



California Energy Commission Clean Transportation Program

FINAL PROJECT REPORT

Southern California Electric Vehicle Ready Project

Preparing for the Market Launch of Plug-in Vehicles

Prepared for: California Energy Commission Prepared by: South Coast Air Quality Management District



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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-09-006 to install chargers for public, workplace, and destination charging. In response to PON-09-006, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards January 10, 2011 and the agreement was executed as ARV-10-045 on April 30, 2016.

ABSTRACT

The Southern California Electric Vehicle Ready project is a collaboration between local government agencies, universities, destination sites, and local utilities to install 321 Level 2 chargers (two more chargers than required by the grant) at workplaces, destinations, and other sites for increasing public charging infrastructure in the greater Los Angeles/Southern California region. In January 2010, Los Angeles Department of Water and Power submitted an Electric Vehicle Ready Southern California proposal in response to CEC-PON-09-006 to install over 1,200 Level 2 electric vehicle charging stations at a cost of \$3.1 million. This proposal was submitted on behalf of the Southern California Regional Collaborative whose members included Los Angeles Department of Water and Power, County of Los Angeles, South Coast Air Quality Management District, and several California State University and University of California campuses. In January 2011, the California Energy Commission awarded Los Angeles Department of Water and Power with a reduced grant of \$840,750 to install 319 Level 2 chargers. Los Angeles Department of Water and Power then transferred administration of the grant to South Coast Air Quality Management District to administer in September 2011 and a revenue agreement between California Energy Commission and South Coast Air Quality Management District was executed in March 2012. Some of the original Southern California Electric Vehicle Ready Project partners dropped out of the project so memorandum of agreement for entities to host Level 2 chargers were executed with installers such as Adopt A Charger and Clean Fuel Connection and new site hosts such as the Cities of Burbank, Covina and Lake Elsinore; destinations/workplaces such as the Cabrillo Marine Aquarium, California State Parks, Disneyland, Getty Center/Villa, Huntington Hospital, Los Angeles County Museum of Art, Los Angeles Zoo, Pasadena Art Center and Pomona College. All of the installations were completed by April 2016. In general, the chargers are highly utilized and have often sparked additional electric vehicle charger installations at these sites.

Keywords: Electric Vehicles, Electric Vehicle Charging, Electric Vehicle Infrastructure, Fast Charging, electric vehicle supply equipment, electric vehicle charging stations, AB 118, Los Angeles Department of Water and Power, South Coast Air Quality Management District

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EXECUTIVE SUMMARY

Plug-in vehicle market launch announcements by General Motors and Nissan, the quantity of battery electric vehicles in the 1990's, and the hybrid vehicle market penetration in Southern California strongly suggests that the six county Southern California region will have the largest market penetration of plug-in vehicles in the United States from 2010 through 2020. The Los Angeles region has begun to prepare for the launch of plug-in vehicles (plug-in hybrid electric vehicles and battery electric vehicles (BEVs) collectively) by evaluating the current charging infrastructure, conducting education and outreach to future customers, and analyzing methods to streamline the installation process. One critical path analysis has been the level of public infrastructure that will be required to eliminate range anxiety in order to successfully transition to plug-in vehicles.

Southern California has established a regional coalition that ranges from the ocean to the desert, from Santa Barbara County through Orange, Riverside, and San Bernardino Counties. It represents a population of approximately 18 million individuals and is one of the most environmentally challenged regions in the nation. The Southern California Regional Collaborative's *Electric Vehicle-Ready Southern California, Preparing for the Market Launch of Plug-in Vehicles* proposal defines the magnitude of the plug-in vehicle readiness challenge faced by the region and suggests that the initial step towards preparedness is to convert public charging sites that were installed in the 1990's to public charging infrastructure that will support the expected plug-in vehicle market penetration in future years.

The project's objective is to build upon the expertise gained in the 1990's to install public charging infrastructure in Southern California that meets Society of Automotive Engineers approved J1772 standards for the connector and has sufficient regional coverage to eliminate plug-in vehicle customer range anxiety concerns.

The Southern California Regional Collaborative has identified the locations of previously charging infrastructure and determined that these installations are properly located across the region. We believe that upgrading infrastructure at these sites (maximizing the number of locations improved with available funds) to be the most cost effective. We have also identified select new locations that complement these existing locations.

The *Electric Vehicle-Ready Southern California, Preparing for the Market Launch of Plug-in Vehicles* proposal funded the upgrade and installation of 321 Level 2 chargers. California Energy Commission funding partially offset hardware and/or installation costs, and match share by the Southern California Regional Collaborative partners funded the remainder. Additional chargers were installed at these same sites using other funding (not counted as match share).

The project was administered by South Coast Air Quality Management District, the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino Counties. South Coast Air Quality Management District as the administrator assumed responsibility for disbursement of funding to the Southern California Regional Collaborative Partners upon installation of charging infrastructure. Los Angeles Department of

Water and Power was the lead agency who applied and was awarded the original grant by the California Energy Commission (CEC). The Los Angeles Department of Water and Power's services territory, the City of Los Angeles, has the greatest number of public charging infrastructure in the United States. The County of Los Angeles executed the development of an open competitive solicitation and established a County purchasing agreement for the charging infrastructure which Southern California Regional Collaborative members were able to utilize.

In summary, the Southern California Regional Collaborative recognized the strong need to become plug-in vehicle ready. The individual collaborative members initiated the steps necessary to serve this market. The region had the collective experience and cost-effective locations for installing charging infrastructure. The process was equitable for the regional communities and enabled a competitive open process that not only supported the Southern California region but also the State's objective of having public charging infrastructure that enabled the market launch of plug-in vehicles and the resulting environmental and energy security benefits.

CHAPTER 1: Project Purpose, Partners, Strategies, Management and Implementation

1.1 Overview

The Southern California Electric Vehicle Ready project is a collaborative between local government agencies, universities, destination sites, and local utilities to install 321 Level 2 chargers (two more chargers than required by the grant) at workplaces, destinations, and other sites for increasing public charging infrastructure in the greater Los Angeles/Southern California region. In January 2010, the Los Angeles Department of Water and Power (LADWP) submitted an *Electric Vehicle Ready Southern California* proposal in response to CEC PON-09-006 to install over 1,200 Level 2 electric vehicle charging stations at a cost of \$3.1 million. This proposal was submitted on behalf of the Southern California Regional Collaborative whose members included LADWP, County of Los Angeles, South Coast Air Quality Management District (SCAQMD), and several California State University and University of California campuses. In January 2011, the CEC awarded LADWP with a reduced grant of \$840,750 to install 319 Level 2 chargers. LADWP then transferred administration of the grant to SCAQMD to administer in September 2011 and a revenue agreement between the CEC and SCAQMD was executed in March 2012. Some of the original Southern California Electric Vehicle Project partners dropped out of the project so memorandum of agreements for entities to host Level 2 chargers were executed with installers such as Adopt A Charger and Clean Fuel Connection and new site hosts such as the Cities of Burbank, Covina and Lake Elsinore; destinations/workplaces such as the Cabrillo Marine Aquarium, California State Parks, Disneyland, Getty Center/Villa, Huntington Hospital, Los Angeles County Museum of Art, Los Angeles Zoo, Pasadena Art Center and Pomona College. All of the installations were completed by April 2016. In general, the chargers are highly utilized and have often sparked additional electric vehicle charger installations at these sites.

1.2 Need for Public Charging Infrastructure

To provide further context, at the time that CEC awarded seven grants through PON-09-006 in January 2011, commercially available plug-in electric vehicles (PEVs) were relatively rare and new. In December 2010, the Nissan Leaf and Chevy Volt launched their first model year vehicles. Current thinking at the time emphasized the importance of residential charging over access to workplace, destination or other forms of public charging. However, since that time, research has shown that while residential charging is the single most important source of charging, in heavily urbanized areas such as the greater Los Angeles region, more than 50 percent of the population lives in multi-unit dwellings. Residents living in multi-unit dwellings are often unable to install charging infrastructure since they may not own the common areas such as garages or are unable to obtain approval from their landlords or homeowner

associations to install charging infrastructure. Hence public charging at workplaces and destinations is critical to PEV drivers who are unable to charge at home.

The California PEV Vehicle Collaborative recently released cumulative PEV sales that indicate that an estimated 202,744 PEVs were sold in California from 2011 – April 2016, out of a total of 440,924 PEVs sold nationwide. This is shown in Figure 1.

This clearly indicates that California continues to have the highest ratio of car ownership in the world and almost 38 percent of the State's greenhouse gas emissions come from the transportation sector. In 2009, announcements for the commercial launch of PEVs for 2010 came from Chevrolet, Ford, Nissan, Daimler, Mitsubishi and several start-up companies. For the Southern California region to meet the needs of the early adopters of PEVs, existing charging infrastructure needs to be upgraded with the Society of Automotive Engineers approved J1772 connector and new charging infrastructure needs to be installed to expand public charging infrastructure in Southern California.





Source: California PEV Collaborative.

In order to accelerate the upgrade of existing charging infrastructure and the installation of new charging infrastructure, the Southern California Regional Collaborative submitted a proposal to fund the *Electric Vehicle-Ready Southern California Preparing for the Market*

Launch of Plug-in Vehicles project to retrofit and expand an already extensive network for BEVs and plug-in hybrid electric vehicles, collectively known as PEVs (Table 1).

Year	CVRP Rebates (South Coast)	/RP Rebates Issued bouth Coast)Califor PEV Sa		EVSE Insta	lled (South Coast)						
	Plug-In Hybrid Electric Vehicles	Battery Electric Vehicle		Level 2	Direct Current Fast Charger						
2016	30,192	32,865	209,059	27,278	3,770						

Table 1: Vehicles and Infrastructure in Place

Sources: California PEV Collaborative (2016). <u>PEV Sales Dashboard</u>. Data last updated June 3, 2016. Retrieved June 17, 2016 from_http://www.pevcollaborative.org/; Center for Sustainable Energy (2016). <u>California Air</u> <u>Resources Board Clean Vehicle Rebate Project, Rebate Statistics</u>. Data last updated June 6, 2016. Retrieved June 17, 2016 from_https://cleanvehiclerebate.org/rebate_statistic_; Department of Energy's Energy Efficiency and Renewable Energy (2016). <u>Alternative Fuels Data Center</u>. Data last updated June 17, 2016. Retrieved June 17, 2016 from <u>http://www.afdc.energy.gov</u>.

The *Electric Vehicle-Ready SoCal Project* provided public charging to support PEV sales. Within the next few years, the influx of PEVs to the Southern California market led to substantial reductions in greenhouse gas emissions and criteria air pollutants, including air toxics. Over 60,000 Clean Vehicle Rebates were issued to PEVs in the South Coast Air Basin, which is a partial estimate of the portion of PEVs sold in California that are being driven in the South Coast Air Basin. The Department of Energy's Alternative Fuels Data Center estimates that 31,048 Level 2 and direct current fast chargers were installed in the South Coast Air Basin as part of an overall regional public charging infrastructure network. All of this is shown in Figure 2.



Figure 2: South Coast Air Basin CVRP Rebates by Month

Source: Center for Sustainable Energy (2016). <u>California Air Resources Board Clean Vehicle Rebate Project,</u> <u>Rebate Statistics</u>. Data last updated [June 6, 2016]. Retrieved [June 17, 2016] from https://cleanvehiclerebate.org/rebate-statistic

1.3 Benefits of PEV Infrastructure

1.3.1 Air Quality Goals Conformance

As the network of public charging infrastructure is upgraded to accommodate the Society of Automotive Engineers J1772 connector and new infrastructure is established, the use of PEVs will steadily increase in the region. PEVs are among the cleanest light-duty zero emission vehicles which are available in wide commercial release. By providing substantial charging infrastructure to fuel these vehicles, fewer greenhouse gas and priority pollutant/toxics (criteria air pollutants) will be emitted, as compared to conventionally fueled vehicles.

Anticipated air pollutant emission reductions associated with the project are expected to be surplus to regulation and move the State closer to the goals of the Governor's Zero Emission Vehicle mandate, *California Energy Commission's Investment Plan for the Alternative and Renewable Fuel and Vehicle Technology Program,* and California Air Resources Board under the Global Warming Solutions Act of 2006.

The proposed project complements, and does not interfere with, efforts to achieve and maintain federal and state ambient air quality standards. This project improves upon emission reductions and air quality benefits detailed in the *State Implementation Plan for Ozone*, California Phase 2 Reformulated Gasoline standards, and the state's diesel fuel regulations by providing charging infrastructure to fuel PEVs.

1.3.2 Surplus to Regulations

The construction of PEV charging infrastructure is not required by state or federal regulations, South Coast Air Quality Management District rules, or any known memoranda of understanding with a government entity in the project area. Thus, the project complies with the prohibition against funding projects that are required to be undertaken by state or federal law, district rules or regulations, or local government agreements, per Section 3103 of the Regulations for the Alternative and Renewable Fuel and Vehicle Technology Program. PEV projections and associated future vehicle counts attributable to regulatory compliance have been identified in a September 2009 Southern California Edison's Market Trends Study, which is based on associated the California Air Resources Board projections. Therefore, none of the emission reductions claimed by this project are generated by regulatory programs that cannot be funded by Assembly Bill 118 resources (e.g., low-carbon fuel standard, tire efficiency program, and vehicle miles traveled reductions). Furthermore, the SCAQMD Fleet Rules (series 1190 and 1186.1) are not accounted for in the state implementation plan and do not require the purchase or use of PEVs when replacing government fleet vehicles. The provisions in AB 32 that relates to local government actions, as detailed in Senate Bill 375 (Steinberg), require a regional approach to reducing vehicle miles traveled in order to limit greenhouse gas emissions from light duty transportation sources, but they do not specifically require policies or programs to provide charging infrastructure for use by PEVs. The proposed project also goes beyond low-carbon fuel standard requirements, which can be met with biofuels, natural gas, hydrogen, and fuels other than electricity. The proposed program also goes beyond the requirements in the zero-emission vehicle program, which can also be met with fuel cell vehicles. In addition, the zero-emission vehicle program does not require vehicles to be sold, but rather to be produced and delivered for sale.

1.3.3 Alignment of Goals and Objectives

The Southern California Regional Collaborative fully shares the goals of CEC to:

- Develop and improve alternative and renewable low-carbon fuels;
- Optimize alternative and renewable fuels for existing and developing engine technologies;
- Produce alternative and renewable low-carbon fuels in California;
- Decrease, on a full fuel cycle basis, the overall impact and carbon footprint of alternative and renewable fuels and increase sustainability;
- Expand fueling infrastructure, fueling stations, and equipment;
- Improve light-, medium-, and heavy-duty vehicle technologies;
- Retrofit medium- and heavy-duty on-road and non-road vehicle fleets;
- Expand infrastructure connected with existing fleets, public transit, and transportation corridors;
- Establish workforce training programs, conduct education and promotion, and create technology centers.

Support of the goals listed above additionally leads to the identified Southern California Regional Collaborative objectives of improving air quality, reducing greenhouse gas emissions, reducing our reliance on imported oil, spurring green economic development with green jobs and ensuring PEV customer satisfaction.

The State of California has also established Sustainability Goal #1 to achieve Substantial Reduction of Greenhouse Gas Emissions. Substantial reduction of greenhouse gas emissions can be achieved through transportation electrification across California. Three critical path items must be executed to enable transportation electrification:

- PEV production;
- Creation of statewide PEV charging infrastructure that serves the entire population beyond early adopters and including those in disadvantaged or environmental justice communities;
- Customer/consumer outreach that eliminates concerns and leads to a seamless transition from fossil fuels to electricity.

The Southern California Regional Collaborative continues to reach out to public agencies and private organizations across Southern California to establish a collaborative of entities to execute projects to accomplish the three critical path items. Partners include the regional cities, counties, utilities, educational institutions, and organizations such as SCAQMD, Los Angeles Department of Water and Power, County of Los Angeles, original equipment manufacturers and electric vehicle supply equipment (EVSE) manufacturers, advocacy groups, large workplaces and destinations.

1.4 Detailed Project Description

The Southern California Regional Collaborative upgraded and installed new public charging infrastructure. Each Southern California Regional Collaborative partner identified specific locations for 727 upgrades and 479 new installations, for a total of 1,206 projects (of which 321 were funded by CEC and completed by April 2016). Existing site owners provided letters of intent/support to participate in the project and executed a memorandum of agreement with SCAQMD. Some of the original project participants were replaced by other workplaces, destination sites, or installers. A list of the EVSE details and proposed sites are listed in Appendix 1 and 2.

The proposed breakdown of the Southern California Electric Vehicle Ready Project is as follows:

• Upgrade current charging infrastructure within Southern California to utilize the Society of Automotive Engineers approved J1772 connector, allowing all PEVs to access public charging infrastructure. From 1995 – 2000, PEV charging infrastructure was installed in various cities and counties in California. This infrastructure has served nearly 3,000 PEVs to date and now forms the basic public charging infrastructure upon which the Southern California Regional Collaborative proposes to build upon.

- Proposed Upgrades to Existing Charging Infrastructure
- Cost Estimated at ~\$3,500 per charger
- CEC Requested funds ~\$1,904 per charger

• Add new charging infrastructure to Southern California. Additional charging infrastructure will be necessary to meet future PEV demand. This charging infrastructure includes residential charging, workplace charging, and public charging. According to market research, Southern California residents and commercial fleets are likely be early adopters and therefore will serve as a launch market and key centers for PEV deployment. Southern California will need additional public and workplace charging infrastructure, while still maintaining accessibility, as appropriate, for legacy PEVs during early commercial deployment.

- Proposed Installations of New Charging Infrastructure
- Cost Estimated at ~\$6,900 per charger
- CEC Requested funds ~\$3,781 per charger

The Southern California Regional Collaborative identified the locations of previously charging infrastructure and determined that these installations are properly located across the region. Upgrading infrastructure at these sites will be the most cost-effective use of funds. New locations have also been identified that complement these existing locations.

The project was administered by SCAQMD, the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside, and San Bernardino Counties. As the Project administrator, SCAQMD assumed responsibility for disbursement of funding to the Southern California Regional Collaborative Partners upon installation of charging infrastructure. LADWP was the lead agency who applied and was awarded the original grant by CEC. LADWP's services territory, the City of Los Angeles, has the greatest number of public charging infrastructure in the United States. The County of Los Angeles executed the development of an open competitive solicitation and established a County purchasing agreement for the charging infrastructure which the Southern California Regional Collaborative members were able to utilize. SCAQMD and the Southern California Regional Collaborative partners assisted with installation and negotiations as necessary at each site location. Once installed, the site owner served as the owner/operator of the charging infrastructure. Owner/Operators consulted the Southern California Regional Collaborative partners as needed and were responsible for reporting data and communicating to the Southern California Regional Collaborative partners as requested on a regular basis and agreed upon in the memorandum of agreement.

Though not included in our match calculation, many of the Southern California Regional Collaborative partners, in preparation of the launch of PEVs, had already made their sites PEV ready by running electrical conduit to parking lots at new buildings, and applied for other sources of grant funds. LADWP designated \$40 million under a Smart Grid Grant awarded by the Department of Energy to study the interaction between the Smart Grid and PEVs, including battery aggregation, grid and distribution impacts, and customer behavioral studies, with the Jet Propulsion Laboratory, University of California, Los Angeles and University of Southern California. Lessons learned and data collected through the Smart Grid Grant were shared with the Southern California Regional Collaborative partners.

Additionally, SCAQMD and LADWP hosted websites including general PEV industry information, available PEVs and EVSE, benefits/incentives from the State/City/Utility. The Project shared charging infrastructure locations with mapping applications such as <u>PlugShare</u> (www.plugshare.com) and the Department of Energy's <u>Alternative Fueling Station Locator</u> (http://www.afdc.energy.gov/locator/stations/).

Outreach and visibility are imperative to the success of PEV deployment. Locations that are easy to search online and find on the streets through signage, etc. will facilitate the success of this project. University of California, Los Angeles contributed programming services to develop the regional charging infrastructure map, as well as applications for the iPhone, Droid, and other smart phones. All upgrades/installations completed by the Southern California Regional Collaborative were shared on these websites.

CHAPTER 2: Deployment and Utilization of Chargers

Deployment and utilization of charging infrastructure are important considerations to ensure that public charging infrastructure is placed in high priority locations and is highly utilized. From 2011 – 2016 when charging infrastructure was deployed in the Southern California Electric Vehicle Ready project, local governments, utilities, universities, destination sites, and installers collaborated to broaden the geographical reach of the existing public charging infrastructure network in the southern California region. Initially it was challenging to find site hosts where charging infrastructure could be deployed but in the past two years there has been a greater awareness of the need and value of PEVs as more consumers purchase these vehicles and create a demand for charging beyond residential charging.

2.1 Deployment of Level 2 Chargers

Although about 1,200 sites for Level 2 charging infrastructure were determined ahead of time some of these sites did not get installed as planned. Some of this had to do with the delay in executing memorandum of agreements with the Southern California Regional Collaborative partners which was partly due to the transfer of the grant from LADWP to SCAQMD, and then subsequent execution of a new grant agreement with SCAQMD. Some of the existing Level 2 infrastructure sites were upgraded through CEC's Reconnect California program with Clipper Creek and some new Level 2 infrastructure sites were installed through Department of Energy's Electric Vehicle Project with ECOtality and ChargePoint America with ChargePoint/Coulomb Technologies. The Electric Vehicle Project installed approximately 12,500 Level 2 residential and public charging stations in 18 cities in the United States. ChargePoint America installed more than 4,600 Level 2 residential, commercial and public charging stations in the regions in the United States. These three projects had significant, heavy deployments in the state of California and in the greater Los Angeles and San Francisco Bay Area metropolitan regions in particular, with much of this activity initiated in 2011 and concluded in 2013.

Many of the installations for the Southern California Electric Vehicle Ready program started in 2013 with the original project partners. Having some project partners unable to participate in the project for various reasons enabled new cities, counties, universities, workplaces, and destination sites that did not have an opportunity to partner in the original proposal install Level 2 infrastructure in their jurisdictions. In many cases, these installations were the first Level 2 charging infrastructure to be installed, particularly in locations in Riverside and San Bernardino Counties. The original grant focused on partners from Los Angeles and Orange Counties, with one or two exceptions.

When new potential site hosts were first approached in 2013 about hosting Level 2 charging infrastructure, many staff were unfamiliar with the technology and some felt that it might not be widely utilized as it would in early adopter communities in Los Angeles County. However by 2014 and 2015, many sites became actively interested in taking advantage of incentive funding to install a small number of Level 2 infrastructure as a pilot project as more local residents began to purchase PEVs and inquire about the availability of public charging infrastructure and more local elected officials saw the benefits of having public charging infrastructure in their municipalities as a way of providing a green image and supporting zero emission, alternative infrastructure.

By 2015 all of the rebates had been assigned to sites. However, a last-minute dropout by the City of Santa Monica made 22 additional rebates available. Adopt A Charger was able to find homes for these rebates, with many of these installations taking place as late as April 2016, up to the ending date of the program. Adopt A Charger was able to utilize their pre-existing relationships at the California State Parks and California State Universities as well as local museums and aquaria to persuade site hosts to agree to install infrastructure on an accelerated timeline between February – April 2016. The three initial successful site installations at the Baldwin Hills Scenic Overlook, Leo Carrillo State Park, and Malibu Creek State Park persuaded other state park sites such as Kenneth Hahn State Recreation Area, Old Town San Diego State Historic Park, and Will Rogers State Park to move forward to install charging infrastructure. Based on the high utilization at the Getty Center and Villa, and their communication of their success to other local museums and aquaria, made the Getty Foundation decide to install additional infrastructure at these sites in 2016 and the Cabrillo Marine Aquarium and Los Angeles County Museum of Art installed their first chargers as well. Adopt A Charger also worked closely with LADWP and the City of Los Angeles to install infrastructure at many sites in the City of Los Angeles as part of Mayor Eric Garcetti's initiative and challenge to City agencies to install 1,000 public charging stations by 2017.

2.2 Deployment of Direct Current Fast Chargers

There was one direct current fast charger (as well as six Level 2 chargers) installed as part of the Southern California Electric Vehicle Ready Project at the Los Angeles Zoo (see Figure 3 on the next page). In general, the rebate amount of \$2,500 per Level 2 charger or \$5,000 per direct current fast charger was not enough to significantly incentivize the installation of direct current fast chargers without other funding covering the majority of the cost. LADWP covered the majority of the cost through its Charge Up, LA! rebate program. This installation was started in May 2015 and completed in October 29, 2015, with a press event on November 3, 2015, with Mayor Eric Garcetti at the ribbon cutting event. The direct current fast charger at the Los Angeles Zoo is one of three direct current fast chargers installed by the City of Los Angeles as part of the Mayor's electric vehicle initiative; the other two fast chargers are at Los Angeles International Airport and at LADWP headquarters in downtown Los Angeles. All three direct current fast chargers are available for use free of charge.

Mayor Garcetti has been a strong advocate of PEVs and associated infrastructure as evidenced by his push for City agencies to install 1,000 public charging stations by 2017. "As our nation's car capital – we have the highest per-capital car ownership rates in the United States – Los Angeles can really move the needle on electric vehicle adoption on a meaningful scale. By installing more publicly-available charging stations for electric vehicles, we'll make it easier for Angelenos to switch from gas-powered polluters to zero-emission vehicles – benefitting our environment, promoting a clean economy, and creating green jobs."



Figure 3: Los Angeles Zoo, Direct Current Fast Charger and Level 2 Chargers

Six Level 2 chargers and one direct current fast charger with CHAdeMO and Society of Automotive Engineers Combo connectors were installed as part of free public charging infrastructure offered as part of the City of Los Angeles' Mayor's initiative to install 100 direct current fast chargers in the City.

Photo Credit: Patricia Kwon.

Having a strong advocate in City politics has enabled the City of Los Angeles and LADWP to install 1,024 chargers as part of the City's overall public charging infrastructure network.¹ In April 2016, LADWP's Board recently approved a \$22 million new residential and commercial EVSE incentive program offering rebates of \$500 per charger (\$250 per charger additional for an optional dedicated time of use meter) for residential chargers and \$4,000 per charger for commercial installations.

¹ Source: Los Angeles Department of Water and Power, City of Los Angeles, *Sustainable City Plan, First Annual Report 2015-2016.*

2.3 Examples of Installations

Another factor in facilitating successful installations of public charging infrastructure has been the ability for the Southern California Electric Vehicle Ready grant to provide gap funding towards installations at sites that already had partial funding in place. Installers such as Adopt A Charger and specialize in assembling a portfolio of funding sources that various sites are able to take advantage of. This can include discounts on offered by manufacturers such as Clipper Creek, Leviton, and Eaton; other rebate programs such as LADWP's Charge Up, LA!; site host funding; using in-kind labor that also counted towards CEC match share; and private corporate funding such as from Nissan or other original equipment manufacturers. Adopt A Charger typically installs non-networked, dumb chargers that use the Liberty Plug-ins Hydra system to collect utilization data such as kilowatt-hour (kWh) dispensed. It also typically works with its regular installer, Sustainable Solutions Partners, so that installations are able to be coordinated smoothly and completed quickly, if needed. For the Southern California Electric Vehicle Ready grant, 25 Level 2 charger installations at eight sites were completed in April 2016 to utilize the rebates that the City of Santa Monica was unable to take advantage of.

The City of Santa Monica was unable to utilize the 22 rebates assigned to them because it had initially gone out with an request for proposal for non-networked, dumb chargers and the terms of the request for proposal did not allow them to use the Liberty Plug-ins Hydra system to collect utilization data required by the Southern California Electric Vehicle Ready grant. After consultation with its City legal counsel the City decided to rerelease another request for proposal for networked chargers and to utilize City funding for this project, as there was not sufficient time to install the chargers by the April 2016 deadline.

For the six California State Parks where Level 2 chargers were installed, Adopt A Charger had received a CEC grant in July 2014 to install infrastructure at 14 California State Parks as part of California State Parks' *Cool Parks* initiative. Match funding was provided by The Kashia Band of Pomo Indians, Monterey Bay Unified Air Pollution Control District, Google, Southern California Edison, and LADWP.

Sustainable Solutions Partners and PlugShare provided in-kind donation of services, and Clipper Creek provided discounted EVSE. Chevrolet had provided partial funding for Level 2 chargers installed at Leo Carrillo State Park and Malibu Creek State Park in 2013. One significant challenge to installing public charging infrastructure at the California State Parks was that many parking lots did not have a sufficiently even slope to meet the new Americans with Disabilities Act (ADA) requirements proposed by the California Division of the State Architect, starting in January 2017. ADA requirements include no more than a 2 percent horizontal or vertical slope which required many parking lots at these parks to go through repaving/regrading in order to meet the slope requirement. ADA requirements also require that the first charger installed by ADA accessible even if only a small number of chargers are being installed, making smaller installations not cost effective. Lastly, ADA requirements for larger installations call for a minimum number of standard ADA, van ADA and ambulatory ADA accessible parking spaces, all with different space and access requirements. This will make future installations starting in January 2017 even more challenging from a cost perspective. Adopt A Charger was able to install chargers at six California State Parks, complying with current existing regulations, under the Southern California Electric Vehicle Ready grant. In addition, there will be additional chargers installed at 12 additional California State Parks under the Cool Parks Initiative and funded through a separate grant by the CEC. Some of the other state parks to receive chargers include Crystal Cove State Park, Huntington State Beach, Bolsa Chica State Beach, and Los Angeles State Historic Park. Two of the California State Park installations are shows in Figure 4 below.



Figure 4: Installations at Leo Carrillo and Malibu Creek State Parks

Four Level 2 chargers were installed at Leo Carrillo and Malibu Creek State Parks as part of free public charging infrastructure offered as part of the California State Parks *Cool Parks* initiative. Photo Credit: Adopt A Charger.

Adopt A Charger worked through its connections with local museums and aquaria to encourage these sites to offer destination charging. Staff at the Getty Foundation spoke positively of their experience in installing Level 2 charging infrastructure that was able to serve staff and visitors equally well, despite the challenges of having limited parking at their facility. A senior manager at the Getty Center was an early PEV adopter, which helped encourage facilities staff to look into installing infrastructure prior to any demand for charging from Getty visitors. "We have a lot of staff. We have many visitors we see coming in with electric vehicles, and we really wanted to be able to be welcoming to them here," said Bob Combs, director of security at the Getty Center. Usually, our length of stay is about three to four hours, so it really matches up well with a typical visit," Combs said. Staff at the Getty Center and Villa also communicated with staff at other museums and aquaria to encourage these facilities to install charging infrastructure for their staff and visitors. In April 2016 Cabrillo Marine Aquarium and Los Angeles County Museum of Art installed two and three Level 2 chargers respectively. The Huntington Museum ran conduit for future PEV infrastructure while doing its renovation for a new visitor center in 2015-2016 and will be installing Level 2 chargers later in 2016, outside of the Southern California Electric Vehicle Ready grant. Some of the chargers installed at the Getty Center for visitors are shown in Figure 5.



Figure 5: Getty Center Installation

Sixteen Level 2 chargers were installed at the Getty Center and Villa in 2014 and 2016. The Getty Foundation has installed a total of 24 Level 2 chargers at the Getty Center and eight Level 2 chargers at the Getty Villa using Southern California Electric Vehicle Ready and other funds.

Photo Credit: Adopt A Charger.

Cabrillo Marine Aquarium used signage for its Level 2 chargers as a way of highlighting important ecological and environmental messages consistent with its institutional philosophy. Chargers at museums and aquaria for the Southern California Electric Vehicle Ready Project were provided to the public free of charge. The dwell time at museums and aquaria are typically two or more hours which is consistent with Level 2 charging, providing a sufficient amount of charging to allow visitors to fully or almost fully recharge their PEVs and easily make the trip home on electric vehicle miles traveled. Destinations such as the Getty Center and Villa that were initially wary of installing infrastructure because of their limited parking and not wanting to designate parking to PEVs only, found that these spots were highly utilized by visitors and staff. An example of messaging on the importance of electric vehicle chargers is shown in Figure 6.

Figure 6: Messaging at Cabrillo Marine Aquarium Our Oceans are rapidly changing because of our rampant use of fossil fuels



These free EV chargers are provided by Cabrillo Marne Aquarium and the City of Los Angeles, Department of Recreation and Parks through a partnership with Adopt-a-Charger program



Reducing our use of fossil fuel and the emission of greenhouses gases through energy conservation, innovative design and other creative approaches will help us reduce the impact on our ocean.

Electric vehicles are one solution. Electric vehicles decrease greenhouse gas emission by about half when compared with gasoline vehicles.



Source: Cabrillo Marine Aquarium.

Clean Fuel Connection is another EVSE installer that was able to offer multiple sources of funding to allow sites to install public charging infrastructure. Some of these were larger installations that received CEC grants for public charging infrastructure. The Southern California Electric Vehicle Ready funding was used for smaller parking lot installations not covered by these larger grants such as the Chip and Dale parking lot at Disneyland Resort (Figure 7 below). These installations at Disneyland came after earlier installations at smaller Disney locations such as executive offices in Burbank to test the viability of offering electric vehicle chargers for Disney staff.



Figure 7: Disneyland Resort Installation

Disneyland Resorts installed 15 chargers as part of the Southern California Electric Vehicle Ready program, and an additional 32 dual pedestal ChargePoint chargers at Disneyland Resort, Downtown Disney, Disneyland Hotel, Paradise Pier Parking Garage and Grand Californian Valet Parking.

Source: Patricia Kwon.

Several California State University campuses installed Level 2 chargers including Long Beach, Los Angeles, Cal Poly Pomona, San Bernardino, and the Chancellor's Office in Long Beach (see Figure 8 below), as well as Pomona College and the Art Center of Pasadena.



Figure 8: California State University Campus Installations

Source: Patricia Kwon.

California State University Los Angeles installed eight chargers in Lot 3, one in Lot C, and four Chargepoint chargers in Lot 10 as part of the Southern California Electric Vehicle Ready program. Photo Credit: Patricia Kwon.



Figure 9: City of Palmdale Installation

Several cities also installed Level 2 chargers including the Cities of Beverly Hills, Claremont, Covina, Lake Elsinore, Los Angeles, and Palmdale (see Figure 9 above). These chargers were typically at City Hall or at a city owned parking structure nearby commercial retail establishments including restaurants, shops, and city parks. The County of Los Angeles also installed 85 chargers at various County offices/workplaces and destinations such as the Los Angeles County Arboretum and Walt Disney Concert Hall as part of the Southern California Electric Vehicle Ready program, and 117 chargers using County and Mobile Source Air Pollution Reduction Review Committee funding.

2.4 Pricing of Chargers

Public charging for Level 2 and direct current fast charging tends to be offered either for free or a pricing structure of per hour or per kWh. For the public chargers installed under the Southern California Electric Vehicle Ready program, the vast majority (88 percent) of public chargers were free of charge rather than having a fee per hour (10 percent) or per kWh (2 percent). Part of the abundance of free charging through the Southern California Electric Vehicle Ready program had to do with the decision by LADWP and the County of Los Angeles to not charge employees and the public for charging, and private and corporate funding put together by Adopt A Charger towards electricity costs. Pricing models for the chargers are shown in Table 2 on the next page.

Source: Patricia Kwon.

EVSE (#)		Site Type		Pricing Model			
Level 2	Direct Current Fast Charger		Free	Per Hour	Per kWh		
19		Parks	17	2			
48		Universities	37	11			
63	1	Destinations (museums, amusement parks, etc.)	53	10			
16		Hospitals	16				
23		Local Government (City Hall, parking structures)	8	9	6		
152		Workplaces	152				
Total	·		283	32	6		

Table 2: Charger Pricing Models

Source: SCAQMD staff calculations.

2.5 Utilization of Chargers

On average, the greatest utilization per charger (in kWh) was from chargers deployed at workplaces at the City and County of Los Angeles (11,261 kWh/charger). Charger utilization at destinations (5,068 kWh/charger), hospitals (4,151 kWh/charger) and universities (4,146 kWh/charger) were fairly similar. Chargers at California State Parks (2,218 kWh/charger) and local government sites (city hall or parking structures, 1,780 kWh/charger) had lower use rates. The particularly high utilization at workplaces had much to do with the large number of fleet vehicles in the LADWP fleet, which had the highest utilization rate per charger in the Southern California Electric Vehicle Ready program. This is shown in Figure 10 (next page).



Figure 10: Charger Utilization by Site Type

Since the vast majority of chargers installed were free, it is difficult to determine simply by pricing model if free chargers get high utilization. Some of the chargers included in the per hour pricing model were the chargers installed at the Disneyland resort which required payment of a parking fee; these chargers were generally highly utilized (see Figure 11).

Source: SCAQMD staff calculations.



Figure 11: Charger Utilization by Pricing Model

Source: SCAQMD staff calculations.

2.6 Adequacy of South Coast Charger Network

Given the overall high utilization rates of chargers installed under the Southern California Electric Vehicle Ready program there is evidence to suggest that much more public and workplace charging infrastructure should be installed. It is also important to continue to facilitate the placement of residential charging both for single family residences and multi-unit dwellings. Several utilities in the South Coast Air Basin offer residential electric vehicle charger rebate programs of \$250 - \$500 towards hardware, including a \$1 million residential electric vehicle charger rebate program funded by the Clean Fuels Fund and Mobile Source Air Pollution Reduction Committee. SCAQMD also administers an Enhanced Fleet Modernization Program that provides significant incentives towards PEVs and residential charging infrastructure for low income residents in disadvantaged communities. The Enhanced Fleet Modernization Program is currently oversubscribed, but the California Air Resources Board has just provided additional incentive funding for this program. The California Public Utilities Commission has also approved Southern California Edison's' Charge Ready program, a pilot program which will install up to 1,500 Level 2 chargers in its territory, with 10 percent allocated to residents in disadvantaged communities. CEC has also funded and will continue to fund inter-regional direct current fast charging corridors to connect urbanized and more rural parts of California and to provide fast charging corridors which connect to the already existing fast charging corridor through the states of Washington and Oregon.

CHAPTER 3: Assessment of Results and Policy Recommendation

3.1 Assessment of Results

The Southern California Electric Vehicle Ready program was successful both in deploying the required number of chargers and in creating a collaborative network by which additional chargers were installed during the time period of the program and future installations will occur this year and in subsequent years.

3.2 Funding Strategies for Site Analysis & Site Host Engagement

Since the Southern California Electric Vehicle Ready program started at the beginning of the release of new PEVs, initially site hosts did not feel an urgent need to install charging infrastructure, either for their employees or for the public. In the last two years, this attitude has shifted so that it was easy to find site hosts and in fact many site hosts who wished to install charging infrastructure could not be provided any incentive funding, since all of the funding was committed. Occasionally there were opportunities for new site hosts who were not part of the original CEC application to participate due to a Southern California Electric Vehicle partner dropping out of the program.

Once the need for public charging infrastructure was apparent, the two most frequent types of obstacles to installing infrastructure had to do with the lack of familiarity with the technology, types of chargers available, factors to consider in planning for current and future PEV demand and infrastructure needs, how to perform this work, and which installers and/or network providers were most qualified to perform this work. Once Southern California Electric Vehicle partners were able to find capable installers and/or network providers to perform the work, this enabled site hosts to become more comfortable with installing infrastructure. In going through this engagement process, it quickly becomes apparent that making it easy to install charging is a key element of success, as the primary mission of site hosts is not to provide public charging infrastructure.

The other type of obstacle to installing infrastructure had to do with creating a package of funding in addition to the Southern California Electric Vehicle Ready incentive of \$2,500 per Level 2 charger or \$5,000 per direct current fast charger. These funding amounts were far from sufficient to cover the full cost of hardware and/or installation. Some Southern California Electric Vehicle members were large agencies such as LADWP or the County of Los Angeles that regularly applied and obtained outside funding such as grants from the Department of Energy or Mobile Source Air Pollution Reduction or had their own agency funds to apply towards partially funding installations of charging infrastructure. Smaller Cities or universities often relied on installers and/or network providers such as Adopt A Charger or Clean Fuel Connection to approach site hosts with a package of multiple sources of funding so that the

site host had a comparatively small amount to provide towards the project. These multiple sources of funding could include donations or discounts from EVSE manufacturers or original equipment manufacturers or private/public foundations.

LADWP also provided a number of rebates towards workplace or public charging infrastructure to site hosts throughout the City of Los Angeles to install additional charging infrastructure beyond the Southern California Electric Vehicle Ready grant (since many of these sites were not part of the Southern California Electric Vehicle Ready program, they are not included in the Appendix). Given the extensive involvement of LADWP in key charging installations throughout the City of Los Angeles and in conjunction with Mayor Garcetti's initiative for public charging infrastructure, Southern California Edison's Charge Ready program has the same potential to fund a significant amount of public and workplace charging infrastructure in its territory cities outside the City of Los Angeles. Southern California Edison's Charge Ready program has the same potential to fund a significant amount of public and workplace charging infrastructure in its territory cities outside the City of Los Angeles. Southern California Edison's Charge Ready program has structured differently than LADWP's electric vehicle charger rebate program which provided an incentive per charger; for site hosts approved by the Charge Ready program, the entire cost of electrical infrastructure up to the charger is funded by the program. Electrical infrastructure upgrades at sites with insufficient power add significantly to the cost of installation and transformer and electrical panel upgrades can make installation financially infeasible.

In general, site host engagement was most apparent when there were successful instances of a similar type of site host being able to install charging infrastructure, having that infrastructure highly utilized, and having an installation partner and/or network provider who was able to keep the up time of the chargers high. In addition, installers and/or network providers were able to offer site hosts multiple sources of funding in addition to the Southern California Electric Vehicle Ready funding to make up gap towards hardware and installation costs.

3.3 Integration of EVSE Deployment with Regional PEV Council Planning

Since its formation in 2012, the Southern California PEV Coordinating Council has been very active in providing information, gathering stakeholders, applying for joint funding opportunities through the Department of Energy, CEC and other agencies, and holding a forum on EVSE planning and deployment activities in the region. All of the major stakeholders in EVSE planning and deployment are members of the Southern California PEV Coordinating Council including Southern California Association of Governments; SCAQMD; LADWP; Southern California Edison; County of Los Angeles; University of California, Los Angeles Luskin Center; Metro; Los Angeles Economic Development Council; original equipment manufacturers such as Toyota, Honda and Hyundai; EVSE manufacturers such as Chargepoint, Clipper Creek, and CarCharging Group; installers/network providers such as Adopt A Charger, Clean Fuel Connection, Electric Vehicle Connect, and Greenlots; and other organizations.

Marco Anderson of Southern California Association of Governments has served as the coordinator and host for the Southern California PEV Coordinating Council meetings, and Rick Teebay (County of Los Angeles, Office of Sustainability) and Patricia Kwon (SCAQMD, Technology Demonstration) have served as Chair and Vice Chair of the Council. Meetings have been held on a bimonthly or as needed basis to discuss major issues of interest. Some of the Council activities have also formed into other related groups such as the formation by the Los Angeles Economic Development Council of a Southern California Tech Center for Alternative Fuels and Advanced Vehicles funded by CEC in 2014. The Southern California Association of Governments has also completed sub-regional PEV planning efforts funded by CEC with the University of California, Los Angeles Luskin Center, South Bay Cities Council of Governments, and Western Riverside Council of Governments in June 2013.

The Southern California PEV Coordinating Council was an active member of a coalition of California agencies on the Department of Energy's Clean Cities Coalition funded California PEV Readiness Project completed in June 2013, as well as a similar coalition of California agencies on the Department of Energy's Clean Cities Coalition funded California Fleets and Workplace Alternative Fuels Project completed in January 2015. The strong relationships forged with the Southern California PEV Coordinating Council have allowed continued integration of EVSE planning and deployment activities.

3.4 Networked vs. Non-Networked Chargers

The specific needs of charging infrastructure by site hosts has continued to evolve as deployment has increased beyond a minimum of charging stations. Initially non-networked or dumb chargers were viewed as sufficient to meet the needs of PEV drivers to minimally address gaps when distances between home, workplace and destinations were greater than the electric range of PEVs. However as greater PEV adoption has occurred, PEV drivers have greater needs than were initially the case. Networked chargers have now become the norm in situations where charging demand far exceeds the supply of chargers. PEV drivers want to have information available that only networked chargers can provide including real-time availability, ability to reserve chargers in advance, assured methods of payment that include the ability to pay using an radio frequency identification card or credit card, and the ability to access multiple charger networks through a single network's radio frequency identification card. Site hosts have also discovered greater needs such as the ability for cost recovery rather than providing free electricity, the ability to recover costs without spending an unreasonable amount on network fees and per transaction fees, and ability to collect data to confirm utilization rates and patterns for chargers at their site. Site hosts that are not interested in cost recovery may continue to install non-networked chargers, sometimes in conjunction with a system such as a Hydra unit from Liberty Access Technologies that provides data collection and pin codes for dumb chargers than can be used for cost recovery but have much lower transaction fees than typical networked chargers.

3.5 EVSE Business Models

A variety of EVSE business models are currently in practice. Many site hosts, particularly large agencies whose primary purpose is to provide workplace and/or fleet charging with some public charging made available, may continue to install non-networked chargers or those with a Hydra unit and not engage in cost recovery. Chargers installed by Adopt A Charger provide three years or more of electricity costs to site hosts with the understanding that site hosts will not engage in cost recovery during that initial period, and many of these site hosts continue to follow that practice of offering free public charging. Non-networked chargers at these sites will still have meters or some other form of data collection to provide utilization data both for research purposes and as a condition of grant funding. Certain network providers such as Chargepoint, eVgo, Electric Vehicle Connect, and Greenlots install networked chargers by various EVSE manufacturers where site hosts do charge fees—these can be per hour or per kilowatt-hour or as part of a flat parking fee. In some instances, fees charged are part of a monthly subscription plan similar to cell phone plans where the use of chargers in a particular network is included in the subscription and there is not an additional charge by the site host. In the absence of a subscription plan, the fee structure set by the site host prevails. Since data on subscribers of charging networks is not available, it is impossible to determine the impact of the network provider subscription plan EVSE business model. As these networks continue to expand in the Southern California region, it is anticipated that the impact of subscription models will only continue to increase and may become the predominant EVSE business model as all PEV drivers may be subscribers of at least one charging network. Purchasers of new PEVs are often offered a free charging subscription for an initial period of time after purchase of their vehicle (i.e. one year) and are likely to continue as a member of that charging network once the initial period of free charging has passed. The charging market will continue to evolve and change substantially from its current form, particularly as adoption of PEVs moves into the mainstream market. The release of widely affordable 200-mile electric range PEVs in 2017 will also be a significant factor and is likely to increase electric vehicle miles traveled and trip patterns to that akin to conventional gasoline vehicles. This will increase the demand on all forms of charging: residential (single family and multi-unit dwellings), public (destinations and corridor charging), and workplace (both Level 2 and fast charging). As 2020 and 2025 approach, key deadlines for California's zero-emission vehicle mandate, the need for infrastructure to support 1 million and 1.5 million PEVs on the road, will mean that the need for public charging infrastructure will continue to be present and increasingly urgent. CEC funded projects such as the Southern California Electric Vehicle Ready Project which are earlier pilot projects on how to successfully create public and workplace charging infrastructure will provide important insights on charging infrastructure deployment.

GLOSSARY

AMERICANS WITH DISABILITIES ACT (ADA)—One of the most significant federal laws governing discrimination against persons with disabilities, passed in 1990. Prohibits discrimination against individuals with disabilities in employment, housing, education, and access to public services. The ADA defines a disability as any of the following: 1. "a physical or mental impairment that substantially limits one or more of the major life activities of the individual." 2. "a record of such impairment." or 3. "being regarded as having such an impairment."

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.

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 Energy Commission'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
- 5. Planning for and directing state response to energy emergencies.

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

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.

LOS ANGELES DEPARTMENT OF WATER AND POWER (LADWP)—An electric municipal utility serving the greater Los Angeles, California, region.

MOBILE SOURCE AIR POLLUTION REDUCTION REVIEW COMMITTEE (MSRC)—A committee comprised of one representative from each of the following agencies:

- South Coast District (South Coast Air Quality Management District SCAQMD)
- Southern California Association of Governments (SCAG)
- San Bernardino County Transportation Authority (SBCTA)
- Los Angeles County Metropolitan Transportation Authority (LACMTA)
- Orange County Transportation Authority (OCTA)
- Riverside County Transportation Commission (RCTC)
- State Board (ARB)
- A regional rideshare agency selected by the other members of the MSRC committee

All member appointments and alternates are made by the respective appointing authority. The authorized appointing authority may reappoint or fill a vacancy by giving notice in writing to the MSRC Chairperson.

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.

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.

APPENDIX A: SITE DATA SUMMARY

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
Adopt a Charger- Baldwin Hills Scenic Overlook 6300 Hetzler Road Culver City, 90232	3	Clipper Creek / CS-40	3 / 0	March 2014	NA	2,880	Free
Adopt a Charger- Kenneth Hahn Adopt a Charger- State Recreation Area 4100 S. La Cienega Blvd. Los Angeles, 90056	4	Clipper Creek / HCS-40	4 / 0	April 2016			Free
Adopt a Charger- Leo Carrillo State Park 35000 Pacific Coast Highway Malibu, 90265	2	Clipper Creek / CS-40	2 / 0	March 2014	NA	5,208	Free
Adopt a Charger- Malibu Creek State Park 1925 Las Virgenes Road Calabasas, 91302	2	Clipper Creek / CS-40	2 / 0	March 2014	NA	34,060	Free
Adopt a Charger- Old Town San Diego State Historic Park 4002 Wallace St. San Diego, 92110	4	Clipper Creek / HCS-40	4 / 0	April 2016			Free
Adopt a Charger- Will Rogers State Park 1501 Will Rogers State Park Road Pacific Palisades, 90272	2	Eaton / NA	2 / 0	April 2016			Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
Adopt a Charger- Cabrillo Marine Aquarium 3720 Stephen M. White Dr. San Pedro, 90731	2	Clipper Creek / HCS-20	2 / 0	April 2016			Free
Adopt a Charger- Getty Center 1200 Getty Center Drive Los Angeles 90049	9	Leviton / EVB32	9 / 0	February 2015, April 2016	NA	15,745	Free
Adopt a Charger- Getty Villa 17985 Pacific Coast Highway Pacific Palisades 90272	7	Leviton / EVB32	7 / 0	February 2015, April 2016	NA	392	Free
Adopt a Charger- Los Angeles County Museum of Art 5905 Wilshire Blvd. Los Angeles, 90036	3	Clipper Creek / CS-40	3 / 0	April 2016			Free
Adopt a Charger- Los Angeles Zoo 5333 Zoo Drive Los Angeles, 90027	6	Clipper Creek Efacec / HC- S40 QC-50	6 / 2	November 2015	NA		Free
Adopt a Charger- California State University Chancellor's Office 401 Golden Shore Long Beach, 90802	4	Schneider / EVO230 PDR	4 / 0	September 2014, April 2016	NA	44,971	Free
Adopt a Charger- California State Polytechnic University, Pomona 3801 W. Temple Ave. Pomona, 91768	4	Clipper Creek / CS-40	8 / 0	April 2016			Free
California State University, Long Beach- Parking Lot 2 1250 Bellflower Blvd. Long Beach, 90840	2	Clipper Creek / CS-40	2 / 0	May 2014			Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
California State University, Los Angeles- Lot 3 5151 State University Drive Los Angeles 90032	1	Chargepoint / CT4023	2 / 0	July 2013	365	57,667	Free
California State Polytechnic University, Pomona- Parking Lot H 3801 W. Temple Ave. Pomona, 92407	2	Clipper Creek / CS-40	2 / 0	December 2013	NA	25,166	Free
California State University, San Bernardino- West Parking Structure 5500 University Parkway San Bernardino, 92407	2	Clipper Creek / CS-40	2 / 0	April 2014	NA	NA	Free
City of Claremont- Claremont Village Parking Structure 470 W. 1 st Street Claremont, 91711	1	Chargepoint / CT4023	1 / 0	February 2014	1,801	11,808	\$1.25 / hour
City of Claremont- Claremont City Hall 225 W. 2 nd Street Claremont, 91711	1	Chargepoint / CT4023	1/0	February 2014	2,150	14,709	\$1.25 / hour
City of Covina- Civic Center Parking Structure 125 E. College Street Covina, 91723	1	Chargepoint / CT4023	2 / 0	September 2014	352	2,434	\$.39 / kWh
City of Covina- Civic Center Parking Structure 124 E. College Street Covina, 91723	1	Chargepoint / CT4023	2 / 0	September 2014	64	451	\$.39 / kWh
City of Covina- Metrolink Parking Lot 559 N. Citrus Ave. Covina, 91723	1	Chargepoint / CT4023	2 / 0	September 2014	96	812	\$.39 / kWh

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
City of Lake Elsinore- City Hall 135 S. Main Street Lake Elsinore, 92530	2	LiteOn / IC2	4 / 0	September 2015	40	171	Free
City of Los Angles- Los Angeles Department of Water and Power 111 N. Hope Street Los Angeles, 90012	18	Clipper Creek / CS-40	18 / 0	May 2013	NA	496,811	Free
City of Los Angles- Los Angeles Department of Water and Power 111 N. Hope Street Los Angeles, 90012	34	Clipper Creek / CS-20	34 / 0	June 2013	NA	260,259	Free
City of Los Angles- Los Angeles Department of Water and Power 111 N. Hope Street Los Angeles, 90012	20	Eaton / Dual 30A Pedestal	20 / 0	January 2014	NA	6,990	Free
City of Los Angles- Los Angeles Department of Water and Power 111 N. Hope Street Los Angeles, 90012	26	Leviton / EVB32	26 / 0	March 2014	NA	697,330	Free
City of Los Angles- Getty Museum 1200 Getty Center Drive Los Angeles, 90049	12	Leviton / EVB32	12 / 0	February 2015	NA	20,993	Free
City of Los Angles- California State University Los Angeles 5151 State University Drive Los Angeles, 90032	11	Chargepoint / CT4021	11 / 0	August 2014			Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
City of Palmdale- City Hall / Development Services 38250 Sierra Highway Palmdale, 93550	1	Eaton / Dual 30A Pedestal	2 / 0	December 2014	459	2,062	\$1 / hour
City of Palmdale- Oasis Park Recreation Center 3850 East Ave South Palmdale, 93350	1	Eaton / Dual 30A Pedestal	2 / 0	December 2014	127	894	\$1 / hour
Clean Fuel Connection- Disneyland 1313 Disneyland Drive Anaheim, 92802	10	Chargepoint / CT4021	10 / 0	January 2014	22,127	198,249	Parking fee
Clean Fuel Connection- Beverly Hills Parking Garage 450 N. Crescent Drive Beverly Hills, 90212	6	Chargepoint / CT4021	6 / 0	October 2015	795	5,100	Parking fee
Clean Fuel Connection- Burbank Water & Power 201 E. Magnolia Ave. Burbank, 91502	2	Chargepoint / CT4021	2 / 0	July 2015	418	2,506	Free
Clean Fuel Connection- Huntington Hospital 100 W. California Blvd. Pasadena, 91109	4	Chargepoint / CT4021	4 / 0	February 2016	170	1,567	Free
Clean Fuel Connection- Pasadena Art Center 950 S. Raymond Ave. Pasadena, 91105	6	Chargepoint / CT4021	6 / 0	April 2015	3,333	23,972	Free
Clean Fuel Connection- Pomona College 333 N. College Way Claremont, 91711	6	Chargepoint / CT4021	6 / 0	June 2014	510	3,731	\$1.25 / hour

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
County of Los Angeles- Internal Services Department 1102 N. Eastern Blvd. Los Angeles, 90063	4	Schneider / EVO230PDR	4 / 0	October 2014	484	2,712	Free
County of Los Angeles- Internal Services Department of Telecommunications 1110 N. Eastern Blvd. Los Angeles, 90063	4	Schneider / EVO230PDR	4 / 0	October 2014	752	3,047	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles Law Library Lot 10 145 N. Grand Ave. Los Angeles, 90012	4	Schneider / EVO230PDR	4 / 0	October 2014	1,092	10,769	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles Music Center 135 N. Grand Ave. Los Angeles, 90012	6	Schneider / EVO230PDR	6 / 0	October 2014	1,976	16,538	Free
Associated of Los Angeles (County of Los Angeles)- Disney Concert Hall Lot 16 115 S. Grand Ave. Los Angeles, 90012	6	Schneider / EVO230PDR	6 / 0	October 2014	4,049	36,755	Free
Associated of Los Angeles (County of Los Angeles)- Internal Services Dept Lot 29 313 N. Figueroa Ave. Los Angeles, 90012	4	Schneider / EVO230PDR	4 / 0	October 2014	1,482	10,475	Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
Associated of Los Angeles (County of Los Angeles)- Harbor University of California, Los Angeles Medical Center 1000 W. Carson St. Torrance, 90502	4	Schneider / EVO230PDR	4 / 0	October 2014	2,897	32,746	Free
Associated of Los Angeles (County of Los Angeles)- Olive View Hospital 14445 Olive View Dr. Sylmar, 91342	4	Schneider / EVO230PDR	4 / 0	October 2014	2,001	28,677	Free
Associated of Los Angeles (County of Los Angeles)- Department of Public Works 900 S. Fremont Ave. Alhambra, 91803	3	Schneider / EVO230PDR	3 / 0	October 2014	2,485	33,054	Free
Associated of Los Angeles (County of Los Angeles)- Department of Public Works Annex 901 S. Fremont Ave. Alhambra, 91803	3	Schneider / EVO230PDR	3 / 0	October 2014	2,240	27,698	Free
Associated of Los Angeles (County of Los Angeles)- Department of Public Works Motor Pool 900 S. Fremont Ave. Alhambra, 91803	5	Schneider / EVO230PDR	5 / 0	October 2014	2,196	24,776	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff Century Station 11705 S. Alameda St. Lynwood, 90059	1	Schneider / EVO230PDR	2 / 0	October 2014	284	1,624	Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff San Dimas Station 270 S. Walnut Ave. San Dimas, 91773	1	Schneider / EVO230PDR	2 / 0	October 2014	812	7,963	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff Santa Clarita Station 23740 Magic Mountain Parkway Santa Clarita, 91355	1	Schneider / EVO230PDR	2 / 0	October 2014	1,585	13,822	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff Temple City Station 8838 Las Tunas Drive Temple City, 91780	1	Schneider / EVO230PDR	2 / 0	October 2014	1,451	20,034	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff Walnut Station 21695 Valley Blvd. Walnut, 91789	1	Schneider / EVO230PDR	2 / 0	October 2014	1,584	16,230	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff West Hollywood Station 780 San Vicente Blvd. West Hollywood, 90069	1	Schneider / EVO230PDR	2 / 0	October 2014	1,055	12,754	Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Sheriff Lost Hills Station 27050 Agoura Road Agoura Hills, 91301	1	Schneider / EVO230PDR	2 / 0	October 2014	595	5,623	Free
Associated of Los Angeles (County of Los Angeles)- Pitchess Detention Center 29320 Wayside Road Castaic, 91384	2	Schneider / EVO230PDR	4 / 0	October 2014	56	402	Free
Associated of Los Angeles (County of Los Angeles)- High Desert Regional Health Center 335 E. Avenue I Lancaster, 93535	2	Schneider / EVO230PDR	4 / 0	October 2014	317	3,423	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles Arboretum 301 N. Baldwin Ave. Arcadia, 91007	3	Schneider / EVO230PDR	3 / 0	October 2014	2,306	30,603	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Probation 9150 Imperial Highway Downey, 90242	2	Schneider / EVO230PDR	2 / 0	October 2014	791	11,836	Free
Associated of Los Angeles (County of Los Angeles)- Los Angeles County Registrar / Recorder 12400 Imperial Highway Norwalk, 90650	3	Schneider / EVO230PDR	3 / 0	October 2014	2,698	35,682	Free

Site name & address	EVSE Count	Charger Make / Model	Total Charge Points (L2 / Direct Current Fast Charger)	Date Placed in Service	Total Charging Sessions	Total kWh	Pricing
Associated of Los Angeles (County of Los Angeles)- Ranch Los Amigos National Rehabilitation Center 7601 Imperial Highway Downey, 90242	5	Schneider / EVO230PDR	5 / 0	October 2014	1,247	11,520	Free
University of California, Irvine- Mesa Parking Structure 100 Mesa Road Irvine, 92697	2	Chargepoint / CT4021	2 / 0		780	6,210	\$2.50 / hour
University of California, Santa Barbara- Parking Structure #10 552 University Road Santa Barbara, 91306	1	Chargepoint / CT2120	1/0		150	12,425	\$1 / hour
University of California, Santa Barbara- Parking Structure #18 552 University Road Santa Barbara, 91306	1	Chargepoint / CT2120	1/0		150	12,425	\$1 / hour
University of California, Santa Barbara- Parking Structure #22 552 University Road Santa Barbara, 91306	1	Chargepoint / CT2120	1/0		150	12,425	\$1 / hour

Abbreviations: CC=Clipper Creek, CP=Chargepoint, EAT=Eaton, SCH=Schneider, LEV=Leviton, NA=Data not available. Data not reported for chargers installed in April 2016. Source: *Patricia Kwon.*

APPENDIX B: EVSE ALLOCATIONS

Southern California Electric Vehicle Member	Total EVSE	Contract Execution Date	EVSE Installation Date
Adopt A Charger (California State Parks)—2 for Will Rogers	13	4/4/14	March 2014, April 2016
Adopt A Charger (Kenneth Hahn State Recreation Area)	4		April 2016
Adopt A Charger (Getty Center)—4 for Getty Center	9		February 2015, April 2016
Adopt A Charger (Getty Villa)—2 for Getty Villa	7		February 2015, April 2016
Adopt A Charger (California Polytechnic University, Pomona)	8		April 2016
Adopt A Charger (Cabrillo Marine Aquarium)	2		April 2016
Adopt A Charger (Los Angeles County Museum of Art)	3		April 2016
Adopt A Charger (California State University's Chancellor's Office)	6		September 2014, April 2016
Adopt A Charger (Los Angeles Zoo)	1 Direct Current Fast Charger+6		November 2015
Associated of Los Angeles (County of Los Angeles)	38	10/10/14	October 2014

Southern California Electric Vehicle Member	Total EVSE	Contract Execution Date	EVSE Installation Date
California State University Long Beach	2	7/11/14	May 2014
California State University, Los Angeles	2	8/5/13	October 2013
California State Polytechnic University Pomona	2	6/6/14	December 2013
California State University, San Bernardino	2	4/4/14	April 2014
City of Claremont	2	8/29/13	June 2014
City of Covina	6	1/22/14	September 2014
City of Lake Elsinore	4	10/10/14	September 2015
City of Los Angeles	115	11/22/13	June- December 2015
City of Palmdale	2	7/11/14	December 2014
Clean Fuel Connection, Inc. (City of Beverly Hills)	6	4/4/14	September 2015
Clean Fuel Connection, Inc. (City of Burbank)	2		March 2014
Clean Fuel Connection, Inc. (Disneyland & Downtown Disney)	10		December 2013
Clean Fuel Connection, Inc. (Huntington Hospital)	4		January 2016
Clean Fuel Connection, Inc. (Pasadena Art Center)	6		March 2015

Southern California Electric Vehicle Member	Total EVSE	Contract Execution Date	EVSE Installation Date	
Clean Fuel Connection, Inc. (Pomona College)	6		June 2014	
County of Los Angeles	47	9/6/13	October 2014	
University of California, Irvine	2	8/28/13	October 2013	
University of California, Santa Barbara	3	8/5/13	July 2014	
Total Amount for 321 EVSE:	\$798,500			

Source: Patricia Kwon.