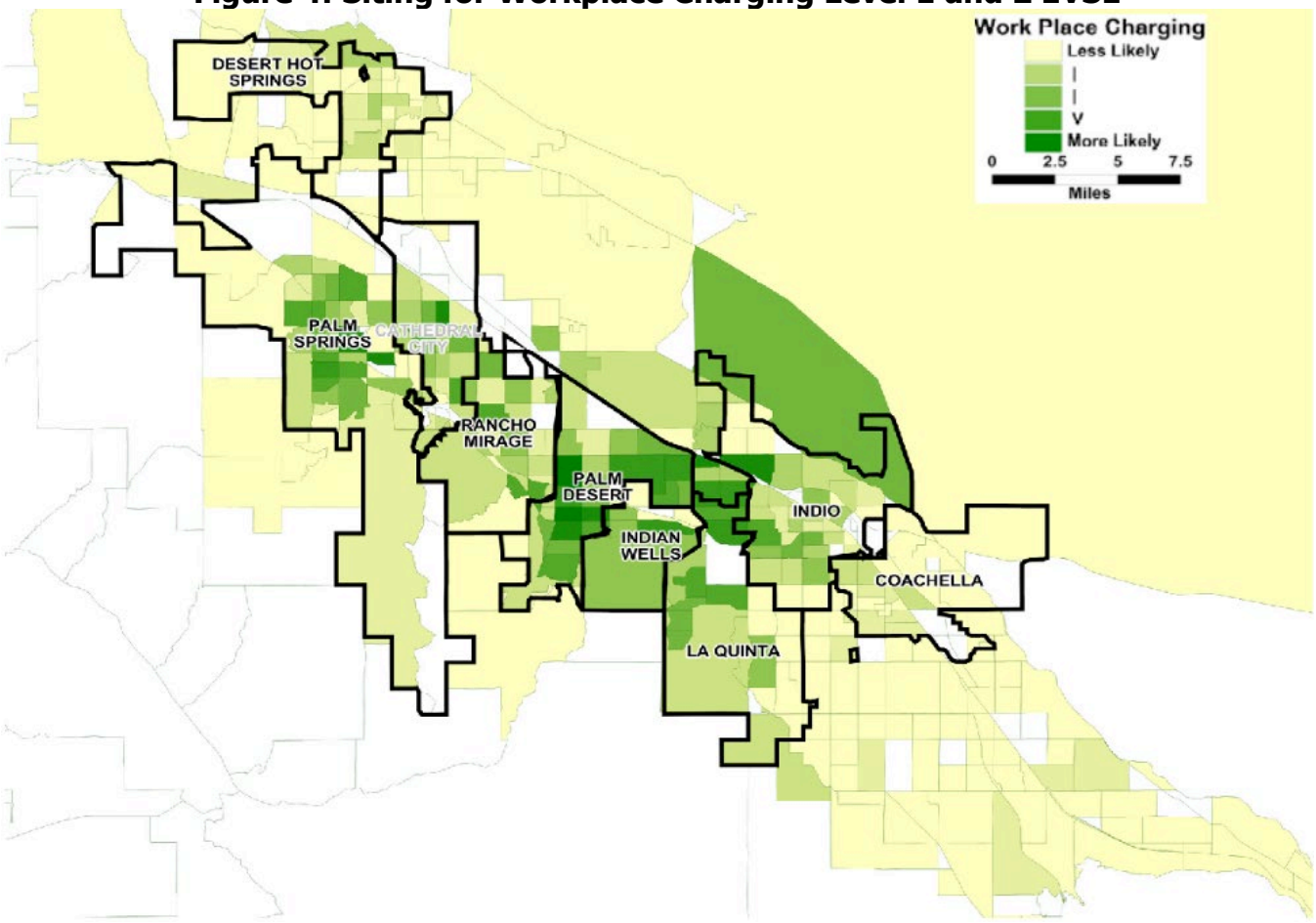
Source: ICF, Coachella Valley Association of Governments (CVAG) GIS Unit

Workplace Charging

ICF worked with Fehr & Peers to develop a method to identify likely areas for workplace charging. Fehr & Peers used the Riverside Travel Analysis Model to identify origin-destination pairs in the morning (6a-9a) and evening (3p-7p) peak hours. Fehr & Peers developed a matrix of trips by trip purpose (e.g., home to work, home to school, and home to shopping). Using the regions that have the most likely PEV adopters (see the previous subsection), ICF weighted trips based on the likelihood that it would be completed with a PEV. Only the afternoon peak trips that were identified as home to work were considered for this aspect of the analysis—these trips represent 37 percent of total trips during this period.

The map in Figure 4 shows the location of areas that will likely experience high demand for workplace charging—areas where likely PEV owners work and vehicles are parked for several hours during the day.

Figure 4: Siting for Workplace Charging Level 1 and 2 EVSE



Source: CVAG GIS Unit, Fehr & Peers, ICF

Opportunity Charging

Opportunity charging covers a wide range of situations where a PEV driver could potentially charge when away from home or work. Unlike residential and workplace charging, where vehicles are parked for long enough that they achieve a significant charge even with Level 1 charging, opportunity charging will take place at locations where drivers are parked for varying times; therefore, the level of charging bears much greater consideration when siting opportunity charging.

Table 7 shows the preferred charging method based on the available charging time at different venues.

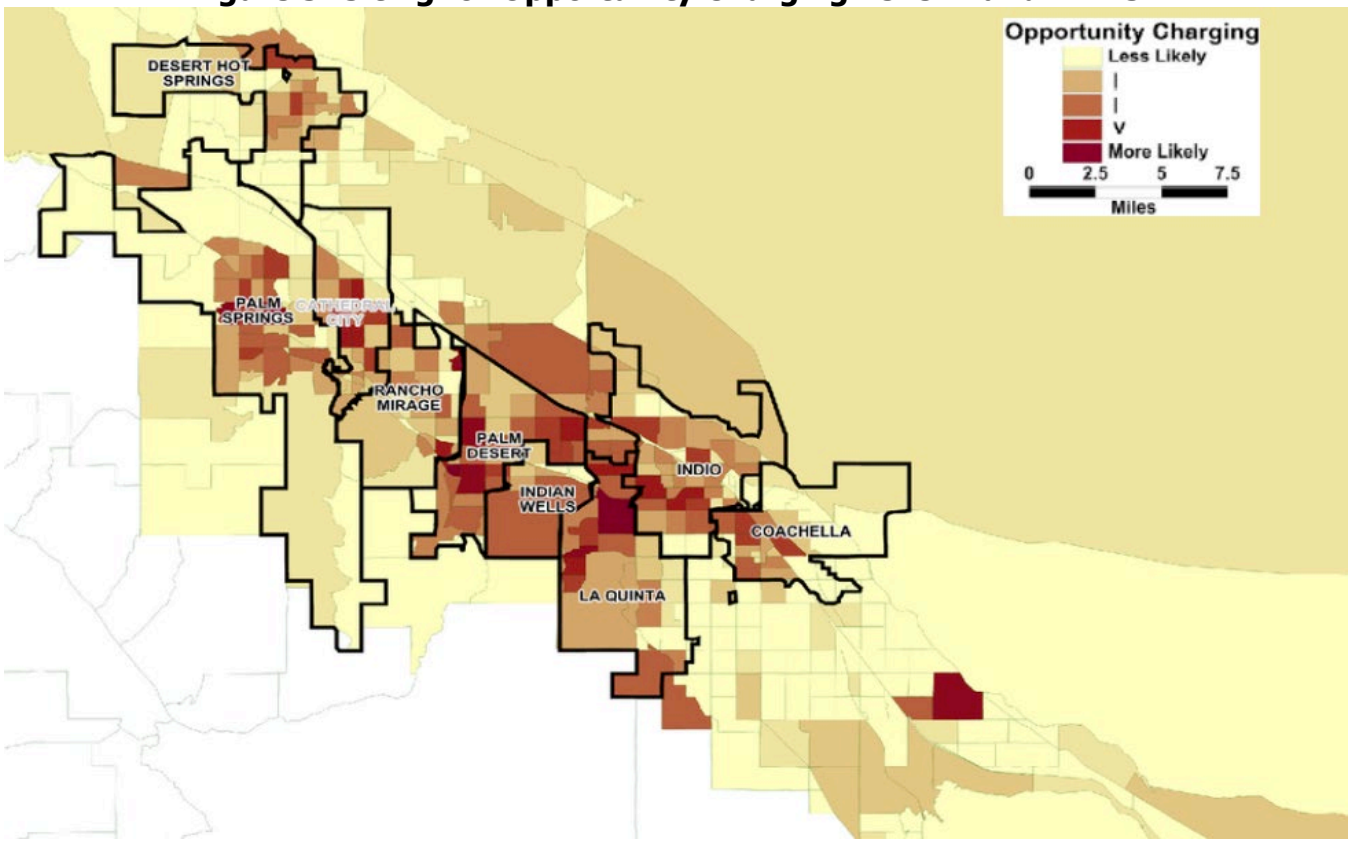
Table 7: Available Charging Time and Recommended Charging Level for Different Venues

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
Street/Meters	1–2 hours	Level 1/Level 2
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	8–72 hours	Level 2/Level 1
Interstate Highways	< 0.5 hours	DC Fast/Level 2
Commuting/Recreation Roads	< 0.5 hours	DC Fast/Level 2

Source: ICF International; modified from information provided by SF BayLEAFs

ICF and Fehr & Peers used a similar methodology to identify areas for opportunity charging as for the workplace charging: Trips were filtered by purpose for those that were identified as home to shopping and home to social or recreational activity. Figure 5 shows the concentration of non-work trips for likely PEV owners.

Figure 5: Siting for Opportunity Charging Level 1 and 2 EVSE



Source: CVAG GIS Unit, Fehr & Peers, ICF

Greenhouse Gas Reduction Potential

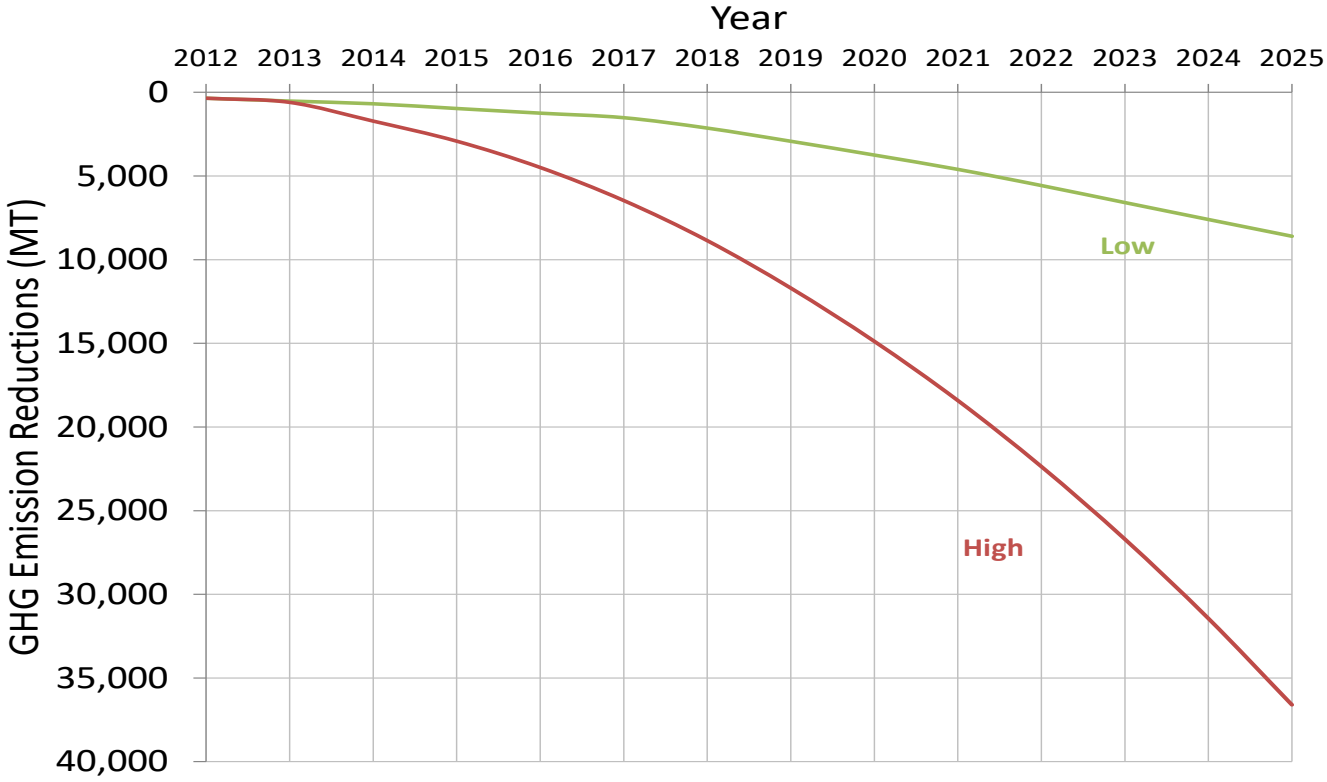
Plug-in electric vehicles have the potential to significantly reduce greenhouse gas (GHG) emissions because they have no tailpipe emissions while driving solely on electricity. There are emissions associated with the production of the electricity used to charge them. However, overall, PEVs have lower associated GHG emissions than conventional vehicles for two reasons: electric motors are more efficient than internal combustion engines; and electricity generation emits less GHGs per unit of energy than gasoline production and combustion. Because of these lower overall emissions, the electrification of transportation technologies is a major focus of various regulatory initiatives in California such as the Zero Emission Vehicle (ZEV) Program and the Low Carbon Fuel Standard (LCFS). Furthermore, the federal fuel economy standards and GHG tailpipe emission standards incentivize the deployment of plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs). To determine how the region is positioned in the face of these growing regulatory drivers, the impacts of vehicle electrification in the Coachella Valley on GHG levels were forecasted and calculated. The GHG emission reduction potential of PEVs is dependent on the following parameters:

- Number of PHEVs and BEVs on the road
- Annual vehicle miles traveled (VMT) and fuel economies of light-duty vehicles
- Percentage of VMT traveled in electric mode or charge-depleting mode for PHEVs Emission factors of electricity and gasoline (i.e., amount of GHGs emitted per kWh or gallon of gasoline consumed)

Detailed descriptions of the following vehicle projections and GHG emission summaries below are documented in the Background and Analysis document.

Two project scenarios – a low and a high emission case – based on the PEV forecasts developed for Coachella Valley (see Figure 1) were analyzed. The annual reductions are shown in metric tons (MT) in Figure 6. Given the lower carbon intensity associated with driving electric vehicles, the GHG reductions increase as the electric VMT relative to overall VMT increase.

Figure 6: Estimated GHG Reductions from PEVs in the Coachella Valley



Source: ICF International

Based on these estimates, PEVs will decrease GHG emission from light-duty vehicles by 8,600 to 36,600 metric tons by 2025 in the low and high PEV forecast scenarios, respectively

As of 2005, light-duty vehicles accounted for 41 percent of GHG emissions in the Coachella Valley.[9] The emissions attributable to light-duty passenger cars, light-duty trucks, and medium-duty trucks for 2005 and 2020 are shown in Table 8.

Table 8: GHG Emissions from Light-Duty Vehicles in the Coachella Valley, 2005 and 2020

Vehicle Category	GHG Emissions (MMT, CO2e)	
	2005	**2020**
Light-duty passenger auto	0.80	1.08
Light-duty trucks	0.63	0.86
Medium-duty trucks	0.33	0.44
Total	**1.76**	**2.38**

Source: Draft Regional Greenhouse Gas Inventory for the Coachella Valley, June 2011

The introduction of PEVs—with an estimated 3,700–14,900 MT of GHG reductions—will only have a minor impact (about 1.5 percent) on overall light- and medium-duty vehicle GHG emissions in 2020 because of the modest adoption rates assumed for the Coachella Valley. However, over time, as PEVs become more popular in the Valley, they will play a much larger role in GHG reductions.

9 Draft Regional Greenhouse Gas Inventory for the Coachella Valley, June 2011.

CHAPTER 2:
Overview of Readiness

PEV and EVSE deployment in the Coachella Valley has been modest to date but is expected to increase significantly in the future based on the analysis presented in Chapter 1 of the Plan. Vehicle and infrastructure forecasts, however, do not answer a critical question related to deployment: How PEV ready is the Coachella Valley and what barriers to mass adoption of PEVs still exist? In other words, as a region, how well prepared are local governments and other stakeholders to support an increasing number of consumers who decide to purchase a PEV and/or to install EVSE at their home? The simplicity of plugging in an electric vehicle belies the complexity of what increased adoption entails—from both a planning and technical perspective. Furthermore, although the PEV driving experience is comparable to or better than conventional vehicles, which is paramount to their success in the marketplace, there are a few crucial differences (and may be perceived by some as barriers to adoption) between the ownership experience of PEVs and conventional vehicles. Ensuring positive end-users' experiences related to these differences will require behind-the-scenes coordination.

ICF and CVAG conducted a survey of local governments in February 2013 to assess the status of readiness in the Coachella Valley.

Seven agencies responded to the survey:

- City of Coachella
- City of Rancho Mirage
- City of La Quinta
- City of Palm Springs
- City of Desert Hot Springs
- City of Cathedral City
- County of Riverside

Each respondent was asked 47 questions about their level of EV readiness in seven areas.

ICF developed a scoring matrix, shown in Table 9, to evaluate the responses given for each survey question. Higher scores were given to answers that indicate "more readiness" and totaled for each agency.

Table 9: Overview of Scoring for Local Government Readiness in the Coachella Valley

Respondent	Readiness Elements							Total
	Permitting	Training & Education	Building Codes	Land Use Plans	Public Charging	MDUs	Fleets	
City of Rancho Mirage	68	20	6	14	8	2	2	**120**
City of Palm Springs	72	16	4	8	17	0	2	**119**
County of Riverside	54	4	8	11	10	4	4	**95**
City of Desert Hot Springs	55	12	5	8	2	4	2	**88**
City of Cathedral City	42	4	4	2	2	2	2	**58**
City of La Quinta	41	2	4	6	2	2	0	**57**
City of Coachella	31	4	2	7	4	4	0	**52**

Source: ICF International

Table 9 highlights that varying stages of readiness for the Coachella Valley. Highlights from the survey include the following:

- Permitting: Survey participants were asked a range of questions about the type of permits required for various EV and EVSE-related activities, cost of the permits, time needed to process permits, EV and EVSE inspections, available guidance for permits, and anticipated permit and inspection requirements. Palm Springs and Rancho Mirage both scored well. Palm Springs scored highly for several reasons:
    - Palm Springs only requires electrical permits for EVSE at single-family homes, commercial properties, open-lot parking, and on-street parking. Many of the other survey respondents require both building and electrical permits.
    - Palm Springs also reported that they charge less for their EVSE installation permit costs in single family homes, commercial properties, open lots, and on-street parking.
    - Adding to the convenience of low-cost permits, Palm Springs is also timely in the delivery of their permits. The respondent for Palm Springs stated that in single-family homes, commercial properties, open lots, and on-street parking, they issue permits on the same day they are requested for the majority of installations.
- Training and education: Survey respondents were asked a series of questions about whether they provide training and education programs for PEV readiness, subject areas

for which they provide such workshops, and tools or guidance that have been developed for PEV readiness.

  - The City of Rancho Mirage scores well because of the number of workshops they offer for various readiness elements.

- Building codes: To gauge the readiness of each agency in the building codes element, respondents were asked questions about whether they have adopted the 2010 California Building Code and whether they have adopted standards other than those in the 2010 Building Code.
  - The County of Riverside was the only agency that had adopted building code requirements that include EV charging stations or pre-wiring for EV charging stations in new construction.
  - The County of Riverside is also one of only two agencies that anticipate that the adoption of revised building code requirements for EVSE will take 2-6 months, rather than 6-12 months or more than one year.
  - The City of Rancho Mirage has since adopted a pre-wiring requirement for EVSE for new construction.
- Land use planning: Respondents were asked if their agencies are involved in updating land use plans for PEV readiness, if they have adopted specific code changes related to land use, and if they have design guidelines for EV charging or parking.
  - Most of the agencies have or are in the process of updating land use plans for PEV readiness; incorporating policies, actions, or objectives in its climate action plan or general plan that encourage electric vehicles; considering adopting any code changes to regulate EV parking or charging spaces or code changes to require, encouraging, or allowing EV parking or charging spaces; adopting design guidelines; and adopting revised zoning and parking ordinances for PEV readiness.
- Public charging: The public charging element of EV readiness was assessed with questions about whether agencies are working on the deployment of EVSE for public charging, if agencies receive funding to work on siting, and how they are determining locations for charging.
  - Palm Springs has been the most active to date regarding public infrastructure deployment (as noted previously in Table 3).
- Multiple-dwelling units (MDUs): Survey respondents were asked questions about whether their agency is creating regulations or code changes that apply to MDUs, and if they work with local agencies to address multi-family dwelling issues.
- Fleets: Survey respondents were asked if their agency is involved in purchasing PEVs for its own fleet and whether their agency has been working with local government agencies on purchasing PEVs for their fleets.

It is important to note that these scores are snapshots in time – readiness in the region has already improved since the survey was administered. However, this survey offers a benchmark from which CVAG can measure readiness moving forward.

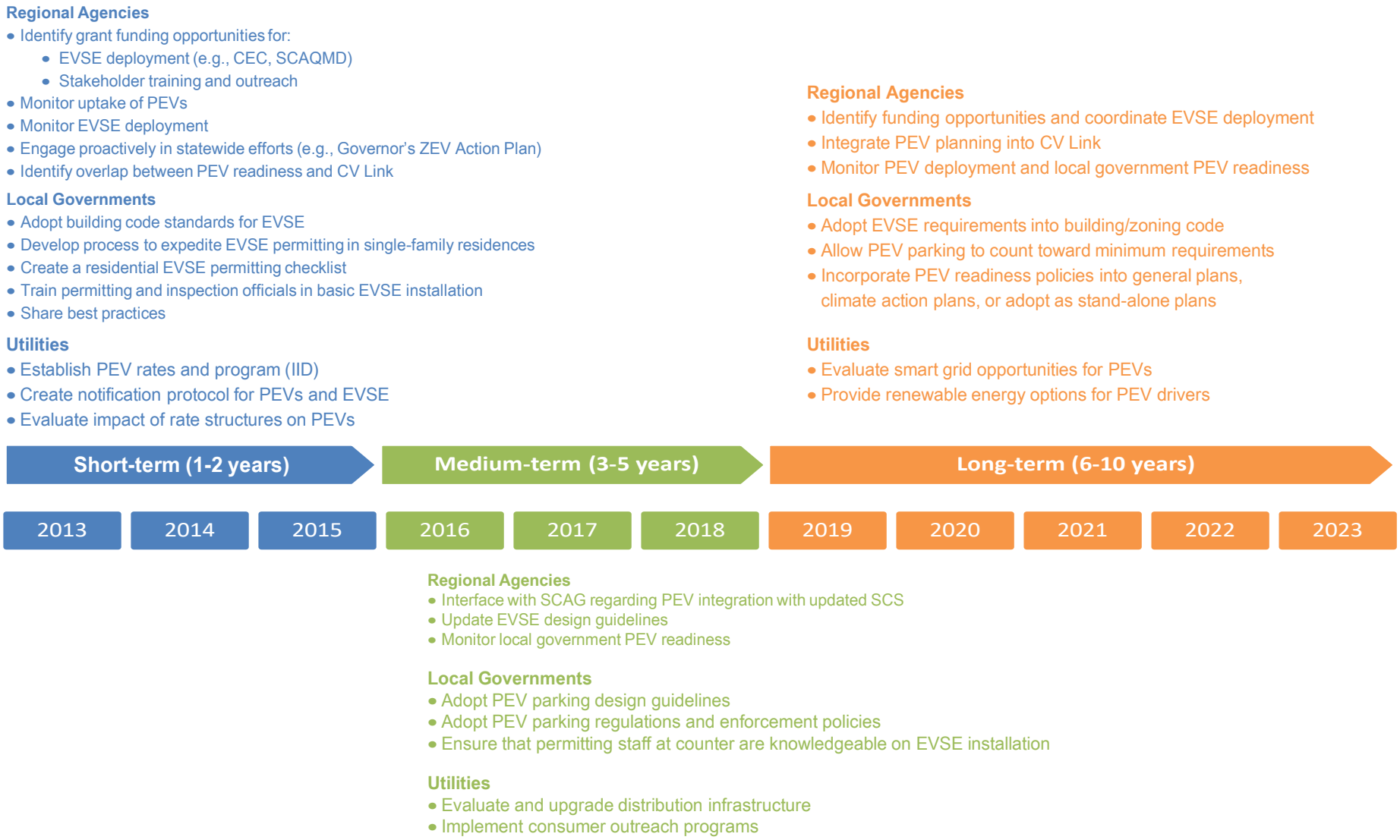
CHAPTER 3:
Local and Regional Governments – Getting Ahead of the Curve

The following sub-sections provide a roadmap and plan for key PEV readiness actions over the coming decade. This section summarizes critical steps that this Plan recommends local governments, regional governments, and utilities in the Coachella Valley to take over the next 10 years to ensure that the region is PEV ready. These recommendations, as well as case studies and examples of best practices, are discussed in more depth throughout the Plan and in the Background and Analysis document.

Short-, Medium-, and Long-Term Actions

Figure 7 shows the key PEV readiness recommendations in this plan for regional agencies, local governments, and utilities over the next 10 years, organized into short-term, medium-term, and long-term actions.

Figure 7: Timeline of recommended key short-, medium-, and long-term PEV readiness actions, by implementing stakeholder



Source: CVAG

The timeline shown in Figure 7 represents general goals for implementation of these strategies across the entire Coachella Valley. However, PEV readiness requires a comprehensive suite of actions, and there are often opportunities to implement some strategies ahead of others. ICF recognizes that many local governments and stakeholders have already completed or made substantial progress toward completing some of the actions shown in Figure 7 ahead of schedule, and that proactive stakeholders will want to look ahead to future requirements in order to begin laying the groundwork for long-term PEV readiness.

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

Short-term (1-2 year) Actions

During the next two years, it is anticipated that the number of PEVs will increase to as many as 1,000 PEVs on the road. During this period, regional agencies and stakeholders (e.g., CVAG, Clean Cities, SCAG, SCAQMD), local governments in the Valley, and utilities will lay the groundwork for successful PEV deployment by working to remove barriers to EVSE installations and incentivizing EVSE and PEV purchases, including:

- Identifying funding opportunities for EVSE deployment in the region
- 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 10 summarizes the short-term PEV readiness actions recommended in this plan.

Table 10: Short-term PEV readiness recommendations and responsible stakeholders

Recommendation	Responsible Stakeholders
Identify grant funding for: • EVSE deployment • Stakeholder training and outreach	CVAG, SCAG, C3VR
Monitor PEV and EVSE deployment	CVAG
Engage proactively in statewide efforts	CVAG
Integrate PEV readiness into CV Link planning	CVAG through California PEV Collaborative
Adopt California Building Code standards for EVSE into local building codes	All local governments
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
Establish PEV program, including PEV rates, potentially EVSE rebate program	Utilities
Create utility notification protocol for PEV purchases and EVSE installations	Utilities
Evaluate impact of rate structures on PEV drivers	Utilities

Source: ICF International

Regional Agencies

Over the short term, CVAG will have the opportunity to help local governments and other stakeholders in the region identify funding opportunities for EVSE deployment and stakeholder training and outreach. CVAG can play a critical role to help local governments identify funding opportunities to improve PEV readiness. To a lesser extent, CVAG can help residents identify resources for PEV incentives—generally, the vehicle side of incentives will fall to other regional and state-level stakeholders.

In addition to seeking funding, CVAG in partnership with Association of Bay Area Governments and Metropolitan Transportation Commission (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 10 above. CVAG will also monitor PEV and EVSE deployment in the region as necessary.

To the extent feasible, CVAG should consider engaging in statewide initiatives through the California PEV Collaborative, including:

- **California ZEV Readiness Guidebook:** The Governor's Office is the lead on compiling these six regional plans into a statewide PEV readiness guidebook. This

document will serve 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, will inform the California Energy Commission's investment plan and programs, provides guidance to local communities and regions, guide state level policy, and convey public infrastructure plans.
- **Multi-family Dwelling Units (MDU) Charging Guidelines:** This guidelines document will provide information, resources, case studies, and tools that will guide residents, homeowners associations, and property owner/managers through the installation and decision-making process, specific to issues for MDU installations.
- **Workplace Charging**: The California PEV Collaborative 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.
- **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 will address the reluctance and uncertainty end users have when considering purchase of PEVs. In addition, CALSTART will develop a report on the monetary and non-monetary incentives that companies can implement to encourage employees to purchase and use PEVs.

Local Governments

Over the next two years, local governments in the Coachella Valley are encouraged to implement 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 processes to expedite permitting for EVSE in single-family residents and creating permitting checklists for residential EVSE installations.
- Train permitting staff in basic EVSE installation through programs such as the Electric Vehicle Infrastructure Training (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 local governments around California that have already taken steps to expedite permitting or create guidance on residential EVSE installations. 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 government will create additional opportunities for cities and counties to learn from peers that are pursuing similar PEV readiness strategies in different contexts.

Utilities

Between now and 2015, it is recommended that utilities continue the process of refining rate structures to ensure that they are competitive and developing 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) Actions

During the medium term (3-5 yeas), PEV adoption in the Valley is anticipated to grow to as many as 3,000 PEVs. This plan anticipates that PEV readiness efforts in the region will continue to focus on residential EVSE installations, while providing increased workplace and opportunity charging. Table 11 summarizes the medium-term recommendations in the plan.

Table 11: Medium-term PEV readiness recommendations and responsible agencies

Recommendation	Responsible Stakeholders
Monitor PEV deployment, market opportunities and local government PEV readiness	CVAG
Interface with SCAG regarding PEV integration into updated Sustainable Communities Strategy (SCS)	CVAG
Update siting plan based on new market data	CVAG
Specify or adopt design guidelines for PEV parking spaces	All local governments
Staff the permitting counter with electrical permitting experts	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

Source: ICF International

Regional Agencies

In the three- to five-year time frame, CVAG will continue to monitor the uptake of PEVs to determine which of the medium-term PEV readiness recommendations to implement and the appropriate level of coordination and funding that are needed to achieve PEV adoption targets. As part of that assessment, CVAG and its regional partners will be evaluating the need and options for augmenting the network of non-residential charging. ICF recommends that CVAG and its partners—through best practices and information sharing—assist local governments with creating design guidelines for PEV parking spaces. Depending on the level of PEV and EVSE deployment in the mid-term future, CVAG 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, ICF has found that many charging spaces in California 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.

Local Governments

Over the medium term, it is recommended that local governments seek to adopt guidance and regulations to support further expansion of workplace and opportunity charging. In particular, it is important for local governments to adopt or create 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 which complement the information provided and resources identified in this Plan[10]. Organizations such as Sonoma County and the PEV Collaborative have also produced design guidelines that local governments can use as resources, and this Plan anticipates that regional agencies will be releasing additional design guidance for charging spaces. However, cities and counties will need to 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 will also need to consider adopting regulations and enforcement policies for PEV parking spaces to ensure that PEVs have unobstructed access to charging.

As an increased number of workplaces, MDUs, and other locations (where it is more complex to install EVSE) apply for permits, having a staff that has been trained in EVSE at the permitting counter will help ensure that these installations are both streamlined and safe. If regional agencies organize staff trainings in EVSE installations over the short term, local governments will have more expert permitting staff on hand.

Over the next several years, utilities will likely have more reliable information on EVSE installations they can get information from local permitting departments rather than relying on consumers. Though local governments are not currently allowed to share residents' information with investor-owned utilities, local governments in areas with publicly owned utility service can work with utilities to create EVSE notification protocols that may serve as a model for more widespread notification over the long term.

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

Utilities

As more data becomes available on PEV deployment and charging demand in the Coachella Valley, 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) Actions

The short- and medium-term prospects for PEV deployment in the Coachella Valley are modest. However, it is important to recognize that there has been strong growth in HEV ownership in the Valley recently; this likely portends good things for PEV deployment in the Valley for the long-term future. The long-term recommendations shown in Table 12 are designed to support PEV adoption, while recognizing that the market is dynamic and is likely to change significantly over the time period considered.

Table 12: Long-term PEV readiness recommendations and responsible agencies

Recommendation	Responsible Stakeholders
Identify funding opportunities and coordinate EVSE deployment	CVAG
Monitor PEV deployment and local government PEV readiness	CVAG
Integrate PEV planning into CV Link	CVAG
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

Source: ICF International, CVAG

Regional Agencies

Over the long term, CVAG will continue to seek funding opportunities to coordinate EVSE deployment. Other regions in California—such as the San Francisco Bay Area and Los Angeles—already have strong growth and will likely continue to see strong growth in PEV deployment. However, in order for California to meet its objectives related to GHG reductions, ZEV deployment, energy security, etc., it is imperative that regions like the Coachella Valley receive the appropriate level of incentives and funding to ensure consistent and, if possible, accelerated PEV and EVSE deployment.

In addition to seeking funding opportunities and coordinating EVSE deployment in the region, CVAG will be responsible for ensuring that PEVs are incorporated into the CV Link project.

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 create 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. 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 should further investigate the potential to offer these options to PEV owners.

The anticipated growth in PEV deployment represents a substantial change in the way that Coachella Valley 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; and ensure that new EVSE is safe, easy to install, and accessible to all. The following subsections detail specific actions that stakeholders can take prepare for growing demand for PEVs.

EVSE Deployment and Utilization

Plans, Policies, and Parking Regulations

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.

This section contains five recommendations for local government agencies to consider ensuring that adequate charging opportunities are available for PEVs and that these charging spaces are designed to accommodate PEVs as efficiently as possible.

Adopt a Climate Action plan, General Plan update, or Stand-alone Plan that Encourages Deployment of PEVs and EVSE

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 different funding streams toward PEV plans and projects.

Create Minimum Requirements for PEV parking

Over the long term, the most effective way 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 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. Table 13 summarizes requirements from existing state codes and examples from municipal codes.

Table 13: 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 Draft Planning and Zoning Code	Multi-unit residential and lodging with 17+ parking spaces	3% of all spaces	Charging stations	Required

Source: CVAG

When implementing parking requirements, local governments should also follow the three recommendations below to ensure that these spaces are affordable to developers, well-managed, and well-designed.

Allow PEV Parking Spaces to Count toward Minimum Parking Requirements

Many jurisdictions have minimum parking requirements specifying the number of spaces that developers must provide for new construction in different land uses. 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.

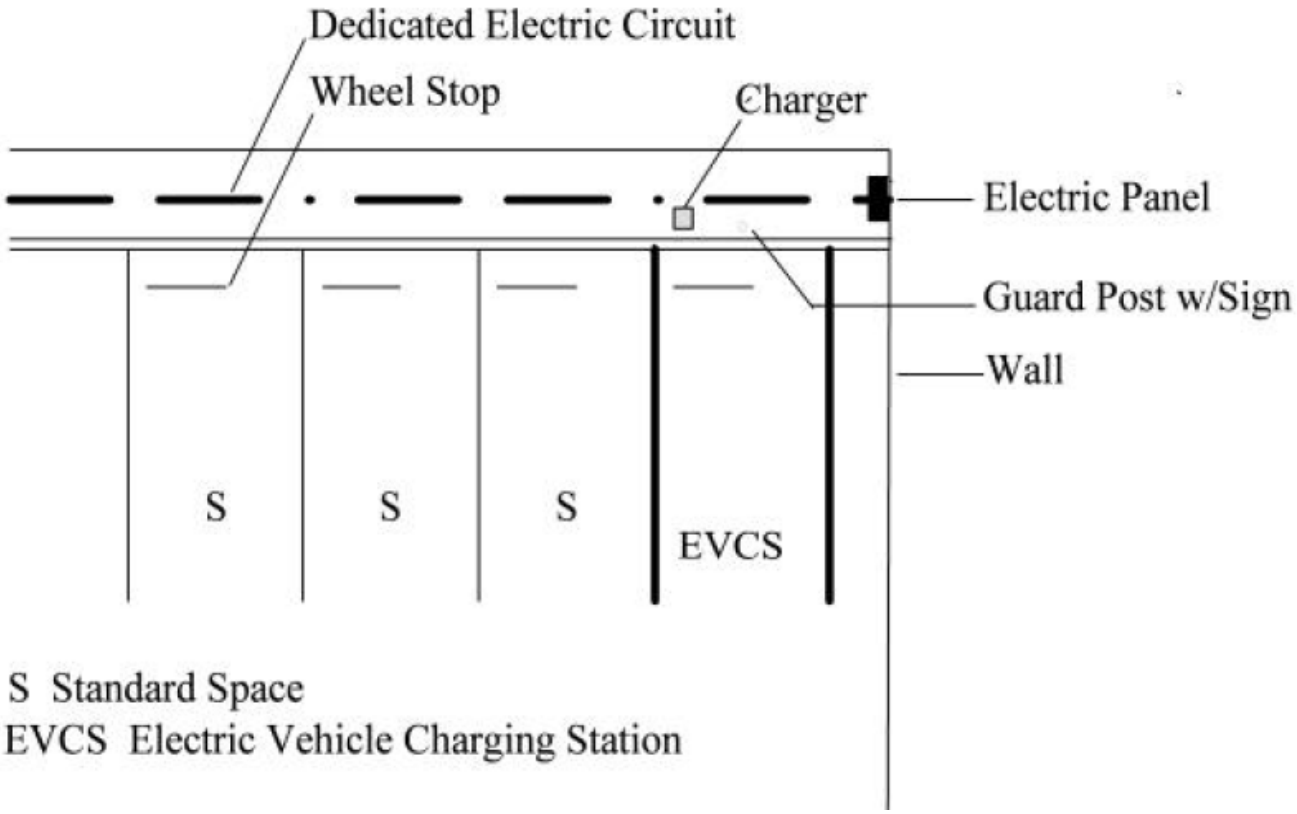
Adopt regulations and enforcement policies for PEV parking spaces

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

Specify Design Guidelines for PEV Parking Spaces

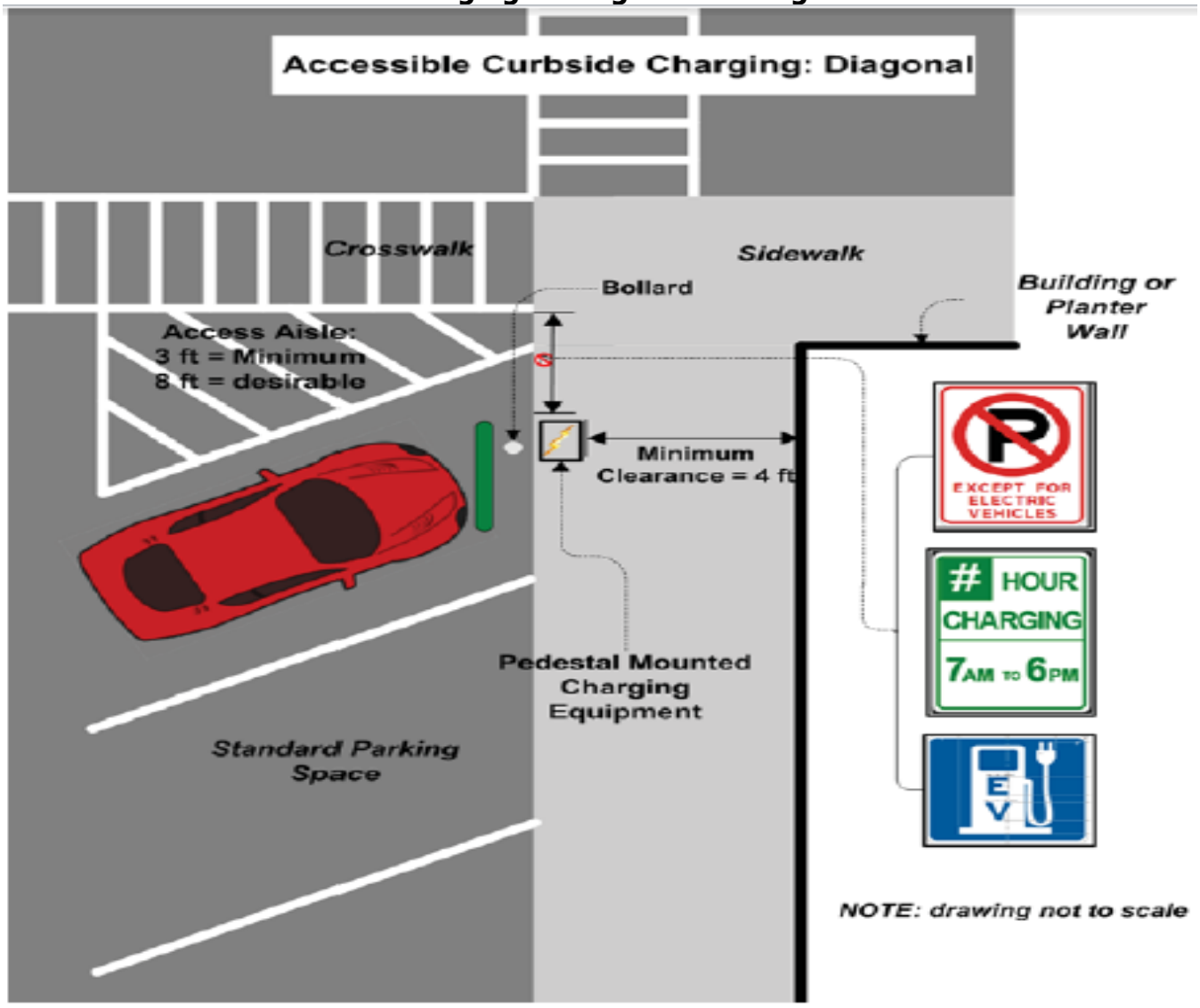
Local governments should also adopt design guidelines that address the many unique considerations associated with PEV parking spaces in order to guide property owners through the process of creating these spaces. Among other factors, these guidelines should address dimensions, configuration, signage, and accessibility for PEV parking spaces. Several existing resources discuss design guidelines; Figure 8 and Figure 9 show examples.

Figure 7: Sonoma County Illustration of a Single Charging Space in Perpendicular Parking



Source: Electric Vehicle Charging Station Program and Installation Guidelines, County of Sonoma, Department of General Services, July 2011

Figure 8: Plug-in Electric Vehicle Collaborative Illustration of Accessible PEV Charging in Diagonal Parking



Source: Accessibility and Signage for Plug-in Electric Vehicle Charging Infrastructure: Report and Recommendations, California Plug-in Electric Vehicle Collaborative, May 2012

Building Codes

Building Codes contain safety standards and specifications that guide new construction and renovations. There are two major opportunities to create building codes that 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.

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 two recommendations for the Coachella Valley's local government agencies to consider.

Adopt Standards for EVSE into the Building Code

Implementing this recommendation 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 location of EVSE relative to vehicles and electrical panels, electrical and technical standards for EVSE, signage and marking, proper ventilation, and accessibility requirements.

Adopt 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.

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.

Permitting and 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 an MDU, or 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 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.

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. 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. The five recommendations in this section summarized below are focused on helping local governments remove barriers to installing EVSE without sacrificing safety and quality control.

Expedite Permitting for EVSE in Single-family Residences

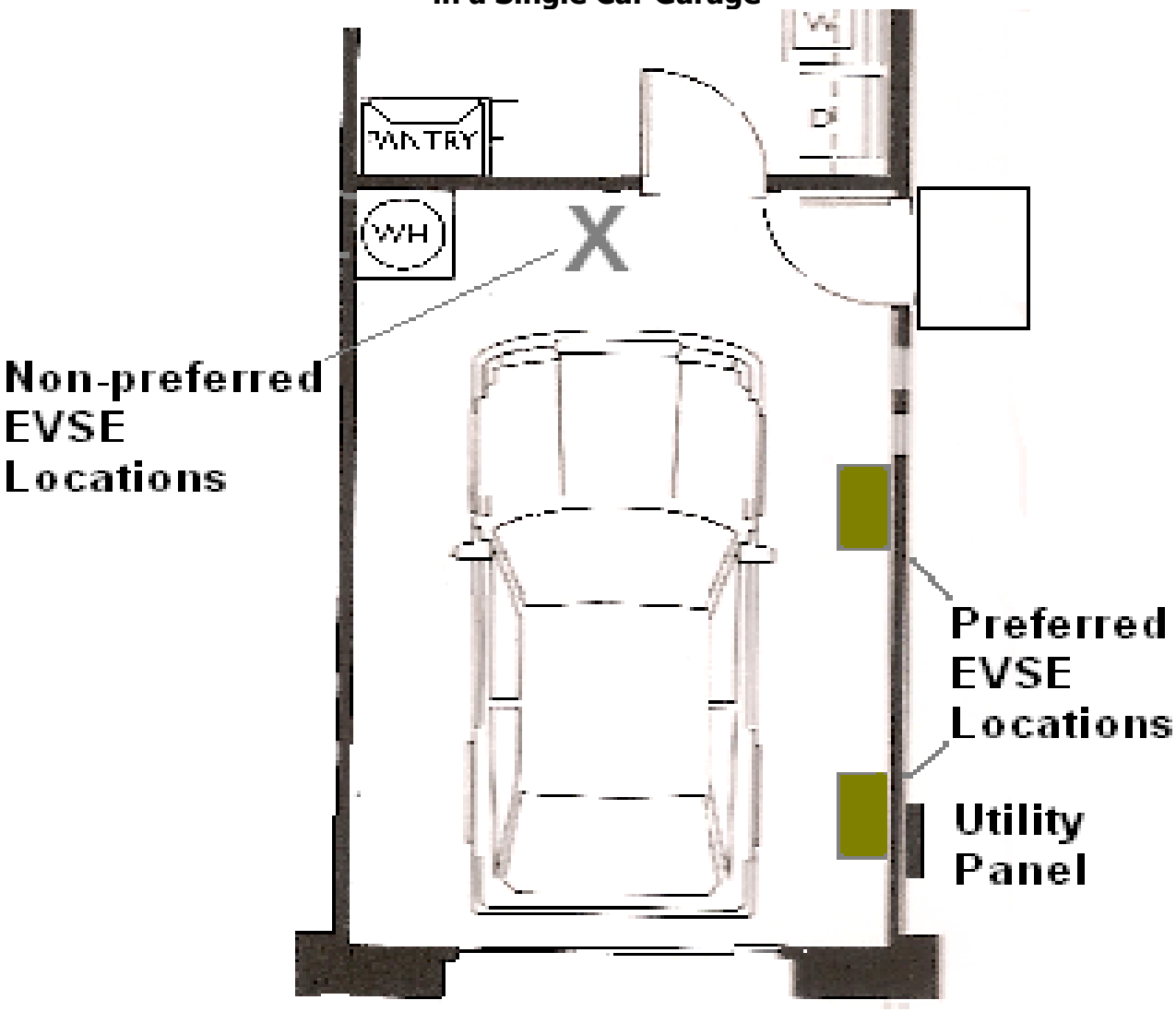
In order to encourage EVSE installations, it is recommended that local governments consider expedite permitting for electric vehicles in SFRs by:

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

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 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 10.

Figure 9: Tri-chapter Uniform Code Committee Diagram of Potential EVSE Locations in a Single Car Garage



Source: International Code Council Tri-Chapter Uniform Code Committee, Policy 18: Commercial or Multi-Family Electric Vehicle (EV) charging station, June 9, 2011, available at http://www.calstart.org/Libraries/EV_Infrastructure_Documents/TUCC_EV_SFR_policy_12_2010.sflb.ashx

Require 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.

Train Permitting and Inspection Officials in EVSE Installation

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

Staff the Permitting Counter with Electrical Permitting Experts

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.

Attract PEV-Related Enterprise

As an emerging industry, the PEV industry is seen by governments as an important opportunity to spur economic growth and create jobs. A recent study commissioned by California Electric Transportation Coalition[11] projected that if PEV market share of new vehicles increases to 15.4 percent by 2025 in accordance with the ZEV Program, this shift would confer new economic growth via long-term energy fuel savings, adding about $5 billion to Gross State Product (GSP) and about 50,000 more jobs by 2030.[12] Furthermore, a recent study of the State of Oregon's electric vehicle industry estimated that the industry has created more than 1,500 jobs in the state and sparked $266.5 million in economic activity.[13] Importantly, the study also found that the PEV industry continued to grow during the Great Recession, at a time when other transportation industries declined significantly.

However, despite the enthusiasm generated by such studies and public proclamations by industry leaders and government funders, the PEV market remains uncertain and industry results have been decidedly mixed in terms of sales, profits, business success, and job creation. For instance, Tesla Motors reported profits for the first and second quarters of 2013, due in large part to the sales of its Model S and the sale of ZEV credits to other automobile manufacturers. Nissan has rejuvenated sales of the LEAF through aggressive price cutting in 2013, which yielded the two highest monthly sales totals to date for the car in March and April. On the other hand, Coda ceased operations in the Bay Area in February 2013, which portended their ultimate filing for Chapter 11 bankruptcy in early May 2013. Similarly, Fisker Automotive filed for bankruptcy in November 2013 after stopping production and laying off most of its staff over the previous year.

In other parts of the PEV market, the news is similarly a mix of successes and failures: California-based Quallion, a lithium ion battery manufacturer opened a manufacturing facility in April 2013. Meanwhile, A123 Systems, which received a $249 million grant from the Department of Energy in 2009, filed for bankruptcy in 2011. Also, there are signs of increasing financial duress and consolidation in a crowded EVSE provider market: CarCharging Group acquired 350 Green in mid-2012. ECOtality—one of the industry's largest providers—recently went bankrupt and their assets were acquired by CarCharging Group.

These stories of success and failure are common in a developing industry. They help communicate a key lesson: Government efforts to pursue PEV-related economic development should be part of a diversified, multi-sector economic development strategy that takes account of both market realities and local competitive advantages and disadvantages.

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

12 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.

13 Oregon's *Electric Vehicle Industry*, Northwest Economic Research Center (NERC), January 2013.

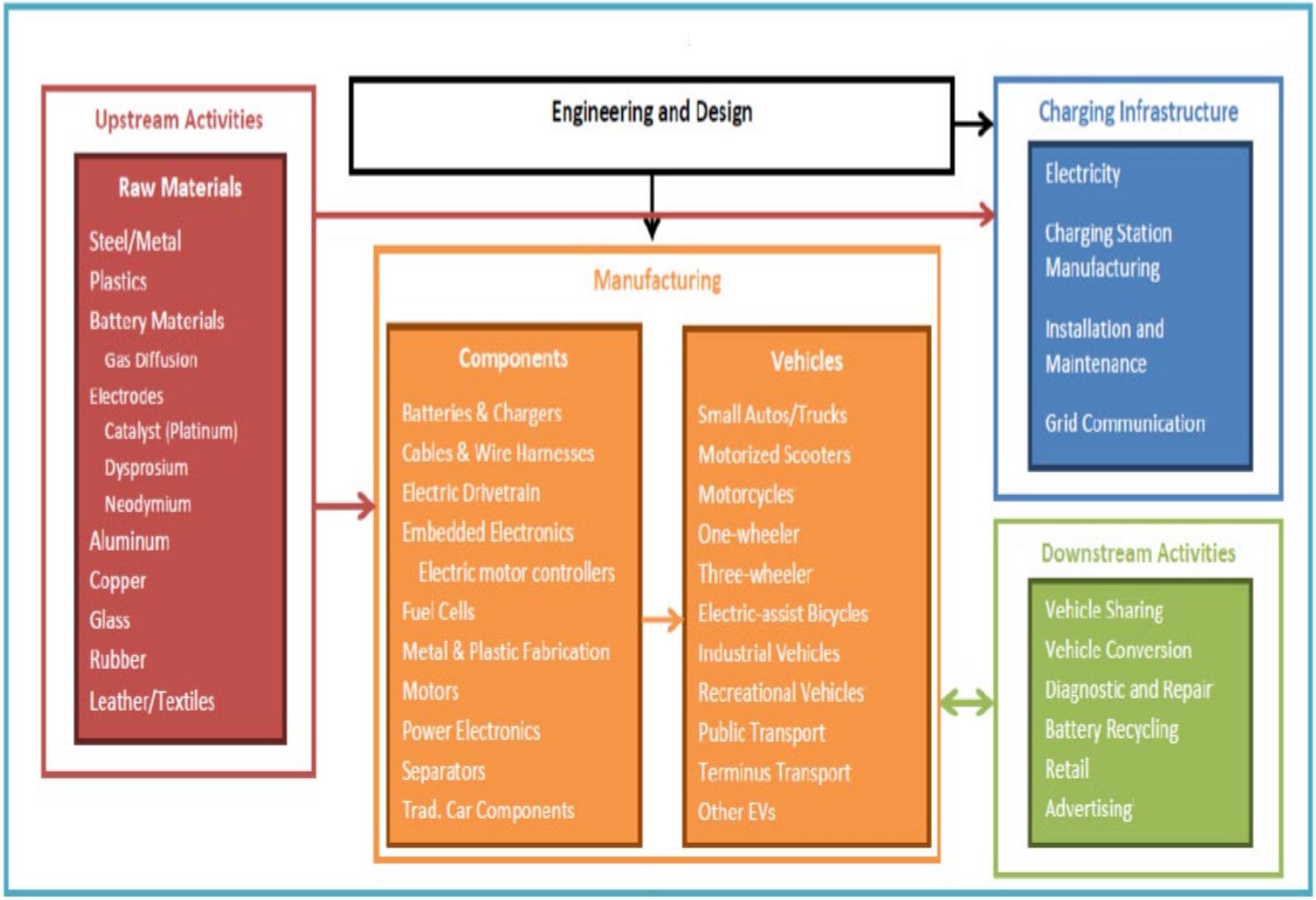
This section examines a range of approaches being used by state and local governments to support PEV-related economic development and draws lessons for future efforts in the Coachella Valley. The following sections include:

- A description of the main elements of the PEV industry cluster;
- A general overview of approaches employed by local and regional governments to spur economic development including business attraction, business retention, and new business creation and incubation;
- A review of efforts of two states – Michigan and Tennessee – to develop large-scale PEV manufacturing;
- A description of local government efforts to retain and grown local PEV businesses, including in the Coachella Valley;
- A discussion of the implications of this research and provides guidance for local governments on actions they might consider for supporting PEV-related economic development.

The PEV Industry Cluster

The PEV industry cluster comprises a range of economic activities including engineering and design; manufacturing of components, PEVs, and EVSE; installation and maintenance of EVSE; and a number of downstream activities such as vehicle conversions and battery recycling. Figure 11 graphically represents the PEV industry cluster, showing an illustrative list of products and services across each of these categories.

Figure 10: PEV Industry Cluster



Source: Adapted from NERC 2013

At the center of the diagram are the main manufacturing-related activities of the PEV industry cluster, including both manufacturers of parts/components for PEVs and vehicle manufacturers, with upstream activities shown on the left side of the diagram and downstream activities on the right. Below is a description of each of the main elements of the PEV cluster, along with a brief discussion of existing firms and opportunities for the Coachella Valley.

- Engineering and Design: A critical phase of the PEV supply chain is the engineering and design activities that lead to PEV product development and design. Product design affects not only demand generation (by differentiating the product against competitors in the marketplace) but also all subsequent phases of the supply chain including material selection manufacturing processes, transport, infrastructure requirements, and retail factors (e.g., price and lead time). The Coachella Valley has some potential in this area.
- Vehicle Manufacturing: Vehicle manufacturers assemble and produce finished PEVs, including light-duty vehicles, medium/heavy-duty vehicles, and a range of other PEVs such as scooters, motorcycles, and recreational vehicles. After the recent closure of Coda's Benicia-based plant, Tesla is the most significant vehicle manufacturer that has a manufacturing facility in California. The majority of U.S. PEV manufacturing occurs outside of California, in states such as Michigan and Tennessee (see State-Level Strategies section) that have lower costs associated with labor, land, and taxation. This segment of the Plan makes a case that the Coachella Valley is not in a position to attract new vehicle manufacturing facilities.
- Component/Part Manufacturing: These firms supply vehicle drivetrains, electric motor controllers, energy storage options, wire harnesses, and other components to the PEV vehicle manufacturers, both within California and outside of the state. Manufacturers of components and other parts for vehicle manufacturing tend to be located in close proximity to vehicle manufacturing facilities. Tesla has taken a slightly different approach and has made a push towards vertical integration that revolves around them producing or directly controlling the production of as many of its vehicles' components as possible. The component/part manufacturing subcluster has some potential for the Coachella Valley. Furthermore, it is consistent with one of the primary targets of the Economic Blueprint for the Coachella Valley: high tech manufacturing.
- Charging Infrastructure: The charging infrastructure portion of the supply chain includes a wide array of manufacturers/vendors of EVSE and the software used to control it. There are many California-based EVSE providers—including ChargePoint and Clipper Creek. Given the likely consolidation of this industry, ICF urges some caution associated with targeting this subcluster. However, the Coachella Valley has been successful with regard to expanding the presence of several companies that install and manage photovoltaic solar power, including Hot Purple Energy and Renova Energy. The success of these types of solar companies could portend positive developments in the Valley with regard to EVSE providers; however, these developments are likely in the medium- to long-term given the projected adoption of PEVs in the Valley.
- **Downstream Activities:** There are a number of downstream activities in the PEV supply chain such as PEV retail sales, PEV maintenance and repair, battery recycling, and vehicle sharing. Most of these will develop as PEV sales increase, and do not warrant targeted strategies to attract these businesses. Rather, they will become

increasingly necessary to capture the full value of PEVs in the marketplace. The College of the Desert has a specialized Advanced Transportation Technologies degree program that will provide a strong resource base of skilled technicians that will be needed as PEVs and EVSE are increasingly deployed in the Valley.

The Valley's PEV-related economic development activities should reflect the likely adoption of PEVs in the region: steady support for the handful of local firms active or developing in the PEV cluster space and identification of new opportunities as PEV-related services are required.

The next section provides an overview of approaches employed by local governments to spur economic development. Subsequent sections provide examples of specific actions that have been taken by state and local governments to promote PEV-related economic development and draw lessons for future actions that might be taken by actors in the Valley.

Economic Development Strategies

Because the Coachella Valley does not have a significant number of companies with a presence in the PEV cluster, local actors must consider a range of approaches they might take to nurture and support local PEV businesses so that the region can capture more economic development opportunities related to PEVs. There is an array of strategies and tools that local and regional governments can employ to attract PEV related enterprise.

Although there is significant interest in attracting new jobs and economic development, for the purposes of this Plan, the economic development strategies that are considered have been expanded to capture a more representative spectrum of options available to local and regional governments. These are characterized in the subsections below.

Business Attraction, Retention, and Formation

Business Attraction

Attracting businesses to relocate in the Coachella Valley through a combination of marketing campaigns and financial incentive packages.

Business attraction is costly and challenging and is rarely successful without financial support at the state level. Even with incentives, business location decisions may be out of the control of regional or state decision makers; research shows that transportation/logistics considerations, labor quality, and markets are the most important factors in these decisions.

Business Retention and Expansion

Working to retain and support existing businesses within the Valley by strengthening critical economic inputs, maintaining a business-friendly environment, and sometimes offering financial incentives.

This strategy aligns with Objective 5 of the Economic Blueprint for the Coachella Valley: Ensure existing Valley businesses are retained and expanded. A business retention strategy makes sense for a variety of reasons. Business retention has been shown to be better at creating jobs than business attraction.[14] A community's existing firms are important assets to its economy; they are the current employers and taxpayers. Business retention also requires less speculation than firm attraction since targeted firms are already located in the community

14 Raymond C. Lenzi, "Business Retention and Expansion Programs: A Panoramic View," Economic Development Review 9 (1991): 7–12.

and have already developed supplier relationships and personal loyalties. Firms often find that staying and expanding is easier than relocating.[15]

Two approaches can be taken when pursuing a business retention and expansion strategy.

- Jurisdictions can offer local firms a range of financial incentives to stay. These may include tax incentives, loans and loan guarantees.
- Stakeholders can take a comprehensive approach with overall goals to create a healthy business climate and strengthen the economic inputs that are identified by local firms as critical to their success and competitiveness. Steps to implement this collaborative process:
    - Analyze the local economy and identify target industries
    - Collaborate with local businesses to identify priority needs
    - Develop initiatives (e.g., R&D and Workforce Development) to meet critical business needs

Business Formation and Incubation

Promoting entrepreneurship and new company formation through provision of key economic inputs, assistance to small businesses, and support for business accelerators and incubators.

Small business assistance programs provide management training, consulting, and research services for small firms. Alternatively, high schools and community colleges can establish business programs to provide entrepreneurship training.[16]

Local governments often support creating business incubators and accelerators programs to aid the success of entrepreneurial companies during their early stages of development. Examples of support for startup firms include:

- Low-cost office space
- Business support resources and services including
- Mentoring and business advice
- Legal and accounting advisement
- Marketing coaching
- Linkages to existing business and investors
- Fostering synergy through the communication and proximity of other incubator startups

Summary of Economic Development Strategies

Of the three economic development strategies outlined above, business attraction is the most costly and challenging, and it is rarely pursued successfully by local governments without financial support at the state level. Business retention and formation strategies have many similarities—in that they both focus on supporting locally grown firms and on strengthening

15 Incentives for Business Attraction and Retention, International City/County Management Association (ICMA) website, available at www.icma.org

16 Tools of the Trade, American Planning Association, available at http://www.planning.org/eda/toolkit/

the economic inputs needed most by these firms—and are often most effectively pursued at the local level.

In pursuing one or more of these strategies, local, regional, and state actors have a range of tools at their disposal, including: offering financial incentives (e.g., tax breaks, loans, grants); launching marketing campaigns; creating favorable policies, regulations, and business climate; and working to strengthen key economic inputs such as infrastructure and the local workforce. Each of these strategies, and the tools employed to support them, are detailed in the Background and Analysis document.

State-Level Strategies

As discussed in the previous sections, many business development efforts can be better leveraged at the state level; however, there are still many challenges for states in developing effective strategies. Several states have made large-scale pushes to attract and develop in-state manufacturing of PEVs. Investments made by Michigan and Tennessee to create PEV-related jobs in the manufacturing sector provide insightful case studies on state-level efforts.

Michigan: Restructuring an Industry

The automotive industry suffered the impacts of the Great Recession acutely; and Michigan was the epicenter of the impacts felt across the vehicle supply chain. To respond to the financial crisis, Michigan laid out an aggressive plan to attract new industries that would help it recover from the losses suffered in the automobile manufacturing space, 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. Furthermore, Michigan dedicated approximately $1 billion in tax credits to companies that manufacture batteries, electronic components for PEVs, and vehicles. Most notably, Michigan struck $100+ million deals with no fewer than six companies.

Although Michigan was successful in its near-term efforts to secure stimulus funding from the DOE, the long-term implications of its investments are more complicated. The investment in battery manufacturing industry is facing consolidation pressures due to over-supply. For instance, the global capacity of lithium-ion battery manufacturing for 2013 was estimated to be nearly 4,000 MW of batteries; however, the demand for batteries is an order of magnitude less at roughly 400 MW of batteries. This oversupply has already led to the bankruptcy of high profile A123, and the other three major battery factories in Michigan are employing a quarter to half of the workers originally planned.

Michigan's mixed experience should caution actors within the Coachella Valley against focusing economic development efforts too narrowly. With such a strong focus on batteries, PEV components, and PEV manufacturing, the payoff of Michigan's investments will be strongly tied to the adoption of PEVs in the marketplace.

Tennessee: Working with Nissan to Develop In-State Manufacturing

Tennessee received attention for its success in developing in-state manufacturing of PEVs at Nissan's production facility in Smyrna, TN. This success in creating PEV-related jobs was not achieved quickly or inexpensively, nor was it part of an explicit strategy to attract PEV manufacturing. Rather, it was the result of a strong 30-year relationship with Nissan, the investment of $200 million in state and local incentives to attract traditional (non-PEV) automotive jobs to the state, and the support of a $1.6 billion federal loan.

The efforts by Tennessee provide at least three important lessons:

- First, the development in PEV manufacturing at the Smyrna plant was not a result of targeted strategy, but rather, the evolution of a longstanding relationship with Nissan in which the state made a series of targeted investments in attracting both traditional manufacturing jobs and higher paying headquarters jobs. The combination of these long-term strategies put Tennessee in a strong position to help Nissan secure federal funding during the recession, based on existing relationships and existing capacity.
- Second, Tennessee's strategy took advantage of basic competitive advantages: namely, lower labor costs (most notably, Tennessee is a right-to-work state in which unions have less impact on labor practices) and lower costs of land.
- Third, attraction packages are expensive. Tennessee prioritized attracting jobs by investing significant financial and organizational resources over the course of decades. Despite the complementary efforts of local governments, the major incentives were provided through coordination at the state and federal level.

Implications of State-Level Case Studies

With the recognition that this Plan highlights the experiences of only two states regarding economic development strategies pertaining to PEVs, there are some key takeaways, including:

- **The private sector is seeking significant incentive packages.** States are offering large incentive packages to attract and retain manufacturing facilities at a scale that cannot be matched by local governments. If the State of California is serious about attracting such facilities, it will likely have to be driven at the state level. These types of packages do expose governments to potential criticisms regarding the spending of taxpayer money, particularly on a dollars spent per job created basis. However, the reality of today's markets indicates that the private sector is seeking large incentive packages when siting manufacturing facilities or moving jobs.
- **Build on existing infrastructure.** In both the Michigan and Tennessee cases, the success of incentive packages was built upon existing infrastructure. In this context, the term infrastructure is used broadly to include the relationships, existing physical capacity, and existing workforce skills needed to maximize the likelihood of success. In other words, the long-term success of a region's economic development strategy is far more likely when it is based on a realistic assessment of the strengths and weaknesses of the region's critical economic inputs and infrastructure.
- **Coordination at the state level is imperative.** The Michigan and Tennessee cases demonstrate that state-level policies and commitments are imperative to the success of local and regional government efforts. Local governments have limited resources—in terms of dollars and personnel—however, they can play important complementary roles when needed. In such cases where the goal is to attract and retain large-scale manufacturing, local and regional governments are often better suited to supporting broader state-level efforts.

Local Government Strategies in the Coachella Valley

As noted above, local governments are often limited in their ability to attract new industries without support at the state or federal level. However, several local governments have been successful using targeted strategies to attract and retain important companies. This section

highlights the efforts of local governments in the Valley to support the growth of firms and jobs along the PEV supply chain and draws lessons for other regional actors.

Coachella Valley iHub

The Valley's iHub is a joint project of Palm Springs, Cathedral City, and Desert Hot Springs. Through the support of its sponsors, iHub provides free office space at the incubator, business planning assistance, and potential investor networking. The iHub focuses on cultivating businesses that fall under the description of sustainable industries such as clean technology and renewable energy. To date, the iHub has nine businesses that are seeking incubation support.

Coachella Valley Enterprise Zone (CVEZ) and Assembly Bill 93

Established in 1992 and re-designated most recently in April 2008, the CVEZ is a 56 square mile region in the Valley. Companies that are located with the zone are eligible for an array of incentives. California's Enterprise Zones will be experiencing significant changes starting in 2014 as a result of the recently passed Assembly Bill 93. Some of the reforms for hiring include:

- A requirement that businesses demonstrate that new positions are created at the firm to earn the tax credit
- The new jobs must include wages that are at least 1.5 times higher than California's minimum wage
- Tax credits are limited to the hiring of ex-offenders, unemployed, veterans, and people receiving income assistance
- New transparency requirements

Although Assembly Bill 93 represents a major overhaul, some of the changes provide an opportunity for areas like the Coachella Valley:

- A credit against state sales and use tax for biotech and manufacturing companies for the purchase of equipment
- A competitive discretionary fund that would provide tax credits worth up to $200 million per year for major job-creation-focused projects approved by the California Competes Tax Credit Committee

Implications of Local-Level Cases

Based on the analysis of local-level use case scenarios, the following factors have been identified as being key drivers to attract businesses and manufacturing:

- **Political leadership:** Define a vision, provide consistent leadership, set ambitious yet feasible targets, and challenges the private sector to help meet them.
- **Cluster Analysis:** Study what types of firms are in the local cluster, determine their position within the broader PEV supply chain, and assess critical needs of these businesses that can be most effectively supported by local government actions.
- **Targeted Use of Incentives:** Consider a range of financial incentives for targeted sectors/firms – including hiring tax credits, sales and use tax credits, and net interest deductions – and use them strategically to leverage additional sources of financing.

- **Leverage Demonstration Projects:** This is akin to "walking the talk." In other words, the private sector is often seeking communities that reflect the value of their products and services.
- **Convening:** Convene key actors from across the PEV cluster and facilitate communication and collaboration between them.

Recommendations for Local/Regional Governments

This section discusses the implications of the discussions from the previous sections and provides recommendations to local and regional governments on the actions they can consider for supporting PEV-related economic development. As discussed previously, there are limited opportunities for local governments to attract new businesses; rather, these efforts will require state-level coordination to create significant incentives.

Focus on Retention More Than Attraction

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.[17] When prioritizing economic development programs for funding, local and regional governments should place business retention efforts ahead of business attraction. If incentives are used at all, they should be made available to existing firms as well as to new prospects.[18]

Analysis Informs Strategy

The Coachella Valley has already engaged in a critical step, namely the analysis of its competitive position and local opportunities. The Economic Blueprint for the Coachella Valley recognizes the varying level of resources that the region has at its disposal for economic development. However, a modest investment may be necessary to understand if and how plug-in electric vehicles and associated support services—including manufacturing and/or engineering design services, technology demonstration, and downstream services—can be incorporated into an update of the Valley's Blueprint.

This Plan highlights the following recommendations pertaining specifically to PEV-related services.

- Focus on Supply Chain Position and Opportunities: The Coachella Valley may have some opportunities to focus on the following portions of the PEV supply chain: component manufacturing, downstream activities (i.e., EVSE or PEV related maintenance and servicing), and vehicle demonstration.
- Challenges of Manufacturing: Given high local costs and aggressive incentive programs in other states with existing manufacturing capabilities, attracting additional large-scale manufacturing plants will be difficult for the Valley (and the State of California, as a whole). However, as part of a larger regional effort (e.g., collaborating with the greater Southern California region), there is more potential that the Valley could draw manufacturing for the PEV industry.

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17 Ibid.

18 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.

- Testing and Demonstration: The Advanced Transportation Technologies program at the College of the Desert affords the Valley an opportunity to expand the role of electric vehicle testing and demonstration in the region. ICF recommends that the Coachella Valley seek to identify demonstration opportunities. Funding organizations and project partners may include the South Coast Air Quality Management District (SCAQMD) and Sunline Transit Agency.
- Collaborate: Reach out to and collaborate with local firms, both on developing EV-related policies and broader economic development strategies. When necessary, local governments should seek collaboration with other local governments to pursue mutually beneficial regional strategies.
- Convene: Bring companies together and help them engage with each other. The CV iHub is a good example of the type of setting whereby entrepreneurial companies can gain valuable support from other startups experiencing similar challenges and successes early in their development.
- Establish Leadership and Goal setting: Define a vision, provide consistent leadership, set ambitious yet feasible goals, and challenge the private sector to help meet them.
- Leverage Financial Incentives: Take active inventory of the incentives that are available at the local, state, and federal level, and communicate these with local firms. Furthermore, for regions with sufficient resources, even modest incentives such as a business license tax exemption can be a critical part of an economic development strategy. This is particularly true of local government's role in incubating firms.

Integrating PEVs into Regional Plans

Introduction to Sustainable Community Strategies

The Sustainable Communities and Climate Protection Act of 2008 (Senate Bill 375, Steinberg, Statues of 2008) requires California's metropolitan planning organizations (MPOs) to prepare a sustainable communities strategy as part of its Regional Transportation Plan to demonstrate how each region will meet its regional greenhouse gas (GHG) reduction target established by the California Air Resources Board. Subregions in the SCAG region, such as the Coachella Valley, have the option to create their own SCS through a delegation process. However, Coachella Valley did not choose this pathway and is therefore included in the SCS developed by SCAG. SCAG established GHG reduction targets of 9 percent per capita reduction by 2020 and a 16 percent per capita reduction by 2035 relative to a baseline year of 2005. SCAG's RTP/SCS lays out a strategy to achieve GHG reductions by reducing vehicle miles traveled (VMT) via a combination of housing/land-use planning and transportation investments, as highlighted in Table 14.

Table 14: Major Initiatives included in SCAG's Regional Transportation Plan

Component	Description / Elements	Investment
Transit	Bus Rapid Transit, Light Rail Transit, Heavy Rail Transit, and Buses	$55.0 billion
Passenger and High-Speed Rail	Commuter Rail and High-Speed Rail	$51.8 billion
Active Transportation	Increase bikeways, bring significant number of sidewalks into compliance with the Americans with Disabilities Act, safety improvements, and other strategies	$6.7 billion
Transportation Demand Management (TDM)	Reduce solo driving through carpooling, vanpooling, mode shifts (transit, bicycling, walking), peak trip shifts, telecommuting	$4.5 billion
Transportation Systems Management (TSM)	Enhanced incident management, advanced ramp metering, traffic signal synchronization, advanced traveler information, improved data collection, universal transit fare cards, and Transit Automatic Vehicle Location (AVL) to increase traffic flow and reduce congestion	$7.6 billion
Highways	Mixed flow, High Occupancy Vehicles and High Occupancy Toll lanes, Toll facilities	$64.2 billion
Arterials	Spot widenings, signal prioritization, driveway consolidations and relocations, grade separations at high-volume intersections, new bicycle lanes, and other design features	$22.1 billion
Goods Movement	Port access improvements, freight rail enhancements, grade separations, truck mobility improvements, intermodal facilities, and emission-reduction strategies	$48.4 billion
Operations & Maintenance	Transit, Highways, and Arterials: Preserve multi-modal system in a good state of repair	$216.9 billion

Source: Modified from Executive Summary of the 2012-2035 Regional Transportation Plan, available online at: http://rtpscs.scag.ca.gov/Documents/2012/final/2012fRTP_ExecSummary.pdf

As it stands today, the SCAG RTP/SCS does not include any explicit strategies related to PEVs or other vehicle technologies. To date, the MTC is the only MPO that has included PEVs in their SCS. Some of the information presented in the sections below is based on work that ICF completed for MTC in support of developing the PEV strategies that were included in *Plan Bay Area*, the region's SCS.

Review of Options

Broadly speaking, there are two ways to integrate PEV readiness into SCS planning: 1) Identify strategies to accelerate PEV adoption or 2) Increase charging opportunities to increase electric VMT. These options are discussed in the subsections below.

SB 375 is vague regarding guidance for the strategies that MPOs and other planning organizations can incorporate into their sustainable community strategies. In the case of *Plan*

Bay Area, MTC opted to approach the integration of PEV strategies conservatively. More specifically, the GHG reduction estimates that MTC reports for three vehicle-related strategies were only estimated for incremental reductions. This approach manifests itself in a variety of ways. For instance:

- In the case of a vehicle buyback program, the benefits estimated were based on the difference in emissions from a PEV and a new conventional internal combustion engine vehicle as opposed to the difference in the emissions from a PEV and the older retired vehicle. Furthermore, it was assumed that these vehicles were in addition to the number of vehicles that would otherwise be deployed to comply with California's ZEV Program.
- For a regional network of EVSE, the only GHG benefits estimated were for an increase in electric VMT for PHEVs. In other words, although it is likely that BEVs would charge using the EVSE deployed by the proposed program, we did not assume that EVSE available at workplaces, for instance, would be sufficient to increase the VMT for BEVs. Furthermore, it was not assumed that the availability of EVSE at workplaces would accelerate PEV deployment above and beyond a baseline level of adoption.

Because the focus of the SCS is on reducing VMT through more traditional integrated land use, housing, and transportation planning approaches, there may be some hesitation about incorporating an advanced vehicle technology strategy.

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 state rebate helps to reduce the purchase price of vehicles significantly; however, the long-term availability of these programs is unclear. 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 estimated to phase out for the major automobile manufacturers starting 2018. In addition, the California Clean Vehicle Rebate Project, which is funded via Assembly Bill 118, is also set to expire–at the end of 2015. Although there are efforts in place to extend the incentive programs developed by Assembly Bill 118 (e.g., Assembly Bill 8 and Senate Bill 11), continuation of these programs is also dependent on Legislature approval. Thus, the availability of future funding from this program is not certain.

Therefore, by 2020, the Coachella Valley can expect limited purchasing incentives available for PEVs. 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.

The following are potential programs related to accelerated PEV adoption that could be incorporated into the SCS for the SCAG region which would help the Coachella Valley achieve its PEV deployment goals:

- **Vehicle Buyback Program:** This program would provide an incentive for trading in an older vehicle that meets a certain fuel economy threshold (as measured in miles per gallon). The level of the incentive would be tied to the efficiency of the vehicle: The lower the fuel economy rates, the higher the incentive. This program is attractive because of 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.

- **Vehicle Purchase Incentive:** The difference between this program and the former is that there is no trade-in requirement. It is conceivable that a region, through its SCS opts to provide incentives for the purchase of PEVs. The program could be very expensive and over-subscribed quickly (hence the trade-in requirement in the previous program described); however, it is conceivable that it be incorporated into the SCS. In the case of the Coachella Valley, a specific program designed for NEV purchases might be applicable—and may be attractive given that the incentive is likely lower, and that the number of residents interested is a smaller sample size.
- **Feebate Program:** A feebate program provides a rebate to the purchase of a vehicle that emits less on a grams per mile basis than a standard and applies a fee to any vehicle that emits more than the standard. In the case of PEVs, the rebate would be fixed. Feebate programs have been developed in the California State Legislature but have never been approved. At this time, it is unclear if regions like the SCAG Region or Coachella Valley have the authority to implement a feebate program; however, it is a policy option that is worth considering as part of the SCS. Feebate programs are often attractive because they are revenue neutral, but to require some budget outlays for administration.

Increasing Charging Opportunities to Increase Electric VMT

The limited range of BEVs (50-100 miles) is often 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.

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 charge their vehicles at home; but for those who have limited access to home charging, the best opportunity to increase charging opportunities to would be at workplaces and destinations (e.g., retail shopping centers). The following strategies offer options to expand charging capacity at various levels.

- **Regional EVSE Network:** The objective of this type of program is to establish a regional public network of EVSE for PHEVs and BEVs. Based on research conducted by ICF, 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 the workplace. This type of program is designed to help overcome some of these barriers by providing financial assistance to interested employers, retailers, parking management companies, and others that qualify. Generally, this program is intended to deploy Level 1 and Level 2 EVSE at places where vehicles are parked for a suitable amount of time (e.g., at least three hours). If PEV drivers are charging at Level 1 or Level 2 for shorter periods of time, then it will limit the potential for extending the range of vehicles given the limitations of the chargers on-board most vehicles.
- **Regional DC Fast Charging Network:** The objective of this program is similar to the one described previously; however, it focuses on supporting BEVs (note: there are no PHEVs on the market today that is equipped with fast charging capabilities). There is

already significant investment planned for DC fast charging EVSE in Southern California, and careful planning will be required to ensure that existing assets are sufficiently utilized to warrant expanding the network further.

- **Multi-Family Residential EVSE Incentives:** The challenge of installing EVSE at multi-family dwelling units will be a barrier to widespread adoption of EVSE. Although groups such as the PEV Collaborative are developing guidance and case studies to help deploy EVSE at multi-family units, there will still be issues on the ground that must be addressed. The SCS is an interesting opportunity to incorporate a multi-family EVSE incentive program because it can be tied into land use planning and housing. In Coachella Valley, the cities have a broad range of residents that live in single- vs. multi-family units. For instance, 33 percent and 28 percent of residents in Palm Springs and Desert Hot Springs, respectively, live in multi-family units; however, only 10 percent of residents in La Quinta live in multi-family units. It is important to note, however, that one of the stated objectives of SCAG's RTP/SCS is to promote mixed-use development. Given that the Coachella Valley is one of the fastest growing areas in Southern California, the issue of multi-family dwelling EVSE may become increasingly important in the medium- to long-term future.
- **Single-Family Residential EVSE Incentives:** Small incentives for single-family residential installations could also accelerate the deployment of PEVs. As the price differential between PEVs and conventional vehicles decreases over time, the additional cost of installing residential EVSE may become a more significant concern. Many consumers do not require residential EVSE today; they can simply use existing 110V service for their PEV charging needs. However, in the future – as vehicle-to-grid technologies evolve for instance, – more consumers may seek to plug into EVSE as part of an overall strategy to manage residential energy consumption. If this is the case, residential EVSE incentives may be appropriate as part of a SCS.

Regional Actions

Stakeholder Training and Education

There is significant opportunity for the Coachella Valley to transition to PEVs. As part of that process, regional bodies like CVAG should seek to conduct marketing, outreach, training, and education relating to vehicles, charging services, and infrastructure. CVAG can partner with regional stakeholders such as SCAG, Clean Cities of the Coachella Valley Region, and SCAQMD to ensure that sufficient training and education is taking place in the region.

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 15 highlights the organizations that are working to provide training opportunities in the Coachella Valley.

Table 15: Organizations engaged in stakeholder training and education in the Coachella Valley

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	At the national level, Clean Cities has developed a 30-minute online presentation for electrical contractors and inspectors regarding EVSE residential charging installation.
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.
California Plug-in Electric Vehicle Collaborative	The PEV Collaborative is working to launch a PEV Resource Center that will provide answers to key issues.
Advanced Transportation Technology & Energy Initiative	The Advanced Transportation Technology 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.

Source: CVAG

As more local and regional agencies seek to educate themselves about the PEV ecosystem, a coordinated effort by the organizations listed above to target training to staff in regions that are likely to experience substantial growth in PEV deployment will help spread best practices among government agencies.

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 recommendations presented as part of this document. This leadership needs to come in the form of policy actions and directives that attempt to standardize and unify, as much as possible, elements such as building codes, parking and zoning ordinances and permitting and inspection across local jurisdictions.

Provide Resources to Local Governments for EVSE Deployment

CVAG should coordinate with SCAG and SCAQMD to ensure that resources are 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.

Coordinate with SCAG to Incorporate Coachella Valley into SCS

This Plan highlights several ways that PEVs can be incorporated into a Sustainable Community Strategy. However, CVAG is a sub-region to SCAG, who develops the region's SCS. Although CVAG has opted not to pursue the development of its own SCS, it will be important to ensure that the region's interests – including those in PEVs – are represented in future updates to the SCS for the Southern California region.

Create Updated Design Guidelines for EVSE in Public Locations, Commercial Properties, and MDUs Based on a Survey of Existing PEV Charging Spaces

Several of the resources referred to 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 California do not conform to design guidelines as a result. This assortment 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 7, utilizing the methodologies that have been used in the development of this Plan (surveys, interviews, site visits etc.).

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 coordinate through the Tri-Chapter Uniform Code Committee, Clean Cities Coalitions, and other organizations to share and offer solutions to common PEV installation issues and make recommendations regarding local permitting practices based on past experience.

CHAPTER 4:
PEV Drivers – Consumers and Fleets

Although there are many benefits at the consumer, business, and societal levels associated with a broad deployment of electric vehicles, there remain many barriers that prevent widespread adoption of PEVs. For this reason, incentives can serve a role throughout the development of the market. The following sections describe the various barriers to adoption and the federal, state, and non-monetary incentives that may help the region overcome these hurdles.

Barriers to Adoption

Despite the ability of PEVs to meet state and federal fleet sustainability requirements, there are a variety of obstacles to acquiring PEVs, highlighted in the following subsections.

High Barriers

The following are the most significant hurdles impacting fleet and consumers' decision-making process. As to be expected, the most substantial barriers are tied to the financial investments that are required to deploy PEVs.

- **Vehicle Purchasing Costs.** Consumers' willingness to pay for new technology, as well as the extent to which they value their convenience will play a large role in PEV deployment. Consumer surveys indicate the manufacturer's suggested retail price (MSRP) of a PEV is of paramount importance, with nearly 70% claiming it is the most important factor in deciding their purchase.[19] Even with incentives, the initial cost of PEVs generally remain higher than HEVs and Internal Combustion Engine vehicles (see Table 1).
- **Infrastructure and Fueling Costs.** Infrastructure and fueling costs can also pose barriers to adoption. Depending on charging demands, the installation of Level 2 EVSE may be cost prohibitive for consumers or fleets.
    - Many consumers are opting for Level 1 charging, which is likely a reflection of the higher high costs of Level 2 EVSE residential installations. In the case of the fuel, most domestic rate structures are tiered and are not optimized for PEV charging.
    - ICF outreach to local government fleets indicates that many of the buildings where vehicles are currently located are at or near electrical capacity—as a result, additional panel upgrades and/or new transformers are required for EVSE installation. Although there are incentives available for EVSE installation, these incentives do not always cover the costs of electrical upgrades. For many fleet adopters, charging vehicles at night would not significantly increase peak electricity costs because the charging is occurring when other operations using electricity are closed or operating at reduced levels. However, for a firm like UPS, peak charging time for PEVs—from roughly 7 PM to 4 AM—coincides with peak operations at

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

warehouse and processing sites. As a result, new electricity infrastructure would be required, and capacity charges would likely increase.

Moderate Barriers

The following are other impediments that fleets and consumers may encounter when considering the purchase of a PEV. These are considered moderate barriers because they can be overcome with less money and effort than the more significant barriers identified previously. In some cases, the challenge can be overcome by investment, whereas in other cases a company or government policy change may be required. Regardless, the changes and potential financial investment required are not considered trivial, but with targeted efforts, these barriers can be overcome.

- **Limited PEV Models and Resale Value Uncertainty.** Over the last several years, about 63% of Californians' new light duty vehicle purchases have been automobiles, with the balance being light trucks. The PEVs available today are in similar vehicle classes as the top-ten sellers, with a focus on the subcompact segment (e.g., the Toyota Prius) and the standard midsize (e.g., Honda Accord). There are fewer offerings in the pickup truck and SUV categories, with the Toyota RAV4 EV the only offering outside of the light-duty automobile category. These types of limitations on PEV options, such as vehicle size and payload capacity, restrict potential purchasing opportunities. Consumers tend to purchase new vehicles that are similar to those that they are replacing and PEV equivalents are limited across many market segments. On the fleet side, companies such as UPS, have very specific needs and make specific component choices for their vehicles. This includes UPS's PEVs, which restrict batteries used by certain manufacturers due to safety concerns. Other related concerns may also include uncertainty about PEV resale value, which is an important consideration for many fleets.
- **EVSE Availability and Charge Time.** Though the limited operational range of PEVs could suffice for many fleets, some have less predictable day-to-day routes and may have concerns about vehicle range in a region without widespread EVSE availability. There may also be concerns about the lengthy charging time of some PEVs if fleet vehicles are operated on a more frequent basis. On the other hand, many vehicles in fleets may not require faster charging at Level 2 AC or DC fast charging; rather, fleet managers (and consumers, for that matter) may prefer a lower cost solution such as Level 1 charging. Level 1 charging is often the least expensive option for fleets with vehicles that are parked for long periods of time. **Accounting Practices**. The accounting practices of some fleets limit their ability to include fuel savings as part of their decision-making process for purchasing new vehicles, restricting amortizing the higher costs of PEVs through fuel savings. For example, the costs of vehicle acquisition could be included in one budget, whereas fuel costs are included in another operating budget. With these types of practices, fleet managers may make the fleet purchase decisions primarily based on initial vehicle costs, not long-term fuel costs. In cases where fuel cost, vehicle price, and maintenance cost are considered as part of a total cost of ownership platform, it was easier to develop a business case for the purchase of PEVs into a fleet.
- **Lack of charging availability of EVSE at multiple dwelling units (MDUs).** MDUs or multi-family units are a commonly identified gap in the EVSE market today. This is a small barrier in the context of fleets; however, it is more significant for individual

consumers. This area continues to be one of the most challenging because of the varying dynamics between vehicle owner, property owner, parking accessibility, electricity demand and load considerations at the facility, and long-term management of the EVSE. To address this barrier, the PEV Collaborative is working on a guidelines document that will provide information, resources, case studies, and tools to residents, homeowner associations, and property owner/managers on the installation of charging stations at MDUs.

- **Lack of EVSE at workplace.** Depending on commute distances, consumers may be wary of purchasing a PEV. If EVSE were more available at workplaces, it may encourage wider adoption of both PHEVs and BEVs. To address this barrier, CALSTART and the PEV Collaborative are working on a guidelines document that will provide 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.

Low Barriers

- **Interoperability of EVSE.** As increasing numbers of EVSE are deployed, generally via a myriad of providers, the interoperability of EVSE will be important for both fleets and consumers alike. It will be important for EVSE providers to ensure that there are multiple ways for fleets and consumers to access their EVSE networks without holding multiple memberships.
- **Americans with Disabilities Act Compliance.** Fleets interested in deploying PEVs may choose to make the associated EVSE publicly accessible. In this case, fleets will have to ensure that publicly available parking is compliant with Americans with Disabilities Act requirements. In some cases, this may increase the investment required significantly. Small incentives for single-family residential installations could also accelerate the deployment of PEVs. As the price differential between PEVs and conventional vehicles decreases over time, the additional cost of installing residential EVSE may become a more significant concern. Many consumers do not require residential EVSE today; they can simply use existing 110V service for their PEV charging needs. However, in the future – as vehicle-to-grid technologies evolve for instance, – more consumers may seek to plug into EVSE as part of an overall strategy to manage residential energy consumption. If this is the case, residential EVSE incentives may be appropriate as part of a SCS.[20]
- **Parking counts and EVSE.** As noted in Chapter 3, many jurisdictions have minimum parking requirements specifying the number of spaces that developers must provide for new construction in different land uses. This is a barrier because PEV parking does not always count towards this minimum requirement. To address this barrier, the Governor's Office of Planning and Research developed a statewide readiness guidebook, which contains best practices for PEV readiness, including parking counts.

Review of Incentives

Several incentives are available for PEV and EVSE purchasers, many of which help overcome the barriers outlined previously in Chapter 1. Table 16 summarizes the incentives that are currently available or are anticipated to become available over the coming decade. A list of current incentives is available at www.driveclean.ca.gov. The following sections describe the

20 PEV Access Guidlines is available at: http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf

ways in which individuals and fleet owners (typically businesses and public agencies) can leverage these incentives, as well as other resources, to accelerate PEV deployment.

Table 16: 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		$2,500–7,500, depending upon battery capacity
Clean Vehicle Rebate Program	State (ARB); administered by California Center for Sustainable Energy	Individuals, businesses	2021 (anticipated)	$1,500–2,500 for purchases of new, ARB-certified PEVs
Hybrid Truck and Bus Voucher Incentive Program (HVIP)	State (ARB); administered by CALSTART	Businesses, fleet owners	2021 (anticipated)	$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
Incentives for EVSE purchases				
Low Carbon Fuel Standard (LCFS) Credits	State (ARB)	Employers, fleet owners		LCFS credits for the electricity used to supply EVSE

Source: IRS Plug-In Electric Drive Vehicle Tax Credit, California Clean Vehicle Rebate Project, Hybrid Truck and Bus Voucher Incentive Program, CARB

Despite the success of incentives and programs to reduce the cost of ownership, it is unlikely that state and federal incentives will be available indefinitely. Stakeholders should consider other options to promote fleet deployment of PEVs. Some of these options may only be available to commercial fleets or government fleets, while some may also benefit personally owned vehicles. The following sections distinguish non-traditional incentive options that apply to one or more of the following: commercial fleets, government fleets, and personally owned vehicles. Each sub-section includes a brief discussion of the potential impact for fleets from each option and, where possible, examples of success stories where fleets were able to obtain savings, increase acquisitions, and reduce emissions.

Table 17: Incentives and Strategies to Accelerate PEV Deployment in Fleets

Program	Description	Example
Incentives for Commercial and Government Fleets, and Personally Owned Vehicles		
Utility Demand Response Programs: PEV Battery Purchase Programs	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. [21] 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	Automotive 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. [22] By gaining access to lower rates or loan options, more consumers may consider fuel-efficient vehicles, such as PEVs.

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

22 Ibid.

Table 17: Incentives and Strategies to Accelerate PEV Deployment in Fields (Continued)		
Program	**Description**	**Example**
Insurance Discounts	Some insurance companies offer discounts on hybrid vehicles and now a couple companies have announced plans to offer discounts for PEVs. Analysts reason that insurance companies are willing to provide discounts because owners of electric vehicles tend to be safer drivers.[23]	Hartford Financial Services offers an electric vehicle discount of five percent,[24] while Admiral Insurance in the UK offers a 10 percent discount for PEV models such as the Nissan Leaf and Mitsubishi i-MiEV.[25]
Restricting Insurance Surcharge	This would prohibit insurance companies from charging a surcharge on insurance for electric vehicles.	In 2011, Florida enacted a statute that restricts insurers from adding such a surcharge based on factors such as new technology and materials.[26]
High Occupancy Lane Access	Provides single occupant use of high occupancy Vehicle 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 from January 1, 2015 to January 1, 2019.
Free Parking	California's Vehicle Code does not prohibit local governments from adopting additional parking ordinances, including designating preferential or free parking for non-charging PEVs.	The cities of Santa Monica, Sacramento, Alameda, Berkeley, San Jose, and St. Helena provide PEVs with free parking. In many cases, there are conditions and restrictions for free parking; for example, San Jose requires that the vehicle be registered in the region or purchased from a dealership in the region.

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

24 The Hartford, "The Hartford Offers Electric Vehicle Discount," Available online at http://newsroom.thehartford.com/News-Releases/The-Hartford-Offers-Electric-Vehicle-Discount-4c9.aspx

25 Admiral, "New insurance discount offered for electric cars," Available online at http://www.admiral.com/press-releases/15052013/new-insurance-discount-offered-for-electric-cars

26 State of Florida, "Florida Statute 627.06535," Available online at http://www.flsenate.gov/Laws/Statutes/2011/627.06535.

Table 17: Incentives and Strategies to Accelerate PEV Deployment in Fields (Continued)		
Program	**Description**	**Example**
Employer Incentives	Private and public employers can provide a variety of incentives to help accelerate the deployment of PEVs. For instance, commercial and government fleets can 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 towards the lease of a PEV that qualifies for a High Occupancy Vehicle sticker. **Integrated Archive Systems in Palo Alto provides employees (who have been with the company for at least 12 months) $10,000 (gross) towards the purchase of a vehicle that qualifies for the green or white High Occupancy Vehicle sticker.** 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.[27]
Table 17: Incentives and Strategies to Accelerate PEV Deployment in Fields (Continued)		
Incentives for Commercial and Government Owned Fleets		
LCFS Credits	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.	It is unclear if any fleets are currently earning LCFS credits under this provision of the regulation; however, it is likely to increase significantly in the future as PEVs become more ubiquitous.
Marketing Incentives	Marketing opportunities may incentivize fleet investment in PEVs by providing fleets recognition. This recognition can	Contra Costa's Green Fleet program has focused more generally on using alternative fuels (e.g., compressed natural gas and

27 Bank of America Energy Benefits, available at http://makeanimpact.bankofamerica.com/EnergyBenefits.

	help commercial fleets meet corporate sustainability goals, while helping government fleets meet environmental performance goals.	biodiesel), more efficient vehicles (e.g., hybrid electric vehicles), and "greening" their maintenance facilities. This is part of the County's ongoing efforts to reduce GHG emissions and energy consumption.
Technical Assistance	Information-sharing can encourage investment in PEVs among fleets. In fact, a McKinsey study indicated that education may be an extremely effective incentive—potentially more so than financial incentives in the long-term.[28] Fleets often require 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.[29] 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.[30]

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

29 Evergreen Fleets, Available online at www.evergreenfleets.org

30 Energy Saving Trust, "Plugged-in Fleets Initiative 100," Available online at http://www.energysavingtrust.org.uk/Organisations/Transport/Products-and-services/Fleet-advice/Plugged-in-Fleets-Initiative-100

Table 17: Incentives and Strategies to Accelerate PEV Deployment in Fields (Continued)		
Program	**Description**	**Example**
Extended Financing Period	Extend 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 helped reduce the upfront burden of the PEV premium.[31]
Leverage Fleet Purchasing Power	If fleets can leverage their relationships with other organizations, they can coordinate a multi-fleet effort to purchase PEVs. The guaranteed sales could allow OEMs to increase PEV production resulting in economies of scale. Joint procurement combines the purchasing power of several public authorities in a single purchasing effort to achieve economies of scale; pools the knowledge and skills of the participating agencies; and reduces 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 Rightsizing	Fleets can work with OEMs to help influence vehicle and battery design, particularly for PEVs. Typically, this type of interaction between fleets and OEMs only occurs for larger fleet purchases (e.g., FedEx; see example to the right).	FedEx worked with OEMs to include smaller batteries in fleet vehicles which reduced the cost of the vehicles.[32] Acknowledging range anxiety, OEMs include large battery packs capable of ranges of 100 miles or more. FedEx negotiated a smaller battery pack for some of their trucks that only travel 15 to 20 miles per day. By "right-sizing" the batteries, FedEx was able to avoid unnecessary costs while also increasing space in their trucks.

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

32 Electrification Coalition, "FedEx: The Electric Drive Bellwether?," Available online at http://www.fleetanswers.com/sites/default/files/FedEx_case_study.pdf

Table 17: Incentives and Strategies to Accelerate PEV Deployment in Fields (Continued)		
Program	**Description**	**Example**
Incentives and Strategies for Government Fleets		
Government Lease Programs	Through government lease programs, the public entity can take advantage of the $7,500 federal tax credit to reduce the upfront cost of the vehicle. Another advantage is the benefit of spreading 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.[33]
Incentives and Strategies for Commercial Fleets		
Front of Line Privileges	This incentive allows taxicab drivers the opportunity to receive head-of-the-line privileges at airports and other popular transit hubs.	In the City of Dallas, dedicated Clean Natural Gas taxicabs authorized to operate at the Dallas Love Field airport receive "head of the line" privileges, which allow the eligible taxicabs to advance to the front of a taxicab holding or dispatch area ahead of all ineligible taxicabs.[34]

Source: CVAG

33 Center for Climate and Energy Solutions, "Deploy Fleet Vehicles," Available online at http://www.c2es.org/pev-action-tool/action-3-1

34 City of Dallas, "Ordinance No. 27831," Available online at http://www.greendallas.net/pdfs/TaxisOrdinance.pdf

Consumer Education and Outreach

There are many stakeholders in the region engaged in the deployment of PEVs and EVSE, including public and private actors. With a market that includes more than 350,000 light-duty vehicles, 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 general public.

As part of the preparation for this Plan, CVAG has worked with state and regional partners – including the Clean Cities Coachella Valley Region (C3VR), Southern California Edison (SCE), and the California Center for Sustainable Energy (CCSE) – to raise awareness about PEVs. Coachella Valley Community Survey

CVAG, in coordination with Arellano Associates and ICF, issued a public survey to Valley residents in February 2013. The survey sought to gauge public perception of and characterize the demand for PEVs in the Coachella Valley region. Over 250 local residents responded to the survey.

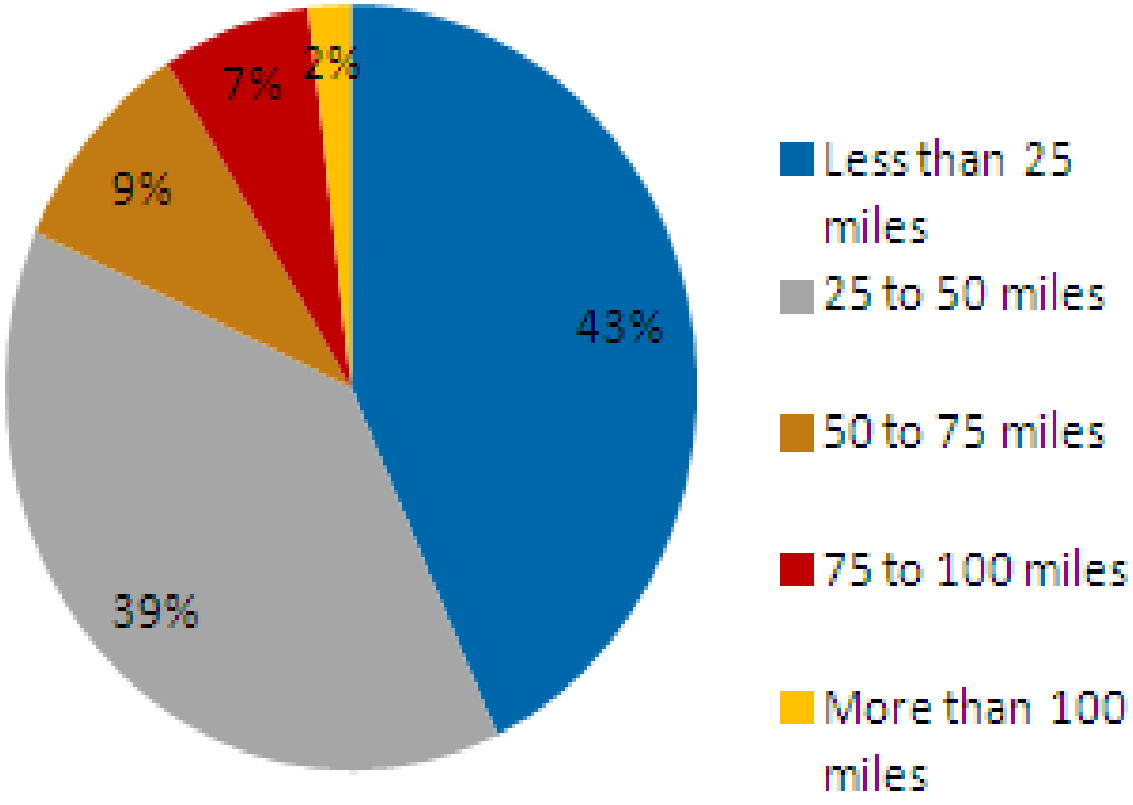
To gather an understanding of Coachella Valley residents' knowledge and opinions about PEVs, survey respondents were asked about their familiarity with PEVs and the existing PEV incentives, as well as their opinion about PEVs.

Overall, survey respondents were largely familiar with PEVs and had positive impressions of the vehicles. Eighty-one percent of respondents indicated they were either somewhat or very familiar, while only four percent of respondents said they were not at all familiar. Regarding perceptions of the vehicles, a majority of respondents (56%) had a good or excellent impression of plug-ins; however, 28 percent had a poor or very poor impression of PEVs.

Regarding incentives, survey respondents were reasonably aware of the Federal, State, and High-Occupancy Vehicle incentives offered to EV-owners in California. Far fewer respondents indicated awareness of utility, home, or parking incentives.

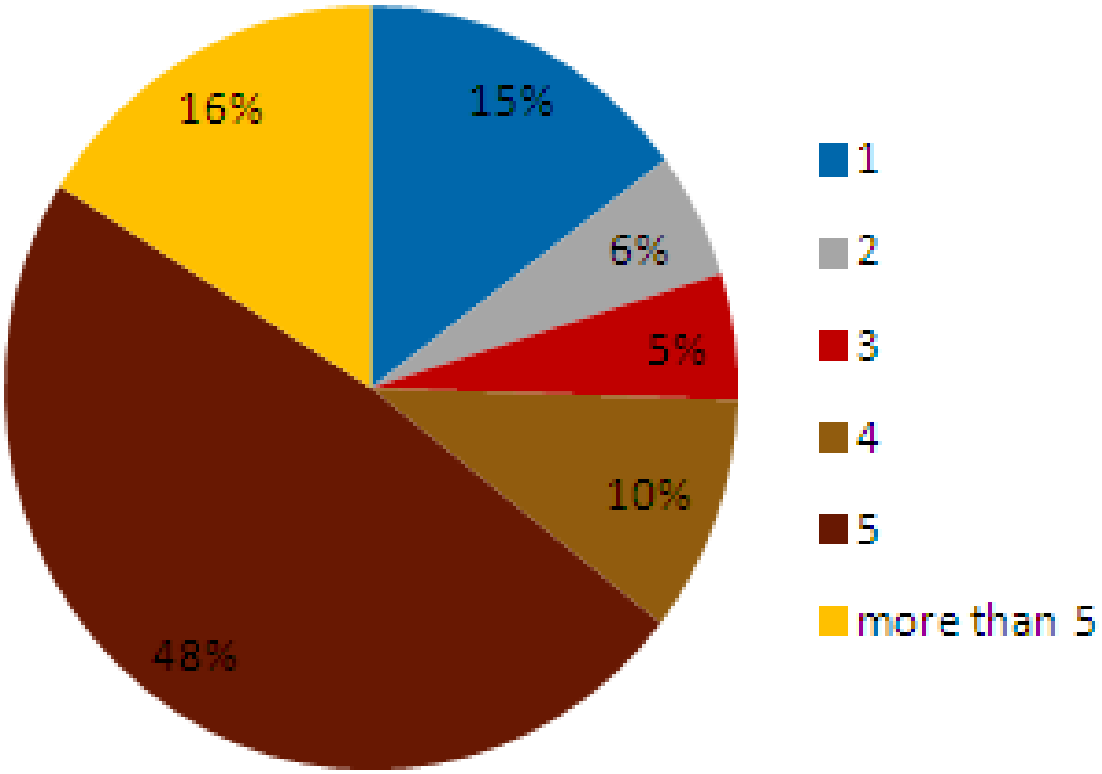
The PEV Community Survey asked respondents about their typical driving patterns in the Coachella Valley. Over three-quarters of the respondents indicated that they drive less than 50 miles per day on average, and over half drive to work or school five or more days per week, as shown in Figure 12 and Figure 13.

Figure 11: Average Daily Miles Driven



Source: ICF International

Figure 12: Days per Week Driven to Work or School



Source: ICF International

To help identify potential PEV infrastructure needs in the Coachella Valley, people taking the survey were asked questions describing characteristics of their homes (i.e., own or rent, single- or multi-family), automobile ownership (i.e., number and types of vehicles owned), and parking choices (i.e., parking locations). Most respondents are single-family homeowners who own at least two cars; this is perhaps not surprising given that 64 percent of survey respondents were PEV owners and other statewide surveys suggest similar home and vehicle ownership patterns. When respondents were asked whether having no charger available in their homes or building garages would be a barrier to purchasing an EV, 49 percent indicated that it would prevent them from buying one entirely.

Survey respondents were also given the opportunity to identify the factors that are most important to them when considering the purchase of an electric vehicle. Battery range was ranked as the top priority by the largest number of people. Total cost of ownership was the second most popular top priority, followed closely by PEV pricing.

Public Workshops

To maximize resources, CVAG has coordinated with other regional stakeholders to publicize the PEV Readiness Plan, including:

- **The Future is Electric: Plug In and Get There.** This workshop was presented in February 2013 and hosted by CCSE, the City of Palm Spring, SCE, and C3VR. The primary focus of this workshop was to review the purchasing incentives available via the Clean Vehicle Rebate Project, at-home charging electric vehicle charging rates from SCE, and an overview of the Readiness Plan.
- **Regional Planning for PEV and Charging Infrastructure Workshop.** This workshop was also presented in February 2013 and hosted by C3VR, CVAG, SCAQMD, CVAG, the California Plug-in Electric Vehicle Collaborative, and SCAG. The workshop focused on readiness elements covered in the Plan.

Next Steps

CVAG will use this Plan to continue working on education and outreach to both consumers and regional stakeholders. Given CVAG's role in the region, its primary focus will be on tracking the progress of the Valley's progress towards PEV readiness

CHAPTER 5:
Utilities – Providing Reliable Infrastructure and Affordable Fuel

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 Coachella Valley include the Imperial Irrigation District (IID) and SCE. IID does not currently provide any information regarding electric vehicles on its website. This is likely a function of the limited consumer demand in IID territory. On the other hand, SCE has a large portion of its business dedicated to electric vehicles largely because of high consumer demand in other parts of SCE territory – primarily Los Angeles. 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 local PEV clusters.
- Municipal utility gap: As noted above, IID does not currently provide any information about electric vehicles and does not have any PEV-specific rates (e.g., time-of-use rates). IID will need support from local communities regarding issues such as notification protocols and understanding potential demand for PEVs in order to assess the potential impact on local distribution infrastructure.
- Limited capacity: There is potential for long-term challenges from 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 significantly, additional capacity may be necessary as the market grows.

Recommendations

Evaluate 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.

SCE currently provides a variety of TOU rates for consumers, as summarized in Table 18.

Table 18: Rate Plans for Electric Vehicles in SCE Territory

Rate Option	Notes					
Residential Plan	Standard residential plan		*Tier 1*	*Tier 2*	*Tier 3*	*Tier 4*
			13¢/ kWh	16¢/ kWh	27¢/ kWh	31¢/ kWh
Home & Electric Vehicle Plan	Single meter with 2 tiers for the entire home and PEV		*Summer*		*Winter*	
			Tier 1	*Tier 2*	*Tier 1*	*Tier 2*
		on-peak 10a–6p	28¢/ kWh	47¢/ kWh	16¢/ kWh	35¢/ kWh
		off-peak 6a–10a 6p–12a	12¢/ kWh	31¢/ kWh	11¢/ kWh	30¢/ kWh
		super off-peak 12a–6a	9¢/ kWh	9¢/ kWh	10¢/ kWh	10¢/ kWh
Electric Vehicle Plan	PEV is charged through separate meter at a different rate that electricity used in home.		*Summer*		*Winter*	
		on-peak 12p–9p	33¢/kWh		23¢/kWh	
		off-peak 9p–12p	11¢/kWh		11¢/kWh	

Source: SCE Rate Plans, available at https://www.sce.com/wps/portal/home/residential/electric-cars

Create Utility Notification Protocol

To minimize the potential grid impacts of EVSE, particularly among residential customers, utilities should be notified 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.

Upgrade Distribution Infrastructure & Evaluate Needs

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

Implement Consumer Outreach Programs

Utilities should take necessary steps to ensure consumers have accurate information regarding utility rates, utility incentives, and programs. A variety of tools should be provided, such as PEV rate calculators, to help customers select the best rate option for their lifestyle. Customers

should know about the availability and benefits of PEV rates, vehicle fueling costs, charging, and the utility role in the installation process. Information should 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.

SCE, for instance, uses the rebates issued from California's Clean Vehicle Rebate Project to inform consumers about the availability of attractive TOU rates. Despite the attractive TOU rates available to consumers (with SCE offering a rate with charging as low as $0.09 per kWh, equivalent to about $1.00 per gallon of gasoline), only 50 percent of PEV drivers in some regions are signed up for TOU rates. The standard car buying purchase does not involve utilities; as a result, utilities are seeking ways to reach consumers and educate them about opportunities to save money.

Assess 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 the following: Develop 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.
- Offer 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.
- Offer alternatives to tiered rate structures for PEV drivers.

Review 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.

Evaluate Smart Grid Opportunities

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

Some early PEV adopters identify environmental benefits as a key reason to switch from internal combustion engine 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, 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.

GLOSSARY

BATTERY ELECTRIC VEHICLE (BEV)—Also known as an "All-electric" vehicle (AEV), BEVs utilize energy that is stored in rechargeable battery packs. BEVs sustain their power through the batteries and therefore must be plugged into an external electricity source in order to recharge.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)—Tasked with regulating stationary sources of air pollution in the nine counties that surround San Francisco Bay: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma counties. It is governed by a 24-member Board of Directors composed of locally elected officials from each of the nine Bay Area counties, with the number of board members from each county being proportionate to its population.

CLEAN CITIES COACHELLA VALLEY REGION (C3VR)– The Clean Cities Coachella Valley Region works with vehicle fleets, fuel providers, community leaders, and other stakeholders to save energy and promote the use of domestic fuels and advanced vehicle technologies in transportation.[35]

CALIFORNIA GREEN BUILDING STANDARDS (CALGreen)– The first-in-the-nation mandatory green building standards code. In 2007, CBSC developed green building standards in an effort to meet the goals of California's landmark initiative AB 32, which established a comprehensive program of cost-effective reductions of greenhouse gases (GHG) to 1990 levels by 2020.[36]

CALIFORNIA AIR RESOURCES BOARD (ARB)—The "clean air agency" in the government of California whose main goals include attaining and maintaining healthy air quality, protecting the public from exposure to toxic air contaminants, and providing innovative approaches for complying with air pollution rules and regulations.

CALIFORNIA CODE OF REGULATIONS (CCR)—The official compilation and publication of the regulations adopted, amended, or repealed by state agencies pursuant to the Administrative Procedure Act (APA). Properly adopted regulations that have been filed with the Secretary of State have the force of law. The CCR is compiled into Titles and organized into Divisions containing the regulations of state agencies.[37]

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The CEC's five major areas of responsibilities are:

1. Forecasting future statewide energy needs.
2. Licensing power plants sufficient to meet those needs.
3. Promoting energy conservation and efficiency measures.
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels.

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35 C3VR is available at https://cleancities.energy.gov/coalitions/coachella-valley

36 CALGreen is available at https://www.dgs.ca.gov/BSC/Resources/Page-Content/Building-Standards-Commission-Resources-List-Folder/CALGreen

37 California Office of Administrative Law (https://oal.ca.gov/)

5. Planning for and directing state response to energy emergencies.

Funding for the CEC's activities comes from the Energy Resources Program Account, Federal Petroleum Violation Escrow Account, and other sources.

CALIFORNIA PUBLIC UTILITIES COMMISSION (CPUC)—A state agency created by constitutional amendment in 1911 to regulate the rates and services of more than 1,500 privately owned utilities and 20,000 transportation companies. The CPUC is an administrative agency that exercises both legislative and judicial powers; its decisions and orders may be appealed only to the California Supreme Court. The major duties of the CPUC are to regulate privately owned utilities, securing adequate service to the public at rates that are just and reasonable both to customers and shareholders of the utilities; including rates, electricity transmission lines and natural gas pipelines. The CPUC also provides electricity and natural gas forecasting, and analysis and planning of energy supply and resources. Its main headquarters are in San Francisco.

COACHELLA VALLEY ASSOCIATION OF GOVERNMENTS (CVAG)–The regional planning agency coordinating government services in the Coachella Valley. By providing solutions to the common issues of the local governments and tribes that are its members, CVAG promotes a better quality of life and balanced growth for residents of Central and Eastern Riverside County.[38]

DIRECT CURRENT (DC)—A charge of electricity that flows in one direction and is the type of power that comes from a battery.

ELECTRIC POWER RESEARCH INSTITUTE (EPRI)—An independent, nonprofit organization for public interest energy and environmental research that focuses on electricity generation, delivery, and use, in collaboration with the electricity sector, its stakeholders, and others. Conducts research, development, and demonstration projects to enhance quality of life by making electric power safe, reliable, affordable, and environmentally responsible.[39]

ELECTRIC VEHICLE INFRASTRUCTURE TRAINING PROGRAM (EVITP)– The Electric Vehicle Infrastructure Training Program provides training and certification for electricians installing electric vehicle supply equipment.[40]

ELECTRIC VEHICLE (EV)—A broad category that includes all vehicles that are fully powered by electricity or an electric motor.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)—Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs, including BEVs and PHEVs.

GREENHOUSE GAS (GHG)—Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (NOx), halogenated fluorocarbons (HCFCs), ozone (O3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs).

38 CVAG is available at https://www.cvag.org/departments.htm

39 Electric Power Research Institute (https://www.epri.com/#/about/epri?lang=en)

40 EVITP is available at https://evitp.org/about-us/

HYBRID ELECTRIC VEHICLE (HEV)—A vehicle that combines an internal combustion engine with a battery and electric motor. This combination offers the range and refueling capabilities of a conventional vehicle, while providing improved fuel economy and lower emissions.

ICF INTERNATIONAL (ICF)–A global consulting services company that combines unmatched expertise with cutting-edge engagement capabilities to help clients solve their most complex challenges, navigate change, and shape the future.[41]

IMPERIAL IRRIGATION DISTRICT (IID)– a fiscally responsible public agency whose mission it is to provide reliable, efficient and affordably priced water and energy service to the communities it serves.[42]

KILOWATT-HOUR (kWh)—The most commonly used unit of measure telling the amount of electricity consumed over time, means one kilowatt of electricity supplied for one hour. In 1989, a typical California household consumed 534 kWh in an average month.

LOW CARBON FUEL STANDARD (LCFS)—A set of standards designed to encourage the use of cleaner low-carbon fuels in California, encourage the production of those fuels, and therefore reduce greenhouse gas emissions. The LCFS standards are expressed in terms of the carbon intensity of gasoline and diesel fuel and their respective substitutes. The LCFS is a key part of a comprehensive set of programs in California that aim cut greenhouse gas emissions and other smog-forming and toxic air pollutants by improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options.

MULTI-FAMILY DWELLING UNITS (MDU)–A property containing two or more residential units within a singular building.

METROPOLITAN TRANSPORTATION COMMISSION (MTC)– a public, governmental agency responsible for planning, financing and coordinating transportation for the nine-county San Francisco Bay Area.[43]

ORIGINAL EQUIPMENT MANUFACTURER (OEM)—Makes equipment or components that are then marketed by its client, another manufacturer, or a reseller, usually under that reseller's own name.

PLUG-IN ELECTRIC VEHICLE (PEV)—A general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from—pure battery electric and plug-in hybrid vehicles.

PACIFIC GAS AND ELECTRIC COMPANY (PG&E)—An electric and natural gas utility serving the central and northern California region.

PLUG-IN HYBRID ELECTRIC VEHICLE (PHEV)—PHEVs are powered by an internal combustion engine and an electric motor that uses energy stored in a battery. The vehicle can be plugged in to an electric power source to charge the battery. Some can travel nearly 100 miles on electricity alone, and all can operate solely on gasoline (similar to a conventional hybrid).

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41 ICF is available at https://www.icf.com/company/about

42 IID is available at https://www.iid.com/about-iid/mission-vision-statements

43 MTC is available at https://mtc.ca.gov/about-mtc/what-mtc

PLUG-IN ELECTRIC VEHICLE (PEV) READINESS PLAN (PLAN)–A plan to help support and accelerate the mass deployment of plug-in electric vehicles in the Coachella Valley region.

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.

SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS (SCAG)– SCAG is the nation's largest metropolitan planning organization (MPO), representing six counties, 191 cities and more than 19 million residents. SCAG undertakes a variety of planning and policy initiatives to encourage a more sustainable Southern California now and in the future.[44]

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD)—The air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino counties. This area of 10,740 square miles is home to over 17 million people—about half the population of the whole state of California. It is the second most populated urban area in the United States and one of the smoggiest. Its mission is to clean the air and protect the health of all residents in the South Coast Air District through practical and innovative strategies.

SOUTHERN CALIFORNIA EDISON (SCE)—One of the nation's largest electric utilities, which delivers power to 15 million people in 50,000 square miles across central, coastal, and Southern California, excluding the City of Los Angeles and some other cities.

SUSTAINABLE COMMUNITIES STRATEGY (SCS)–A plan that focuses on incentivizing regional and local planning and building in ways that bring people and destinations closer together, with low-carbon, alternative and convenient ways to get around. It requires regional metropolitan planning organizations in California to develop long-range plans which align transportation, housing, and land use decisions toward achieving GHG emissions reduction targets set by the California Air Resources Board.[45]

TIME-OF-USE (TOU)–An electricity billing method with rates based upon the time of usage during the day.

UNITED STATES DEPARTMENT OF ENERGY (U.S. DOE)—The federal department established by the Department of Energy Organization Act to consolidate the major federal energy functions into one cabinet-level department that would formulate a comprehensive, balanced national energy policy. DOE's main headquarters are in Washington, D.C.

VEHICLE MILES TRAVELED (VMT)–The total amount of miles driven by an individual or group during a given period of time.

ZERO EMISSION VEHICLE (ZEV)—Vehicles that produce no emissions from the on-board source of power (e.g., an electric vehicle).

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44 SCAG is available at http://www.scag.ca.gov/Pages/default.aspx

45 SCS is available at https://ww.arb.ca.gov/our-work/programs/sustainable-communities-program/what-are-sustainable-communities-strategies