

San Diego Regional **PLUG-IN ELECTRIC VEHICLE (PEV) READINESS PLAN**

.....
Preparing the San Diego Region for Plug-in Electric Vehicles



January 2014



Acknowledgements

Many individuals aided in the preparation of the San Diego Regional Plug-In Electric Vehicle (PEV) Readiness Plan and related products. Of particular note is the sustained involvement of the San Diego Regional Electric Vehicle Infrastructure (REVI) Working Group.

San Diego REVI Voting Members

Susan Freedman, Chair & Allison King, SANDAG

Mike Ferry, Vice Chair, California Center for Sustainable Energy

Brendan Reed, City of Chula Vista

Chris Helmer, City of Imperial Beach

Mike Grim, City of Carlsbad

Kathy Winn, City of Escondido

Kathy Valverde, City of Santee

Scott Munzenmaier, City of La Mesa

Jacques Chirazi, City of San Diego

Peter Livingston, County of San Diego

Chris Schmidt, Caltrans - District 11

Randy Walsh, San Diego Electric Vehicle Network

Dave Weil, University of California, San Diego

Gretchen Crowson & Ramsey Helson, City of Del Mar

Michelle White & Jenny Lybeck,

Unified Port District of San Diego

Paul Manasjan & Brett Caldwell,

San Diego Regional Airport Authority

Joel Pointon & Randy Shimka, San Diego Gas & Electric

Greg Newhouse, Miramar College, Advanced Transportation

Technology & Energy Center

Karen Prescott & Tim Dudek, National Electrical Contractors

Association (NECA)

Michah Mitrosky, International Brotherhood of Electrical

Workers (IBEW) Local 569

San Diego REVI Advisory Members

Mike Watt & Nick Cormier, San Diego Air Pollution
Control District

Chris Parry, US Navy, Department of Defense

Claire Spielberg, Metropolitan Transit System

Bill Cecil, City of Coronado

Diane Langager, City of Encinitas

Ray Pe, City of National City

Dan King, City of Solana Beach

Lyn Dedmon, City of Vista

Andy Hoskinson, Ecotality

Mike Cully, Car2go

Charlie Botsford, Aerovironment

Colleen Quinn, ChargePoint (Coulomb)

David Wang, General Electric

Additional Acknowledgements

The work undertaken through this contract also benefitted from concurrent regional and state PEV efforts, in particular the Zero-Emission Vehicles Community Readiness Guidebook Working Group led by the California Governor's Office of Planning and Research (OPR). SANDAG acknowledges the California Center for Sustainable Energy for its partnership role on this contract.

The following staff of SANDAG and the CCSE had primary responsibility for the preparation of the work products created under this contract.

SANDAG

Anna Lowe

Susan Freedman

Allison King Wood

California Center for Sustainable Energy

Mike Ferry

Tyler Petersen

David Almeida

Jessica Jinn

This document was prepared as a result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California. The Commission, the State of California, its employees, contractors and subcontractors make no warranty, expressed or implied, and assume no legal liability for the information in this document; nor does any party represent that the use of this information will not infringe upon privately owned rights.

Table of Contents

1. Executive Summary	5
2. Introduction	6
2.1 Why Develop This Plan?.....	6
Legislation.....	6
SANDAG.....	7
Regional adoption	7
3. The San Diego Regional Electric Vehicle Infrastructure (REVI) Working Group and Stakeholders	7
3.1 Background and Purpose.....	7
3.2 Organization and Stakeholder Engagement	7
3.3 Regional Barriers to PEV Infrastructure	8
4. PEVs and Public Charging Infrastructure in the San Diego Region	10
5. The Basics of Plug-in Electric Vehicles and Charging Infrastructure	12
5.1 Vehicle Types	12
5.2 Charging Infrastructure	13
Types of charging equipment.....	14
Finding public charging infrastructure	15
Access to public charging infrastructure	15
Locations of public charging stations in the San Diego region.....	15
6. Regional Plug-in Electric Vehicle Infrastructure Existing Conditions	18
6.1 Local Governments	18
6.2 Single Family Residences	18
6.3 Multi-Unit Dwellings.....	18
6.4 Workplace, Retail and Public Locations	19
7. Regional Barriers to EVSE Deployment and Key Recommendations	20
7.1 Regional Planning for Public EVSE Siting	20
Overview	20
Classifying local land use statistics for PEVs	22
Land use/parking analysis for EVSE	22
PEVs in local government fleets.....	23
Public electric vehicle charging stations.....	24
Education and outreach.....	24
7.2 Permitting for EVSE	24
Overview	24
Permitting EVSE installations at single family residences.....	24
Charging at multi-unit dwellings.....	26
Charging at commercial and public sites	26
Charging at the workplace.....	28

Zoning and parking policies for PEVs	29
Building code changes	29
Education and outreach.....	31
7.3 Utility Solutions	31
Overview	31
Utility notification protocol	32
SDG&E time-of-use rates	32
Minimizing grid impacts.....	33
Education and outreach.....	33
8. The Road Ahead	34
8.1 Overview	34
8.2 Increased PEV Presence.....	34
8.3 Estimating Future Demand for EVSE in the Region.....	35

List of Tables

Table 3.1: Regional Barriers to PEV Infrastructure	8
Table 5.1: Commercially Available Light-Duty PEVs	12
Table 5.2: Levels of Charging and Miles of Range	13
Table 5.3: Level 2 Installation Styles	14
Table 5.4: Finding Public Charging Infrastructure.....	15
Table 7.1: Charging Priorities and Destinations.....	22
Table 7.2: Documents for the EVSE Permitting Process	25
Table 7.3: Barriers Facing EVSE Installations at Multi-Unit Dwellings	27

List of Figures

Figure 5.1: Battery Electric Vehicle.....	12
Figure 5.2: Plug-in Hybrid Electric Vehicle	12
Figure 5.3: Charging Installation Cost Spectrum.....	14
Figure 7.1: REVI Regional Barriers.....	20
Figure 7.2: EPRI Charging Pyramid.....	21
Figure 7.3: Steps in PEV Land Use Assessment.....	22
Figure 7.4: San Diego Region Housing, 2012 and 2050	26
Figure 7.5: SDG&E’s Time-of-Use Rates.....	32
Figure 8.1: San Diego Regional PEV Adoption Growth	34

List of Maps

Map 4.1: San Diego Regional PEV Adoption, February 2012	10
Map 4.2: San Diego Regional PEV Adoption, September 2013.....	11
Map 5.1: EVSE in the San Diego Region.....	16
Map 5.2: Carmel Valley/Mira Mesa EVSE Cluster.....	17
Map 5.3: Central San Diego EVSE Cluster	17

Appendices

Appendix A: San Diego Regional Electric Vehicle Infrastructure Working Group Members

Appendix B: Fact Sheets

- Plug-in Electric Vehicles & Charging: Getting Started (p. 1)
- Resources for Public Agencies in San Diego (p. 2)
- Regional Planning for Public Charging in San Diego (p. 4)
- Resources for Fleet Managers in San Diego (p. 6)
- Charging at Condos, Apartments and Community Living Areas (p. 8)
- Workplace Charging for Businesses in San Diego (p. 10)
- Resources for Electrical Contractors in San Diego (p. 12)
- Electric Vehicle Charging Station Installation Guidelines: Residential and Commercial Locations (p. 14)

Appendix C: Tools and Summaries

- San Diego REVI Comments on the Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices (p. 1)
- Request for Proposals Template: Installation and Operation of Electric Vehicle Charging Stations (p. 16)
- San Diego Regional Clean Cities Coalition Dealership Outreach Pamphlet (p. 22)
- CCSE Guide to Plug-in and Get Ready (p. 26)
- Electric Vehicle Charging for Regional Park-and-Ride Lots and Transit Stations (p. 27)
- Building Codes Summary (p. 29)
- Towing Alternative Fuel Vehicles Presentation Summary (p. 32)
- San Diego Plug-in Electric Vehicle Community Seminar: The Electric Vehicle Infrastructure Training Program (EVITP) Summary (p. 34)
- San Diego Regional Nonresidential Charging Infrastructure Study (p. 39)

Appendix D: Resources and Terms

- Resources (p. 1)
- Glossary of Terms and Abbreviations (p.2)



1. Executive Summary

The San Diego Regional Plug-in Electric Vehicle (PEV) Readiness Plan (Readiness Plan or Plan) was developed to support the growing market of PEVs in the San Diego region by enabling municipalities and others to address and resolve challenges of deploying charging infrastructure, referred to as electric vehicle supply equipment (EVSE). While San Diego is already recognized as a national leader in plug-in electric vehicle adoption, with more than 7,000 PEVs on the road and over 500 publicly available charging stations, significant barriers remain as the PEV market continues to expand and evolve within the region.

Multiple stakeholders, including public agencies, property owners and charging station manufacturers, coordinated within the Regional Electric Vehicle Infrastructure (REVI) working group, helped shape and inform the ideas presented in the Plan. The Plan provides background and analysis of the San Diego PEV market and assesses areas in which local governments, workplaces and residents can more easily adopt and better prepare for PEVs and charging infrastructure in the region.

Region-specific fact sheets and educational resources have also been developed and added to the Plan. These materials complement the Plan and can serve as stand-alone resources available to members of the community, municipal staff and other stakeholders. Importantly, these fact sheets highlight recommended solutions to reducing several of the following barriers identified for the San Diego region:

- Lack of Public Knowledge of PEV and EVSE (page 12)
- Regional Planning for Public EVSE Siting (page 20)
- PEVs in Government Fleets (page 23)
- Public Agency EVSE Installations (page 24)
- EVSE Permitting/Inspection (page 24)
- EVSE at Multi-Unit Dwellings (page 26)
- Commercial and Workplace Charging (page 26)
- Zoning and Parking Rules (page 28)
- Building Codes (page 29)
- Training and Education for Municipal Staff and Electrical Contractors (page 30)
- On-Peak Charging and TOU Utility Rates (page 32)

The Plan identifies the complexities behind each barrier and provides guidance for municipalities to address these complexities, educate constituents and streamline permitting and other regulatory policies. Regional and statewide examples are provided throughout the document as model ways to overcome these barriers.

Regional barriers to EVSE deployment, as well as key recommendations to address them, are presented in Section 7 and are divided into three main areas: Regional Planning for Public EVSE Siting, Permitting Issues, and Utility Solutions.

Regional Planning for Public EVSE Siting (pages 20-24) discusses ways in which municipalities can better optimize where charging stations should be located, how to provide public charging for their communities and how to integrate PEVs into a public agency fleet.

Permitting Issues (pages 24-31) discusses the steps and considerations for different charging installations, including single family residences, multi-unit dwellings, commercial locations and the workplace. In addition, it provides local governments with guidance to facilitate PEV charging infrastructure through zoning and building code updates. Finally, it summarizes resources available to first responders and local government staff related to safety training, accessibility issues and electrical service requirements.

Utility Solutions (pages 31-33) addresses the utility's role in planning for PEVs in a community. This section identifies ways to minimize grid impacts and explains how consumers can take advantage of special electricity rates for PEV charging.

Projections show the number of PEVs in California will reach 500,000 between 2018 and 2020. As a result, local governments should begin preparing now for this shift toward electric driving through the strategies presented in the Plan.

2. Introduction

Between 2011 and 2013, over 50,000 PEVs were sold in California. The San Diego region is recognized as a national leader in the adoption of these vehicles with more than 7,000 PEVs and about 500 publicly available charging stations.

As the PEV market expands, the San Diego region benefits in a number of ways: PEVs help improve air quality, save consumers money, reduce greenhouse gas emissions, and foster new companies to grow and create jobs. As more San Diegans purchase PEVs, a robust regional charging infrastructure network will be necessary for supporting this growing market. Building this infrastructure in the San Diego region requires a coordinated effort among local governments, the contractor community, businesses, residents, and the local utility.

The San Diego Regional Plug-in Electric Vehicle Readiness Plan is part of a statewide effort to prepare local governments for the deployment of PEVs. The Plan builds on national efforts to promote regional PEV readiness, including a PEV readiness plan for the San Diego region developed in 2011-2012.¹ Following this national effort, the California Energy Commission (Energy Commission) provided funding to nine California regions with the goal of creating regional infrastructure working groups and creating local regional infrastructure plans.²

The San Diego PEV Readiness Plan identifies barriers to the deployment of PEV charging infrastructure and includes recommendations and resources for public agencies, property owners, consumers and other stakeholders to overcome those barriers. The Plan is a resource for local government officials to assist them in preparing their local governments for a growing PEV market.

¹ In early 2011, the U.S. Department of Energy (DOE) Clean Cities Program funded 16 grants for PEV readiness planning in communities in 24 states. The South Coast Air Quality Management District (SCAQMD) was awarded a \$1 million grant, with the majority of the funding distributed to six regional entities across the state including Greater Los Angeles, the Bay Area, Sacramento, San Joaquin Valley, Central Coast and San Diego. Each region produced a PEV readiness assessment report that evaluated the current PEV "readiness" of the local governments within each of those regions.

² The nine regions include Greater Los Angeles, Bay Area, Sacramento, San Joaquin Valley, Central Coast, San Diego, Coachella Valley, Monterey Bay and Northern California. Each region received \$200,000 for a two-year period (March 2012-March 2014).

2.1 Why Develop This Plan?

There are a number of factors that motivated the development of this Plan. As the following list shows, the State of California has established multiple legislative directives to encourage PEV adoption. Regionally, the San Diego Association of Governments (SANDAG) has identified a number of actions for implementation within the 2050 Regional Transportation Plan and Sustainability Communities Strategy (2050 RTP/SCS) that support these directives. In addition, the rapid growth of the market, especially in the San Diego region, and the real need for local governments to support this growth was also a strong catalyst for coordinating this Plan.

Legislation

The State of California has taken steps to expand and support the adoption of zero emissions vehicles (ZEVs) and the deployment of charging infrastructure throughout the state. Following is a list of some of the legislation guiding California's PEV market.

California's ZEV Regulation: First adopted in 1990 by the California Air Resources Board (ARB), the ZEV Regulation requires car manufacturers to produce a proportional number of ZEVs and advanced technology vehicles to total sales volumes in California. As part of California's Advanced Clean Cars Program, the requirement for ZEVs was amended in 2012 to represent 15% of all new cars sold in California by 2025.

Assembly Bill 118 (Nuñez, Chapter 750, Statutes of 2007): Provides \$1.4 billion through the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) for clean vehicles and their associated infrastructure from 2008 to 2015, which enables the state's vehicle rebates for ZEVs, infrastructure and grants for ZEV-technology companies.

Assembly Bill 8 (Perea): Extends programs aimed at reducing auto emissions in California to 2024, including the Alternative and Renewable Fuel and Vehicle Technology Program, the Air Quality Improvement Program, the Enhanced Fleet Modernization Program and the Carl Moyer Memorial Air Quality Standards Attainment Program.

Assembly Bill 1092 (Levine): Requires the California Building Standards Commission and the Department

of Housing and Community Development to develop standards for electric vehicle charging infrastructure in multifamily housing and nonresidential developments.

Executive Order B-16-2012 (March 2012): Governor Brown's Executive Order calls for 1.5 million ZEVs on California roadways by 2025 and directs the state government to purchase ZEVs. This establishes a goal of 10% of state departments' light-duty fleet purchases be ZEVs by 2015 and 25% by 2020.

The California Plug-in Electric Vehicle Collaborative maintains a list of PEV relevant policies and legislation available at <http://www.pevcollaborative.org/current-california-pev-policy>.

SANDAG

The San Diego Association of Governments (SANDAG) has demonstrated the importance of regional planning and infrastructure development for electric vehicles and charging stations through some of the following approved actions.

The 2050 RTP/SCS includes a number of actions for implementation including providing a forum for regional planning and infrastructure development of PEV chargers and coordinating stakeholders to discuss and mitigate potential impacts to the electric grid from the increase of electric vehicles in the region.

The recommended air quality policy actions in the Regional Comprehensive Plan (RCP) identified the implementation of programs and needed infrastructure to increase the availability and usage of energy-efficient vehicles such as hybrid electric vehicles, battery electric vehicles or those that run on alternative fuels.

The transportation fuels section of SANDAG's Regional Energy Strategy describes alternatives to petroleum-based fuels, funding available to support the advancement of alternative fuels and regional planning for the siting of fueling and charging infrastructure.

Regional adoption

The San Diego region is a leader in PEV adoption. The demand and integration of PEVs into the lifestyles of numerous residents and business owners highlights the shared desire and commitment by people in the region to expand the PEV market.

3. The San Diego Regional Electric Vehicle Infrastructure (REVI) Working Group and Stakeholders

3.1 Background and Purpose

In February 2012, SANDAG established the Regional Electric Vehicle Infrastructure (REVI) Working Group with funding awarded by the California Energy Commission. One of the primary functions of the REVI was to develop a regional readiness plan that identifies, reduces and addresses regional barriers to the deployment of private and public PEV charging infrastructure. The working group builds on previous PEV readiness efforts dating back to 2009.³ REVI was officially established in March 2012 and continued through December 2013. During this time, REVI members discussed and addressed barriers to PEV infrastructure deployment.

3.2 Organization and Stakeholder Engagement

San Diego REVI working group members included representatives from local and regional public entities, nonprofit organizations, utilities, universities and community colleges, labor union representatives, contractor associations and the business community. All REVI meetings were open to the public.

Each of the 19 jurisdictions in San Diego County was invited to participate as a REVI advisory member. SANDAG's six subregions were asked to provide one voting member each from North County Coastal, North County Inland, East County, South Bay, the City of San Diego and the County of San Diego. A complete list of REVI members and advisory members is available as Appendix A of this document.

³ The EV Project, funded by the Department of Energy, provided subsidies for public and residential charging equipment and installations in the San Diego region. As of September 2013, more than 1,400 residential and nonresidential charging units had been installed under the project.

3.3 Regional Barriers to PEV Infrastructure

The REVI identified the following barriers to PEV infrastructure deployment, identified in the table below. The table also lists the relevant sections of the Plan and the fact sheets and resources developed by the REVI for each barrier.

Table 3.1: Regional Barriers to PEV Infrastructure

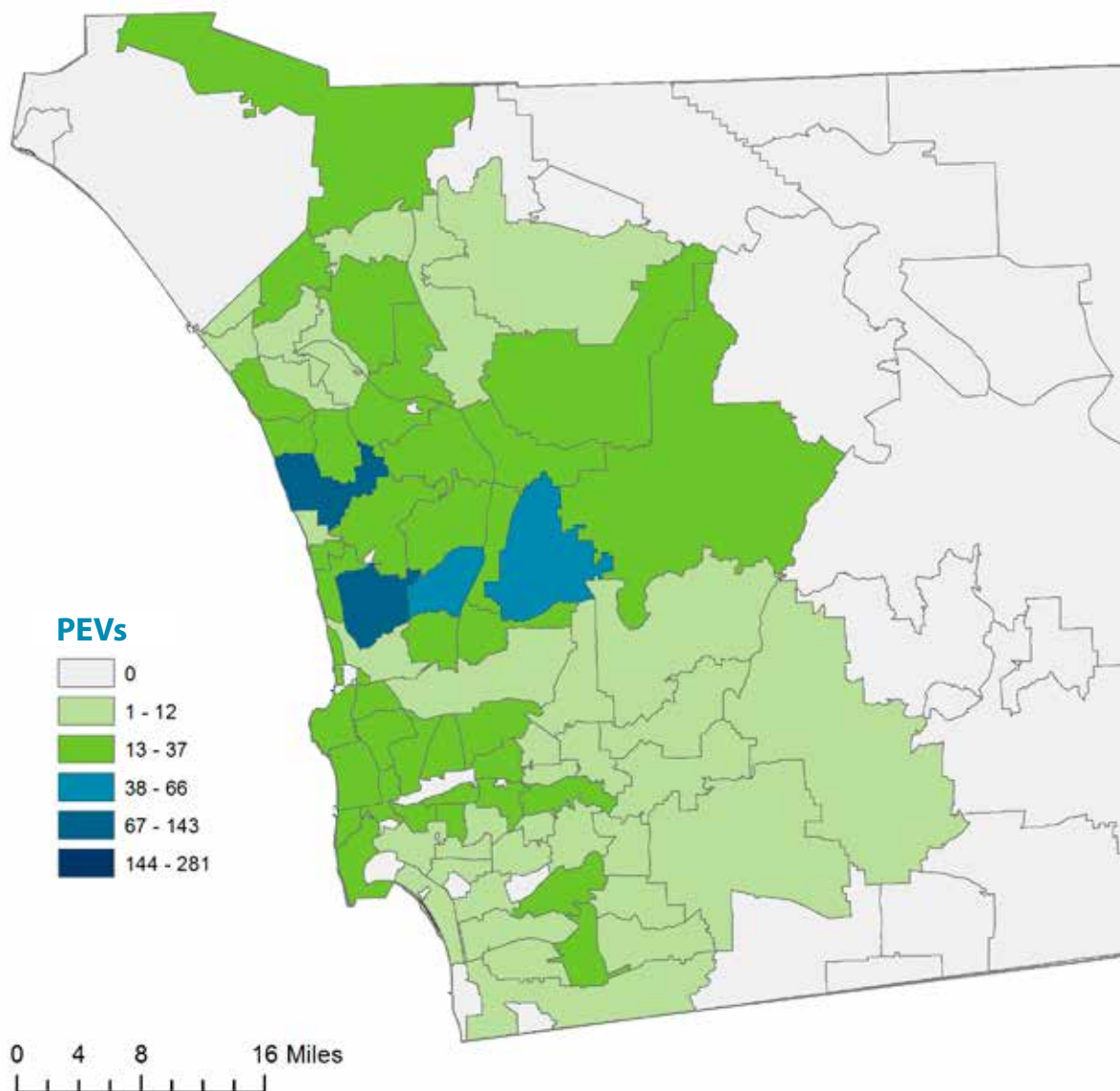
Barrier	Description	REVI Tools and Resources
Lack of Public Knowledge of PEV	Municipal outreach to local residents and businesses	<p><u>Section:</u> The Basics of Plug-in Electric Vehicles and Charging Infrastructure (Page 12)</p> <p><u>Fact Sheet:</u> <i>Plug-in Electric Vehicles & Charging: Getting Started</i> (Appendix B, Page 1)</p> <p><u>Resource:</u> <i>San Diego Regional Clean Cities Coalition Dealership Outreach Pamphlet</i> (Appendix C, Page 22)</p> <p><u>Resource:</u> <i>CCSE Guide to Plug-in and Get Ready</i> (Appendix C, Page 26)</p>
Regional Planning for Public EVSE Siting	Regional land use and transportation plans serve as a basis to identify optimal public EVSE sites	<p><u>Section:</u> Regional Planning for Public EVSE Siting (Page 20)</p> <p><u>Fact Sheet:</u> <i>Regional Planning for Public Charging in San Diego</i> (Appendix B, Page 4)</p>
PEVs in Government Fleets	Procurement justification needed for local public fleets; need to describe PEV benefits, including role in reducing municipal GHGs for Climate Action Plans	<p><u>Section:</u> Regional Planning for Public EVSE Siting: PEVs in Local Government Fleets (Page 23)</p> <p><u>Fact Sheet:</u> <i>Resources for Fleet Managers in San Diego</i> (Appendix B, Page 6)</p>
EVSE Permitting/ Inspection	Lack of streamlined permitting and inspection processes and inconsistent (high) costs across jurisdictions	<p><u>Section:</u> Permitting for EVSE (Page 24)</p> <p><u>Fact Sheet:</u> <i>Electric Vehicle Charging Station Installation Guidelines: Residential and Commercial Locations</i> (Appendix B, Page 14)</p>
Public Agency EVSE Installations	Contracting issues have stalled many public agencies from taking part in EVSE installations	<p><u>Section:</u> Regional Planning for Public EVSE Siting: Public Electric Vehicle Charging Stations (Page 24)</p> <p><u>Resource:</u> <i>Request for Proposals Template: Installation and Operation of Electric Vehicle Charging Stations</i> (Appendix C, Page 16)</p> <p><u>Resource:</u> <i>Electric Vehicle Charging for Regional Park-and-Ride Lots and Transit Stations</i> (Appendix C, Page 27)</p>
EVSE at Multi-Unit Dwellings	Consumer lack of knowledge regarding EVSE installation in these buildings; need to educate and work with HOAs to identify and find solutions to unique building challenges	<p><u>Section:</u> Permitting for EVSE: Charging at Multi-Unit Dwellings (Page 26)</p> <p><u>Fact Sheet:</u> <i>Charging at Condos, Apartments and Community Living Areas</i> (Appendix B, Page 8)</p>

Commercial and Workplace Charging	Lack of understanding regarding benefits and approaches to understanding workplace charging	<p><u>Section:</u> Permitting for EVSE: Charging at Commercial and Public Sites (Page 26)</p> <p><u>Fact Sheet:</u> <i>Workplace Charging for Businesses in San Diego</i> (Appendix B, Page 10)</p> <p><u>Resource:</u> <i>San Diego Regional Nonresidential Charging Infrastructure Study</i> (Appendix C, Page 39)</p>
Zoning and Parking Rules	Lack of standard regional ordinances that facilitate the installation and access to publicly available charging infrastructure	<p><u>Section:</u> Permitting for EVSE: Zoning and Parking Policies (Page 28)</p> <p><u>Resource:</u> <i>San Diego REVI Comments on Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices</i> (Appendix C, Page 1)</p>
Building Codes	Lack of standard building codes that accommodate charging infrastructure or dedicated circuits for charging infrastructure in new construction and major renovations	<p><u>Section:</u> Permitting for EVSE: Building Code Changes (Page 29)</p> <p><u>Resource:</u> <i>Building Codes Summary</i> (Appendix C, Page 29)</p>
Training and Education for Municipal Staff and Electrical Contractors	Lack of knowledge about PEVs and EVSE	<p><u>Section:</u> Permitting for EVSE: Education and Outreach (Page 30)</p> <p><u>Fact Sheet:</u> <i>Resources for Public Agencies in San Diego</i> (Appendix B, Page 2)</p> <p><u>Fact Sheet:</u> <i>Resources for Electrical Contractors in San Diego</i> (Appendix B, Page 12)</p> <p><u>Resource:</u> <i>San Diego Plug-in Vehicle Community Seminar: The Electric Vehicle Infrastructure Training Program (EVITP) Summary</i> (Appendix C, Page 34)</p> <p><u>Resource:</u> <i>Towing Alternative Fuel Vehicles Presentation Summary</i> (Appendix C, Page 32)</p>
On-Peak Charging – TOU Utility Rates	<p>A. Need to discourage charging when electricity supplies are in high demand and cost more; support of time-of-use (TOU) pricing</p> <p>B. High demand charges that impact EVSE host utility bills; expensive metering options to access TOU rates</p>	<p><u>Section:</u> Utility Solutions (Page 31)</p>

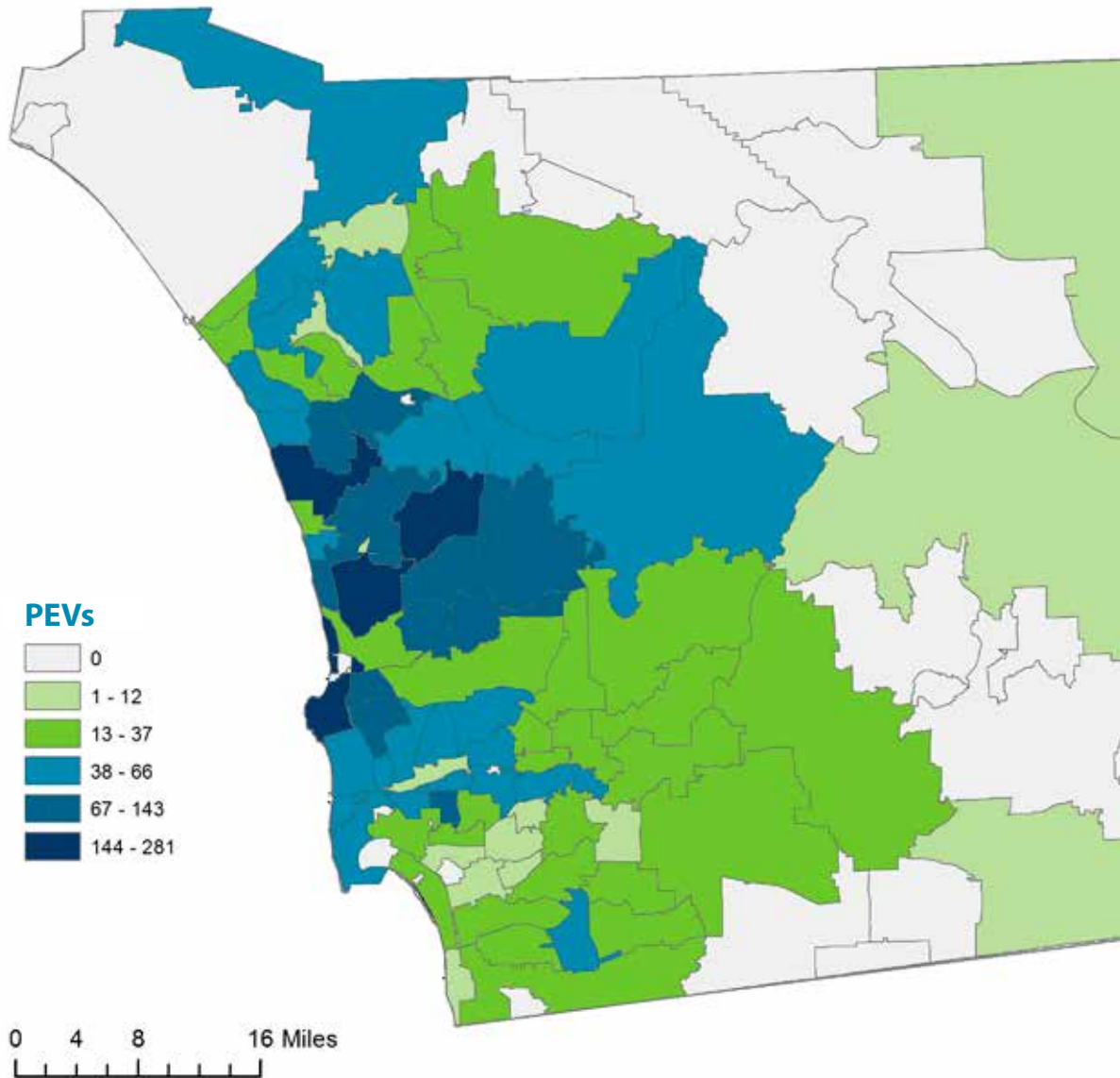
4. PEVs and Public Charging Infrastructure in the San Diego Region

The following maps illustrate the growth of the PEV market in the San Diego region between February 2012 and September 2013.

Map 4.1: San Diego Regional PEV Adoption, February 2012



Map 4.2: San Diego Regional PEV Adoption, September 2013



As of October 2013, there were more than 7,000 PEVs in the San Diego region.

The growth of the PEV market in San Diego, as with the natural growth of the overall market, has been enabled by the expanding availability of models offered by

manufacturers. Table 5.1 shows commercially available vehicles beginning from 2009 to September 2013.

Before 2010, there was only one PEV on the market, the Tesla Roadster. Now there are more than 16 PEV models available.

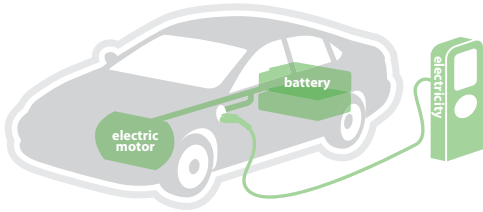
5. The Basics of Plug-in Electric Vehicles and Charging Infrastructure

5.1 Vehicle Types

There are two main types of PEVs: battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).

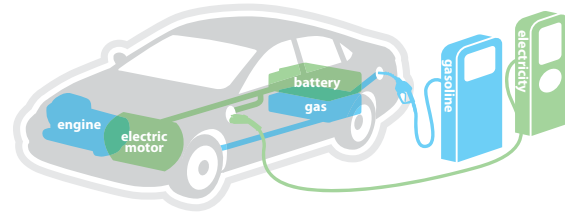
BEVs are fueled entirely by electricity stored in the onboard battery. They are often referred to as zero-emission vehicles. BEVs typically have a range of 70-90 miles on a single charge; however, one vehicle on the market, Tesla Model S, has a single-charge range exceeding 220 miles.

Figure 5.1: Battery Electric Vehicle



PHEVs are fueled by both a battery and another fuel source, usually a gasoline-powered internal combustion engine. These vehicles run on electricity from the onboard battery until the battery is exhausted and then switch to an alternate power source. PHEVs typically have a much shorter electric range than fully electric BEVs, and a standard wall outlet may be sufficient for overnight charging.

Figure 5.2: Plug-in Hybrid Electric Vehicle



The following table includes most of the available light-duty PEVs on the market as of October 2013.

Table 5.1: Commercially Available Light-Duty PEVs

Year	BEV	PHEV
2009	Tesla Roadster*	
2010	Nissan LEAF, Th!nk City EV*	Chevrolet Volt
2011	Fisker Karma*, Smart Fortwo Electric Drive, Coda EV*, Mitsubishi i-MiEV, Wheego LiFe*	
2012	Ford Focus Electric, Azure Dynamics/Ford Transit Connect, Honda Fit EV, Tesla Model S, Toyota RAV4 EV	Toyota Prius Plug-in Hybrid, Ford C-MAX Energi
2013	Scion IQ EV, Chevrolet Spark EV, Fiat 500e, Cadillac ELR	Ford Fusion Energi, Honda Accord Plug-in Hybrid, Porsche Panamera PHEV

*Vehicle is no longer in production

For a complete list of currently available vehicles go to: www.goelectricdrive.com

5.2 Charging Infrastructure

The following table describes the three types of vehicle charging available in relation to the number of miles of range per hour of charge and where such charging opportunities may be found. The time needed to charge a PEV depends on factors such as the size of the battery,

the battery's initial state of charge, the size of the onboard charger and available power from the charging station.

In general, BEVs have a larger battery compared to PHEVs. Both the onboard charger and available power from the charging source determine the vehicle's specific rate of charge.

Table 5.2: Levels of Charging and Miles of Range

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

* Refer to vehicle specifications for exact ratings.

Source: Adapted from PEV Collaborative MUD Guidelines



Types of charging equipment

Level 1 charging infrastructure consists of a charging cord set provided as standard equipment with every plug-in vehicle. This charging cord can plug into any standard 120-volt outlet.

Level 2 charging infrastructure is a designated unit that plugs into or is hardwired into a 208-/240-volt circuit. Level 2 charging consists of a dedicated charging unit, which is often referred to as electric vehicle supply equipment (EVSE). Following is a table that lists the most common types of Level 2 installation styles.



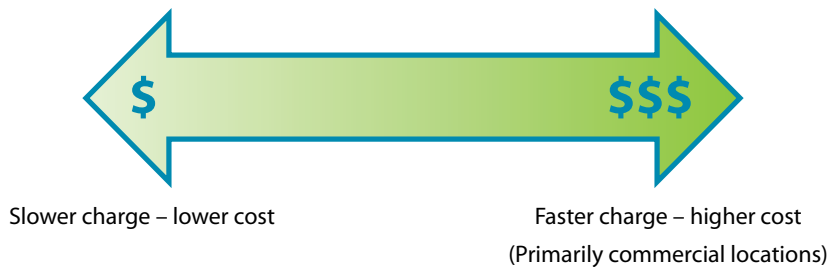
Table 5.3: Level 2 Installation Styles

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

The Electric Drive Transportation Association, a U.S. industry association, maintains a website of more than 40 UL-certified EVSE at <http://goelectricdrive.com/index.php/find-an-ev-charger>. EVSE manufacturers may also provide a contact list of certified contractors for installing charging equipment.

Typically, the least expensive charging infrastructure is the slowest to charge. Conversely, the fastest to charge can be the most costly to install. There are many reasons for the disparity in charging station costs, primarily location, construction and permitting requirements and electrical capacity on-site (spectrum illustrated).

Figure 5.3: Charging Installation Cost Spectrum



Finding public charging infrastructure

Drivers typically utilize websites or mobile applications to locate public charging stations. PEV drivers can find these charging locations by using several online sources.

Table 5.4: Finding Public Charging Infrastructure

Charging Infrastructure Source	Description	Website
Alternative Fuels Data Center Station Locator	Displays hours of availability and number of charging units per site. Allows end users to add new stations.	http://www.afdc.energy.gov/locator/stations
Plugshare	Available online or by a mobile application. Users can leave reviews on public chargers and have their own residential chargers displayed on the map.	http://www.plugshare.com
Recargo	Available online or by a mobile application.	http://www.recargo.com/search
CarStations	Drivers can filter their search by charger type or brand. Available online or by a mobile application.	http://www.carstations.com

Additionally, each charging network (i.e., Blink, ChargePoint, eVgo, etc.) has its own web-based or mobile application to help its members find network-specific charging locations.

Access to public charging infrastructure

Many publicly available charging stations require membership cards to access the charging equipment that are paid for through monthly or yearly subscriptions. ChargePoint and Blink are examples of service vendors that require memberships to gain access to their charging network. Usually, each charging station is host to only one service network.

Some networks are working together to offer cross-network usage. One example is CollaboratEV, an effort to unite the nation's two largest charging networks, ChargePoint and Blink.

Open standards for EVSE can eliminate the need for using proprietary charging hardware. Open Charge Point Protocol (OCPP) is a communication protocol between the charging station hardware and charging networks that would enable a PEV driver to charge at any charger using any network's membership card.

Locations of public charging stations in the San Diego region

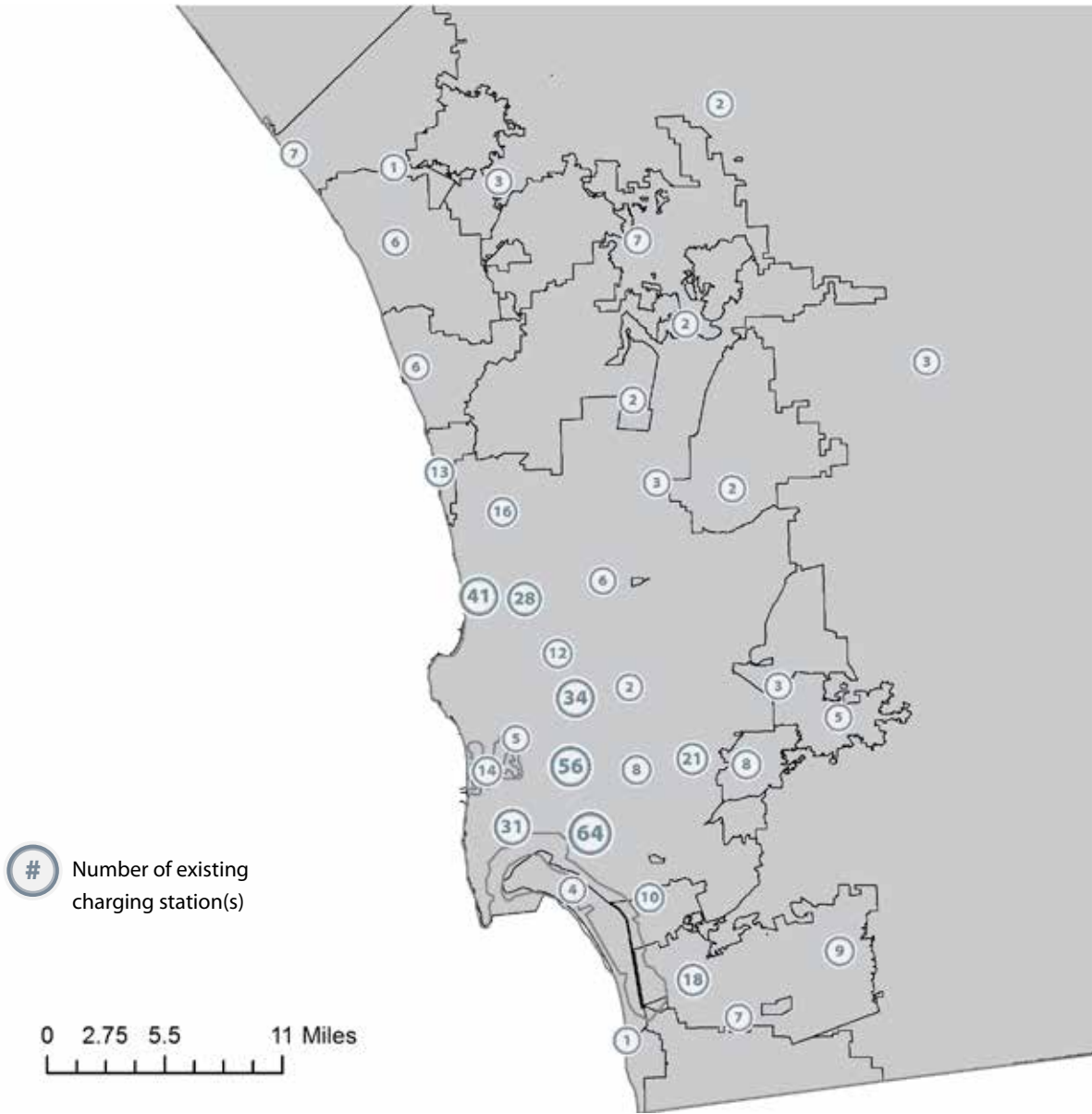
As of October 2013, there are 455 public Level 2 charging sites, four public DC Fast Chargers and two Level 1 charging sites serving the San Diego region.

The following map reflects EVSE clusters in the San Diego region. Two of the densest clusters are in Carmel Valley/ Mira Mesa and Central San Diego. More detailed maps of each cluster are included.

“I see my [Chevrolet] Volt as a starter car on my journey to a 100% electric vehicle, powered by renewable energy. While I learn to work with the constraints of driving an EV, I don’t have to worry about range anxiety and I’m still offsetting some emissions while I’m at it.”

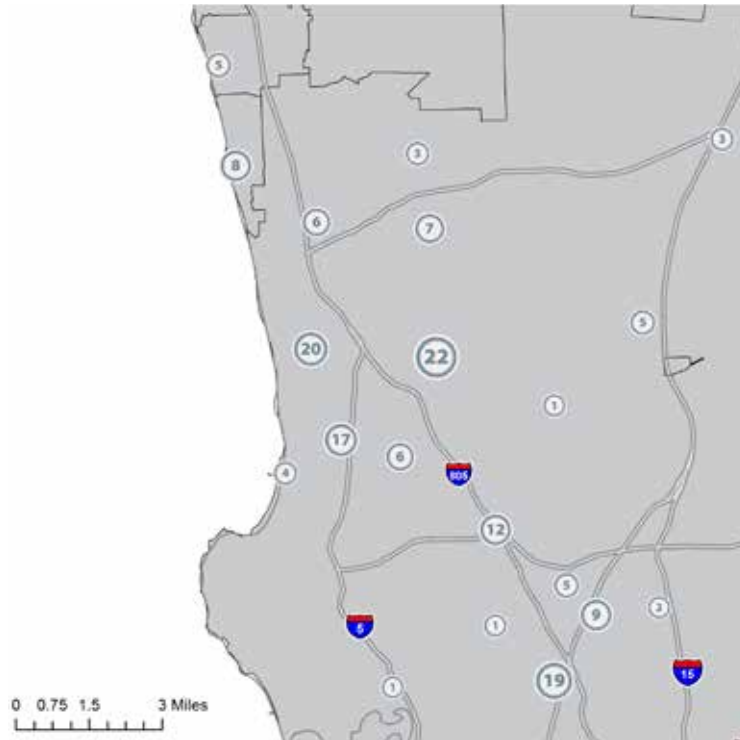
– Nicole Borunda, California Center for Sustainable Energy

Map 5.1: EVSE in the San Diego Region

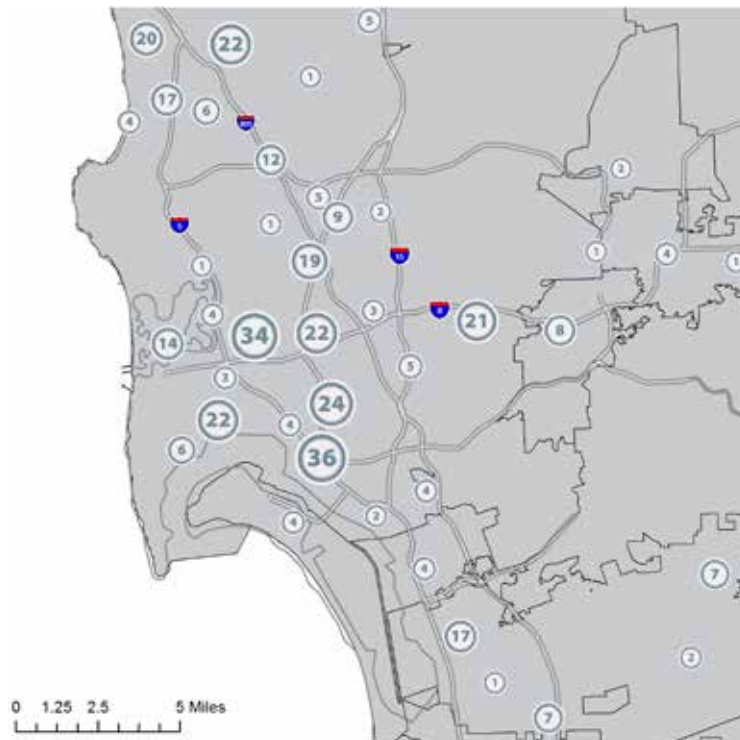


Source: Alternative Fuels Data Center, DOE

Map 5.2: Carmel Valley/Mira Mesa EVSE Cluster



Map 5.3: Central San Diego EVSE Cluster



6. Regional Plug-in Electric Vehicle Infrastructure Existing Conditions

PEV infrastructure in the San Diego region expanded rapidly between 2012 and 2013 with local governments, homeowners, multi-unit property managers and local businesses playing a critical role.

6.1 Local Governments

Local governments continue to influence rates of PEV adoption and infrastructure expansion, primarily through planning efforts or regulatory compliance, such as activities or measures to reduce greenhouse gas emissions (Climate Action Plans) or as steps taken to achieve a green certification for a facility.

“In November 2011, the City of San Diego launched a car share pilot program with a fleet of 300 all electric vehicles. The all-electric car sharing pilot program offers a range of environmental and economic benefits to the City. The pilot program provides an affordable alternative to vehicle ownership and help reduced traffic congestion, vehicle emissions, parking demand and also provides a last-mile alternative solution for short trips that are not feasible using public transit.”

– Jacques Chirazi, City of San Diego

As regional and local land use planning, design criteria development and greenhouse gas (GHG) emissions reduction plans are developed, PEVs continue to be integrated into these efforts in a number of different ways. This integration has resulted in building permit streamlining, training for staff and installations of public charging stations. Stakeholders in the San Diego region have worked collaboratively to leverage resources and

opportunities to better understand and overcome challenges to PEV adoption and EVSE installations.

Local governments can facilitate EVSE installations in several ways. First steps include continuing to improve and streamline building permit processes and integrating EVSE installations, prewiring for installation into public projects and identifying issues in zoning codes that may deny public EVSE installations.

Public agencies can also help disseminate and distribute available training and collateral informing staff, contractors, property owners and residents of existing opportunities. As infrastructure becomes increasingly available for use and as permitting time and permit costs are reduced, PEV adoption will continue to grow. Therefore, local governments play a critical role in PEV adoption.

6.2 Single Family Residences

Charging behavior studies clearly indicate that most PEV drivers charge their vehicles at home.⁴ Many PEV drivers with single family homes will find a standard household outlet (120 VAC) available for charging near where their vehicle will be parked. However, some PEV owners install a dedicated Level 2 (240 VAC) EVSE to charge their vehicle. The installation of a Level 2 charger requires a permit from the local jurisdiction and San Diego Gas & Electric (SDG&E) notification.

Expediting the EVSE permitting and installation process for homeowners and approving new construction projects with infrastructure already in place will help to reduce barriers to home charging and will further PEV adoption. Training and information tailored for homeowners is also essential to easing concerns and informing PEV drivers.

6.3 Multi-Unit Dwellings

Multi-unit dwellings, or MUDs, continue to present barriers to PEV drivers. As noted, most drivers charge their PEVs at home; however, MUDs offer a unique set of challenges. Shared utilities, parking designations or restrictions, as well as design and infrastructure hurdles, make EVSE installations more complex.

⁴ California Plug-in Electric Vehicle Driver Survey Results – May 2013. Clean Vehicle Rebate Project, California Center for Sustainable Energy.

“San Diego Gas & Electric offers workshops to local multi-unit dwelling property managers and owners and provides them a roadmap with the most efficient way to install electric vehicle charging for their residents. With more than 50 percent of the San Diego region living in multi-unit dwelling communities, San Diego Gas & Electric has worked with the California Plug-in Electric Vehicle Collaborative to develop a set of guidelines, surveys and templates for property managers and owners to install charging more efficiently.”

– Joel Pointon, SDG&E

SDG&E has worked with local property managers and MUD PEV drivers to establish best practices, offer workshops and develop case studies of successful local MUD EVSE installations and serves as the co-chair (Joel Pointon) for the California PEV Collaborative MUD Working Group.⁵

The California PEV Collaborative, a multi-stakeholder public-private partnership, is working together to ensure a strong and enduring transition to a PEV market in California, has recently completed the *Plug-in Electric Vehicle Charging Infrastructure Guidelines for Multi-unit Dwellings (Guidelines)*.⁶ The Guidelines include MUD resources and best practices pooled from around the state.

6.4 Workplace, Retail and Public Locations

PEV drivers can be limited to the range of their vehicle. Although most veteran PEV drivers are aware of their vehicle’s range, others experience range anxiety, which can hinder their decision to purchase a PEV or make them less likely to drive one they have purchased. A number of

local retailers, workplaces and public destinations now have EVSE available to their customers, employees and the public. Expanding charging options for PEV drivers will continue to play a critical role in broadening the range and number of PEV owners.

EVSE installations at workplace, retail and public locations will continue to expand the existing charging network and give PEV drivers options similar to those available to drivers of traditional vehicles. Local governments, SDG&E, contractors, businesses and property owners continue to work together to address installation barriers. Contractor and business owner training, education and outreach continue to be crucial to making the decision to install EVSE. Permitting processes, construction and electricity costs are also concerns for local business owners and can impede EVSE installations. One way local governments can help is to provide infrastructure on public property for employees and customers as a means to lead by example and to fill gaps in the charging network.



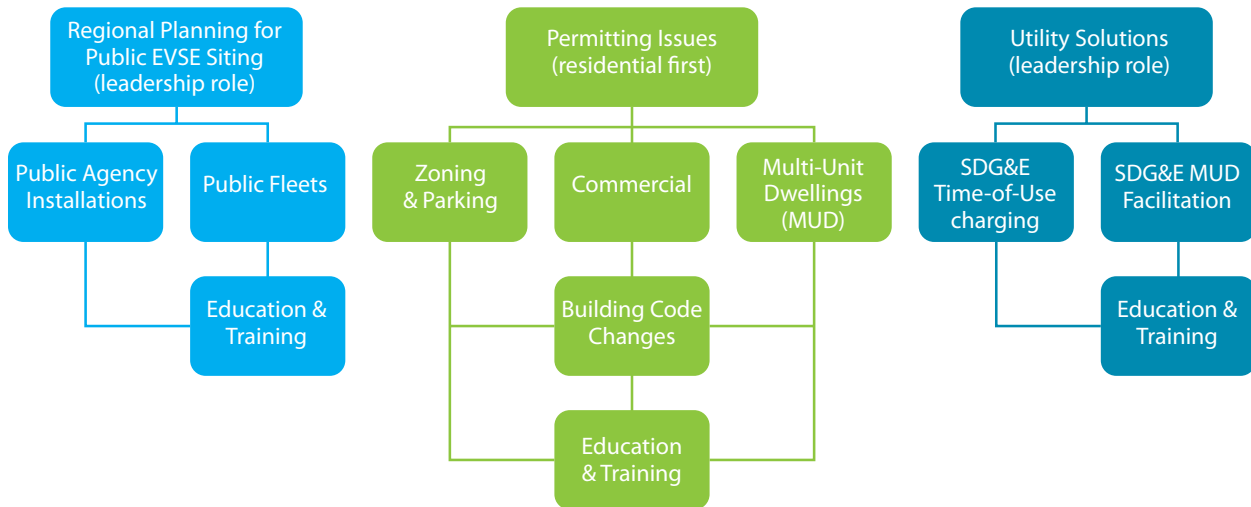
5 <https://www.sdge.com/sites/default/files/documents/998399698/02-20-12%20Multi-unit%20Dwelling%20Case%20Study%20-%20City%20Front%20Terrace.pdf?nid=5346>

6 http://www.pevcollaborative.org/sites/all/themes/pev/files/MUD_Guidelines.pdf

7. Regional Barriers to EVSE Deployment and Key Recommendations

Through earlier PEV planning and siting efforts (i.e., EV Project), several barriers had already been identified as obstacles to regional charging infrastructure installations and PEV adoption (see *Regional Barriers to PEV Infrastructure* section). The REVI defined these, discussed new or expanding barriers to PEV deployment and grouped the eleven barriers into three priorities categorizing complementary or parallel efforts together. The following flow chart illustrates this prioritization of the barriers, and this section defines the priority categories and the activities, resources and outstanding hurdles to addressing each of the barriers.

Figure 7.1: REVI Regional Barriers



7.1 Regional Planning for Public EVSE Siting

Overview

The EV Project established the first regional collaboration and planning effort to establish priorities for the installation of PEV charging infrastructure by forming a working group, the EV Project Stakeholder Advisory Committee (ESAC). It was able to produce infrastructure siting maps that guided the EV Project’s efforts for identifying the location for optimal public charging stations (*Regional Planning for Public Charging in San Diego* fact sheet is included in Appendix B, page 4).

The REVI has built upon the regional planning efforts initiated by the EV Project and identified challenges,

successes and outstanding issues for continued PEV adoption and EVSE deployment. Collaborative planning for regional charging infrastructure is necessary to establish a cohesive and interconnected charging network. Assessing priority siting locations, establishing optimal land use, access and understanding driving behaviors isn’t limited to the boundaries of a single city or public agency. Defining the needs and establishing ideal locations to support EVSE and benefit PEV drivers has to be done on a larger scale to be effective and functional.

Sharing lessons learned and EVSE installation best practices with other practitioners will help ensure broader access and expanded deployment of EVSE. For example, early adopters noted that strategically spacing chargers in a parking lot could offer increased access for multiple parking spaces to a single charge point, which reduces infrastructure and construction costs while optimizing resources and access.

The Electric Power Research Institute (EPRI) pyramid (Figure 7.2) illustrates charging priorities for PEV drivers and aligns with regional siting to date. The base of the pyramid shows that PEV drivers primarily charge at home; this is often the most reliable, comfortable and cost-effective option. Similar to other regions, San Diego has seen most of its infrastructure installed at residential locations.

“It’s a dream come true not to be putting gas or oil into my car.”

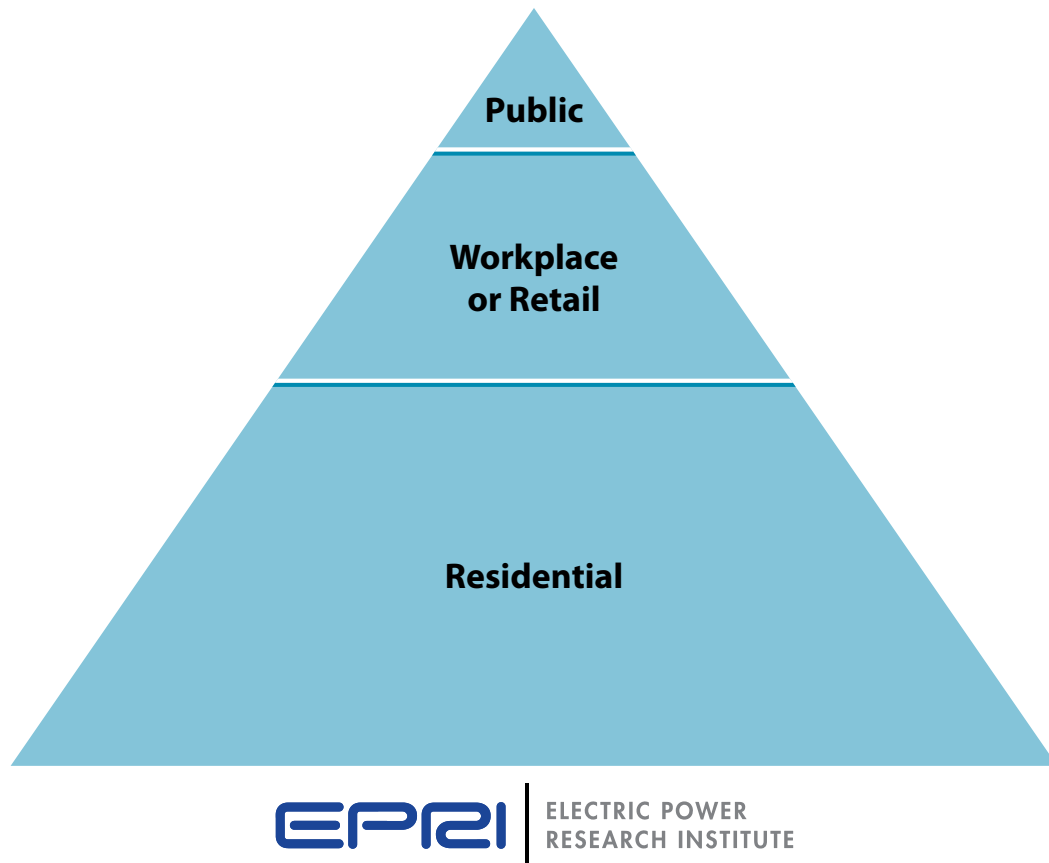
– New PEV Owner

Secondary to home, work is a very common driving destination. Workplace charging offers PEV drivers a reliable charging option during the workweek at a location already visited as part of their daily routine; charging at work won’t add new stops or change existing travel patterns, but does allow for more charging options. The

REVI has recognized the challenges and barriers associated with workplace and retail charging as identified by the EV Project and continues to work to facilitate more EVSE opportunities through new or innovative possibilities; often using local or statewide examples and resources.

Last, and most necessary, for continued PEV adoption is public charging infrastructure, which offers PEV drivers the same conveniences that traditional gas vehicle drivers have. Unfortunately, public charging faces the most barriers and is the least available charging option. However, efforts to make EVSE publicly available in more locations are moving forward and will help to reduce range anxiety and facilitate the transition to PEVs. Working together with other local public agencies has expanded the resources and experience available to address regional EVSE availability.

Figure 7.2: EPRI Charging Pyramid



Classifying local land use statistics for PEVs

Understanding local land uses and PEV driving habits helps to identify optimal locations for charging stations and the appropriate type of charging equipment (EVSE). Table 7.1 describes the different charging equipment and the type of venue or destination at which a PEV driver would use the charging stations.

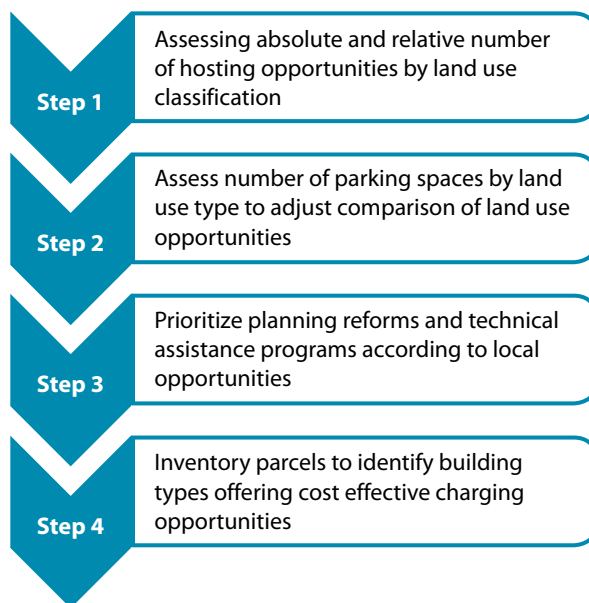
Table 7.1: Charging Priorities and Destinations

EVSE	User Profile	Typical Venues	Charging Time	Miles/Hour Charge
Level 1 (EVSE)	Parked for 6–8 hours	Street/Meters Parking Garages Cultural/Sports Centers Airport (long term)/Hotels	1–2 hours 2–10 hours 2–5 hours 8–72+ hours	3–4
Level 2 (EVSE)	Parked for 2–4 hours	Shopping Centers Airport (short term) Street/Meters Parking Garages Cultural/Sports Centers Airport (long term)/Hotels Highways & Commuting Roads	0.5–2 hours <1 hour 1–2 hours 2–10 hours 2–5 hours 8–72+ hours < 0.5 hours	8–20 (depending on vehicle onboard charger)
DC Fast Charging (DCFC)	Quick stop for 5–30 minutes	Shopping Centers Airport (short term) Highways & Commuting Roads	0.5–2 hours < 1 hour < 0.5 hours	50–60

Land use/parking analysis for EVSE

Parking requirements specific to individual land uses are established by local jurisdictions and often determined through a formula relative to the use or service being provided at the site and the size of the use in conjunction with state and federal mandates, such as those addressing accessibility. All of these factors are important to consider when assessing the potential parking availability for charging stations. The information in Figure 7.3 was developed by the UCLA Luskin Center and describes the steps in assessing parking opportunities for consideration in PEV land use planning.

Figure 7.3: Steps in PEV Land Use Assessment



Source: UCLA Luskin Center, Southern California PEV Readiness Plan

PEVs in local government fleets

The REVI has identified public fleets as having a critical role in the adoption of PEV technology. To support fleet managers and assist policy makers with this transition, REVI has developed tools to help guide agencies through the adoption process.

“One goal of the Port of San Diego’s Green Port Program is to reduce greenhouse gas contributions and other air emissions from Port operations. The EVs have been an important addition to the Port’s fleet, allowing the Port to evaluate the technology, reduce emissions and increase the number of clean, alternatively fueled vehicles that operate on Port tidelands. The EVs have also served as a valuable educational tool by actively engaging Port employees in emissions reduction efforts each time they drive.”

– Jenny Lybeck, Port of San Diego

Converting some or all of a public agency’s fleet to cleaner vehicles not only establishes best practices for vehicle replacement, but also helps local governments attain municipal GHG emissions reductions goals and strategies and helps encourage PEV adoption throughout the region. Institutions such as the Port of San Diego and the University of California, San Diego are leading by example; they are already replacing fleet vehicles with PEVs.

Switching to PEVs helps government fleets play an important role in meeting emissions reduction targets as established by Assembly Bill 23: *Global Warming Solutions Act* and climate mitigation targets in other policy documents such as the following:

- Climate Action Plans and other sustainability plans and goals include GHG reductions from municipal operations, which often entail targeting fleet emissions.
- SANDAG adopted the 2050 RTP/SCS pursuant to the Sustainable Communities and Climate Protection Act

of 2008 (SB375) that specifically targets GHG emissions from passenger vehicles. The 2050 RTP/SCS includes actions for increased use of alternative fuels in local government fleets as well as expanded charging infrastructure.

- The governor’s Zero Emissions Vehicle (ZEV) Action Plan also calls on local governments to increase PEV adoption in order to achieve transportation-related climate goals.

Despite the high up-front costs of PEVs and charging infrastructure, integrating PEVs into a fleet can actually save agencies money in long-term maintenance and fuel costs. Many financial incentives are also available to help offset the costs for PEVs, such as the Clean Vehicle Rebate Project (CVRP) and Hybrid Truck and Bus Voucher Incentive Project (HVIP). To establish whether the investment for PEVs is the best option for a fleet, it is important for fleet managers to consider carefully which vehicles fit their needs. This choice will depend on the following factors:

- Route predictability
- Distance travelled by each vehicle per day
- Vehicle maintenance and service costs
- Use of central parking facilities

Consideration of these factors can assure fleet managers that new PEV additions to their fleet will help optimize their operations and meet local government sustainability goals.

Public agency fleets should work with SDG&E to plan for PEV adoption and charging. The utility can help fleet managers determine charging speed and demand charge fees to keep costs down while meeting operation needs. SDG&E is also crucial for siting and installing EVSE for fleet charging. Placing EVSE strategically near electrical utility equipment can reduce installation costs and knowledge of the impacts from an increase in demand on local distribution equipment will ensure uninterrupted service.

The REVI developed a fact sheet that includes *Resources for Fleet Managers in San Diego* and is in Appendix B, page 6.

Public electric vehicle charging stations

Public charging stations and an integrated charging network are critical to regional PEV adoption. Reducing range anxiety and providing more opportunities for drivers to charge their vehicles will support increased PEV adoption rates. The REVI has identified the lack of available public charging stations as a barrier to regional EVSE deployment and PEV adoption. Local governments play a crucial role in expanding the regional charging network and in ensuring connectivity among major driving corridors.

Public EVSE installations have proven to be more challenging than originally anticipated by the EV Project. Infrastructure, electricity costs, accessibility, operation and maintenance needs have all hindered the installation of public EVSE.

The REVI developed an RFP template (see Appendix C, page 16) to aid local governments, public agencies and businesses with the procurement for installation and operation of electric vehicle charging stations. PEVs are an emerging technology to many agencies and San Diego's local governments are in varying stages of integrating PEVs into their fleets, planning or operational processes and facilities. By using the REVI-developed equipment specifications, contractor minimum qualifications and general scope of work, agencies can minimize efforts, reduce risk and liability to the agency and take advantage of consistent text vetted through other local agencies for the installation and maintenance of public charging stations.

In addition, electric vehicle time-of-use (EV-TOU) rates may be an option offered by SDG&E. By installing a separate electric meter, chargers may qualify for a specific electric rate for electric vehicle charging. A lower rate could make public charging stations more cost effective for the property owner.

Education and outreach

Public agency knowledge or understanding of PEVs has historically been limited. The REVI identified this as a barrier and developed a number of fact sheets as tools for local government staff as they begin to integrate PEV technology in their planning documents, building permitting processes and policy development. In addition to those already listed, fact sheets for *Getting Started*

and *Resources for Public Agencies in San Diego* have been included in Appendix B (pages 1 and 2).

7.2 Permitting for EVSE

Overview

The permitting process is very influential in encouraging or hindering EVSE installations. The San Diego region does not currently have a single, regional standard permitting process. Differences among local jurisdictional processes and requirements for electrical permits and building inspections were cited by the REVI as a barrier to EVSE installations.

After purchasing a vehicle, obtaining a permit for EVSE installation is often an owner's first step in establishing his or her PEV "ecosystem." Public and commercial sites desiring to host EVSE must also begin the installation process with permitting. To ensure that PEV installations are safe, cities and jurisdictions should provide information to businesses or organizations wishing to install EVSE and to all relevant permitting and building officials as needed. Easy access to information and guidance documents should be available through a website or handout.

Although much has been done to support streamlined permitting, inspection and installation processes for EVSE, there are still opportunities for further improvement. The REVI continues to support efforts for further streamlining permitting and installation processes.

The following section describes critical components of the permitting and installation processes as well as identifies opportunities to expand EVSE installations and best practices for specific charging situations.

Permitting EVSE installations at single family residences

PEV drivers primarily choose to charge their vehicles at home. Installing EVSE at a single family home most often requires a permit issued from the local permitting agency. Proper permitting helps to inform SDG&E of the additional electrical demand on local infrastructure and ensures the safety of the equipment.

The REVI has developed *Electric Vehicle Charging Stations Installation Guidelines: Residential and Commercial Locations* (Appendix B, page 14) as a resource and provides detailed information on the permitting and inspection process for single family EVSE installations.

It is important to note that there are often fees required when applying for a permit. PEV drivers should always check with the local permitting agency for specific permitting and inspection costs.

The following table outlines the documents usually needed in the permitting application process.



The permitting process for residential chargers in the San Diego region has been considerably streamlined since the early days of the EV Project. Most notably, the City of San Diego adopted Information Bulletin 187, *How to Obtain a Permit for Electric Vehicle Charging Systems* (May 2012), which includes an electronic E-permit, whereby the electrical permit can be issued online. The City of Oceanside also issued guidelines (January 2013) to assist permit applicants in streamlining the permitting, installation and inspection process for residential EV chargers. Both of these resources have been recognized as a regional best practice by the REVI and are included in the *Permitting and Installation Guidelines* fact sheet (Appendix B, page 16).

To date, San Diego and Oceanside are the only two jurisdictions in the region to develop this type of guidance and standardized permitting process. The lack of standard permitting requirements impedes the EVSE installation process for homeowners, electrical contractors and property managers. REVI has recommended that streamlined installation and inspection processes be adopted throughout the region.

Table 7.2: Documents for the EVSE Permitting Process

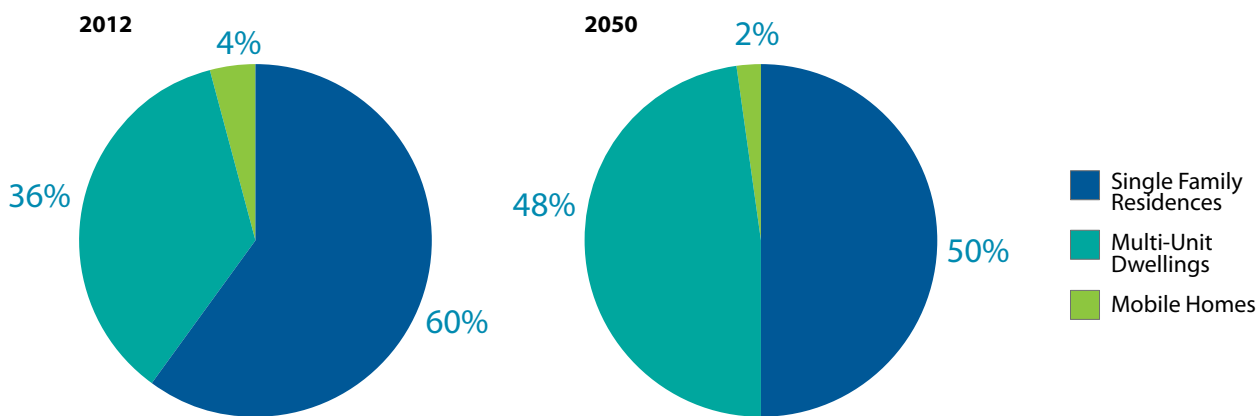
Documentation*	Description
Permit Application	Electrical permit or special permit for EV chargers (to be identified by jurisdiction)
EVSE Manufacturer’s Information	The manufacturer’s installation instructions and EV charger specifications
Site Plan	Identify the complete layout of existing parking space(s)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

* Documentation will be specific to each jurisdiction

Charging at multi-unit dwellings

Multi-unit dwelling (MUD) is a generic term for a spectrum of multi-unit residences including, but not limited to, apartment buildings, attached and detached housing units within a community, high-rise buildings, mobile home communities and others. In 2012, multi-unit dwellings made up 36% of the housing stock in the San Diego region. By 2050, SANDAG predicts this number will increase to nearly half of the housing stock. With roughly 80% of PEV charging taking place at home, reducing the barriers to installing EVSE at MUDs will be critical for supporting future PEV adoption.

Figure 7.4: San Diego Region Housing, 2012 and 2050



Barriers to EVSE at MUDs

Installing EVSE at MUDs presents a number of challenges. Table 7.3 summarizes barriers faced for EVSE installations at MUDs. Some of these barriers are being addressed directly through support from SDG&E, while others are challenges to be addressed on the customer side of the meter. SDG&E has been a leader in supporting MUD EVSE installations and in tackling utility-side barriers. The utility holds quarterly workshops on MUD EVSE installations, participates in statewide and national efforts on facilitating MUD charging and serves as a resource for property owners, local governments and residents.

The REVI has developed a fact sheet to help address barriers to EVSE installations at MUDs that are outside of the utility's role. This fact sheet is a resource for local governments that are assisting with the siting of EVSE at MUDs, residents, building managers, homeowner associations and apartment associations.

Charging at Condos, Apartments, and Community Living Areas fact sheet is in Appendix B, page 8.

Charging at commercial and public sites

While most PHEV and BEV charging happens at home and work, charging stations at commercial and public locations complement a driver's daily commute needs, offer flexibility in traveling and maximize electric miles driven. As PEVs become more prevalent, the demand for diverse EVSE options will increase. Some factors for consideration when determining the feasibility of providing chargers at commercial and public locations are detailed in the REVI *Workplace Charging for Businesses in San Diego* (Appendix B, page 10) and the *Electric Vehicle Charging Station Installation Guidelines: Residential and Commercial Locations* fact sheets (Appendix B, page 14).

Table 7.3: Barriers Facing EVSE Installations at Multi-Unit Dwellings

Barrier	Description
Cost	Installation costs can range anywhere from \$2,000 to \$10,000. A building that has sufficient panel capacity and an existing conduit running from the panel to the PEV parking space will likely only incur charging station, permit and electrician installation/assessment costs, resulting in a lower-cost installation. On the other hand, a building with limited panel capacity, no conduit and a parking space located a significant distance from the electrical panel will likely incur higher installation costs.
Power Supply	Transformers supplying power to multifamily buildings typically have 10% to 15% excess capacity, or overhead, which is enough to sustain a few electric vehicles. However, as PEV adoption grows and vehicles are equipped with higher charging loads, these transformers may be insufficient to handle wide-scale conversion to electric vehicles.
Proximity to Metering Equipment	Service panels for MUDs can be located at substantial distances from where the charging station is to be installed.
High-Rise Units	In downtown San Diego, meter rooms are often located on the upper floors of high-rise units and conduit space is limited. Challenges are faced in installing additional conduit and/or encountering physical limitations (e.g., drilling through concrete floors).
Parking	Parking is not standard across MUD building types. In some MUDs parking is bundled into the rent or sale price of the unit. In other buildings it is unbundled or paid for separately. Unbundled parking spaces can be assigned on a first-come, first-served basis, or they can be unassigned. A charging station tied to a bundled parking space could be added value to a future tenant; however, a charging station on an unbundled or unassigned spot may pose challenges for assigning costs to individual owners. Choice of spaces also must address issues with proximity to metering equipment as addressed above.
Electricity Rates and Meters for Common Areas	Parking garages/lots are typically on a common meter. This means electricity provided in parking garages and other common areas is paid by the property manager or homeowner association (HOA) and then billed to residents through HOA fees or rent. This creates a challenge in allocating charging costs to individual owners.
Homeowner Associations (HOAs)	HOAs cannot prohibit or restrict the installation of a PEV charging station. Senate Bill 880 codified this and other provisions for charging installations in common areas. However, HOA boards may still resist installations. Lack of information regarding charging station installations remain a significant barrier.

Following are some examples for publicly owned and retail EVSE sites where vehicles tend to be parked for an average of two hours:

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

“With my all-electric Nissan LEAF, I have enjoyed using many of the public charging stations in San Diego. They enable me to drive farther than my garage charging would allow, and are located in convenient places that I visit frequently. In addition, [SDG&E] also has workplace charging infrastructure that enables me to use my LEAF to drive to distant meetings and job sites, knowing that I can recharge back at the office in time to use my car for additional trips or errands after work. With these two options, my LEAF has turned into a very productive commuter vehicle that is ready for almost any driving scenario that I have.”

– Randy Schimka, SDG&E

The financial viability, motivations and benefits of hosting EVSE have been analyzed by the California Center for Sustainable Energy (CCSE) and documented in the *San Diego Regional Nonresidential Charging Infrastructure Study* (see Appendix C, page 39). Different business plans for public charging have been tested, but an accepted model has yet to be defined, therefore, permitting and installation of commercial and public charging sites remains a barrier to EVSE deployment.

Charging at the workplace

The San Diego region has a large and growing population of PEV drivers likely to require charging during the workday. Because the workplace is where they spend most of their time outside of the home, expanding workplace charging opportunities will allow commuters more flexibility and maximize electric vehicle miles traveled. Employers may consider several reasons for offering charging stations at work. The REVI developed *Workplace Charging for Businesses in San Diego* (Appendix B, page 10) as a resource for local businesses to use when assessing the potential for installing charging stations.

The choice to add workplace charging is often conflicted between the value proposition of wanting to provide charging as an employee benefit and the up-front and long-term costs associated with the stations. CCSE has developed a report assessing the value proposition for San Diego businesses to offer charging stations, *San Diego Regional Nonresidential Charging Infrastructure Study* (Appendix C, page 39). Documenting and sharing workplace charging experiences and lessons learned with regional stakeholders can help encourage other employers to offer workplace charging.

There are benefits to offering Level 1 EVSE at the workplace as a less expensive alternative to Level 2. Providing Level 1 charging requires less electricity and is ideal for a workplace, where drivers are usually parked for longer times. SDG&E is offering Level 1 charging as a pilot program to its employees.

Charging station installations

Workplace EVSE installations are primarily a cooperative effort. The California Plug-in Electric Vehicle Collaborative has developed the *Workplace Charging Communication Guide* (www.evcollaborative.org/communication-guides) as a communication tool. In addition, the REVI developed *Electric Vehicle Charging Station Installation Guidelines: Residential and Commercial Locations* with details for streamlining and understanding the EVSE installation process (Appendix B, page 14).

Standardized regionally recognized permit processes and procedures for commercial and workplace EVSE installations could reduce the time, costs and confusion associated with workplace charging. This is an opportunity for further consideration by the REVI.

Zoning and parking policies for PEVs

Zoning and parking policies help prescribe where and what types of development can occur within each jurisdiction and play a critical role in EVSE deployment. Parking requirements defined by individual zoning ordinances or existing developments offer challenges to property owners or project developers when trying to identify optimal charger locations and capacity for such stations. Often parking spaces are limited and can't be specified for PEVs only because of minimum parking requirements, accessibility or the opportunity cost of the parking space.

Zoning ordinances

Zoning ordinances offer an ideal mechanism for local governments to define opportunities for EVSE installations through development. Currently, none of the jurisdictions in San Diego County has mandatory EVSE development requirements. The REVI identified the need for statewide requirements to incorporate such language into local zoning ordinances.

The City of Los Angeles (Article 9, Division 4, 99.04.106.6 and Division 5, 99.05.106.5.3.1) and the City of Lancaster (Ordinance No. 958, 10.2.2) have adopted language addressing EVSE in their zoning ordinances and are used as examples by other jurisdictions for integration into their policies.

The California Governor's Office of Planning and Research has developed the *ZEV Guidebook* that provides information to local and regional governments, communities and residents about planning and infrastructure, permit streamlining, general plans and zoning, greening the fleet and incentives and outreach (http://opr.ca.gov/docs/ZEV_Guidebook.pdf).

Accessibility for PEV parking

The Americans with Disabilities Act (ADA) has specific access requirements to ensure that all drivers have access to parking and have presented a number of challenges to EVSE installations. There are currently no mandatory requirements for incorporating EVSE-specific parking spaces in development projects.

Individual jurisdictions can develop standards for application within their own boundaries if they choose. The Governor's Office of Planning and Research issued

draft Accessibility Guidelines for public review, and the REVI discussed the documents and submitted comments in response (included within Appendix C, page 1). This guidance was the first offered by the state but still doesn't include mandatory language for EVSE installations.

Locally, the City of San Diego has developed Technical Policy 11-B that addresses parking accessibility to electrical vehicle charging stations. The REVI has identified this guidance as a best practice for use in the region.

PEV signage

The California Manual on Uniform Traffic Control Devices (CA MUTCD) has been updated by Caltrans (Traffic Operations Policy Directive 13-01) to include PEV signage. The policies included within the directive standardize the signage and pavement markings for zero emission vehicles (ZEVs). Although this policy does not mandate parking requirements for ZEVs or other PEVs, it does regulate the way they are identified.

Zoning and parking policies will continue to be a regional barrier to PEV adoption. The REVI will continue to monitor activities in state and local government activities, but recognizes that until there is mandatory state direction, this will be an ongoing challenge.

Building code changes

Updating local building codes to accommodate EVSE is a long-term regional goal. Costly retrofits and infrastructure requirements for PEV charging can be a significant barrier to adoption. Mandatory building codes can help support PEV adoption by requiring prewiring for charging equipment and a percentage of parking spaces dedicated for PEVs.

The first step toward making building codes more EVSE-friendly is to increase understanding for how building codes are updated among jurisdictions. Local governments also have expressed interest in learning from best practices deployed elsewhere across the state. Existing statewide code can be utilized strategically to avoid the difficult process of writing new code.

California's Green Building Standards Code (CALGreen) is Part 11 of Title 24, California's statewide building code and provides guidance on voluntary measures that public agencies and municipalities can adopt to encourage

PEV charging readiness in new construction. It is at the discretion of local governments to adopt any or all of these measures as mandatory. Currently, no jurisdiction in the San Diego region has adopted the voluntary EVSE-specific code. Future updates to CALGreen and Title 24 will likely inform regional building code policy in the long term.

CALGreen is California's first set of statewide green building standards. It was developed as a result of the California Green Building Initiative and the Global Warming Solutions Act of 2006 (AB 32), which aims to reduce GHG emissions to 1990 levels by 2020. Because buildings are the second largest contributor to GHG emissions in California, next to transportation, CALGreen seeks to reduce their environmental impact. Appendix C, page 29 includes a list of EVSE-specific CALGreen building code sections and examples of mandatory building codes.

Assembly Bill 758 (Skinner, Chapter 470, Statutes 2009) requires the California Energy Commission, in collaboration with the California Public Utilities Commission and stakeholders, to develop a comprehensive program to achieve greater energy efficiency in the state's existing buildings. Through the implementation of AB 758, Title 24 of the California Code of Regulations could be updated to include language that addresses the incorporation and installation of EVSE into existing and future development, which would standardize installation requirements and streamline permitting processes.

“In contrast to many transportation projects that are implemented through a regional government body, local jurisdictions can play a direct role in expanding electric vehicle and other alternative fuel infrastructure in their communities. This provides a meaningful opportunity for us to address local transportation-related greenhouse gas emissions and meet our Climate Action Plan goals. In Chula Vista, we have installed publicly available EVSE at a number of our facilities, helped EVSE installers navigate the permitting process, and are developing a City-specific

alternative fuel infrastructure map to provide to community members and local car dealerships selling these vehicles.”

– Brendan Reed, City of Chula Vista

Assembly Bill 1092, *Building Standards: Electric Vehicle Charging Infrastructure*, was adopted in late September 2013. It would require the next edition of the California Building Standards Code to include mandatory building standards for installation of future EVSE for parking spaces in multifamily dwellings and nonresidential development. This is one of the first regulatory statutes integrating mandatory EVSE requirements into development requirements.

Local jurisdictions can support EVSE deployment by changing their building code. An effective first step would be to adopt the established voluntary EVSE-specific CALGreen code. This would require prewiring for EVSE for all newly constructed residential and nonresidential buildings. All commercial development would require designated PEV-only or low-emission vehicle parking spaces. Standard project conditions or conditions of approval language are another means to integrate codified mechanisms that support EVSE installations.

The following are actions recommended for local government officials to facilitate PEV charging:

- Adopt the CALGreen EVSE codes for residential and nonresidential new construction
- Redefine a “low-rise” building to be six stories or fewer when adopting CALGreen⁷
- Require new construction projects to prewire or lay conduit with the capacity for future wires or cables
- Require new commercial and industrial construction to provide a minimum number of parking spaces be PEV ready
- Require new single family or MUD construction to provide a minimum number of parking spaces be PEV ready

⁷ CALGreen code pertains to “low-rise” buildings, which are defined as three stories or fewer. Extending this building designation to six stories or fewer would increase the number of eligible buildings to accommodate EVSE.

Education and outreach

To facilitate increased EVSE installations in single family residences, multi-unit dwellings, retail locations and the workplace, it is important that all relevant stakeholders (e.g., electrical contractors, property owners, utilities and local government staff) are fully aware of EVSE infrastructure installation requirements and potential challenges. The permitting process requires local government staff and electrical contractors to be fully trained and informed to ensure a rapid and seamless inspection and installation processes. Easily accessible and simple information about PEVs and PEV charging is also crucial for public understanding and adoption (*Plug-in Electric Vehicles & Charging: Getting Started* Appendix B, page 1; *CCSE Guide to Plug-in and Get Ready* Appendix C, page 26).

PEV training for local government staff

A number of training and workshop opportunities have been available and tailored to the specific needs and interests of local government staff. The REVI-supported PEV Readiness workshop (June 2012) and the PEV Community Readiness training session (EVITP, January 2013) are just two opportunities that were available to local public agencies. As training needs are identified, the REVI has worked with training providers and other knowledgeable resources to bring information to the region. Detailed training resources and opportunities for municipal staff are included in the REVI developed fact sheet *Resources for Public Agencies in San Diego* (Appendix B, page 10).

Training opportunities for local contractors

Local contractors are often exploring opportunities to expand the scope of their services to remain current and capable of meeting the needs of the existing market. Learning how to install EVSE is one way of doing this. Electrical contractors are an important part of the EVSE deployment process, and as PEV adoption rates increase, local contractors should be able to support a growing number of installation jobs.

The Electrical Vehicle Infrastructure Training Program (EVITP) provides training and certification for contractors and electricians interested in installing EVSE. The program is coordinated by the DOE and the IBEW/NECA and is offered at community colleges and local electrical training centers. The main curriculum focuses

on training electricians on the best industry practices for EVSE installations (EVITP January 2013 training summary available in Appendix C, page 34).

Clean Cities offers informational videos about EVITP and EVSE installations on their YouTube channel, which is listed on their website at www.eere.energy.gov/cleancities/evitp.html.

Details on the EVITP and other training opportunities available to local contractors are listed in the REVI fact sheet included in Appendix B.

First responders

First responders encounter PEVs, whether it is on the scene of an accident or when assisting a stranded motorist. It is vital they have knowledge about the technology and learn how to safely remove a passenger and tow a vehicle off the road.

The Freeway Service Patrol (FSP) is a free service provided by SANDAG, Caltrans and the California Highway Patrol that helps stranded motorists get back on the highway. The Advanced Transportation Technology and Energy Program (ATTE) at Miramar Community College administered a special training for FSP drivers to ensure they are properly equipped when encountering a PEV on the road. The subsequent *Towing Alternative Fuel Vehicles Presentation Summary* is available in Appendix C, page 32.

A number of training resources and opportunities are available for first responders and are included in the *Resources for Public Agencies in San Diego* fact sheet developed by the REVI (Appendix B, page 2).

7.3 Utility Solutions

Overview

As more PEVs are plugged in at home, work and fleet facilities, the volume and distribution of electricity load demand will be affected. Current estimates show existing infrastructure as sufficient to accommodate off-peak charging in the near term; however, electricity transmission and distribution may face challenges as demand increases in areas where there is a high concentration of homes with PEVs. Transformers and local distribution equipment may require upgrades in certain neighborhoods or near fleet facilities or workplaces with a high volume of charging.

Utility notification protocol

Establishing protocols for utility notification is vital to ensuring safe and reliable electricity service. Early PEV ownership occurred in neighborhood clusters, increasing demand on the local transformer and the likelihood that it will be affected. Communication with SDG&E can guarantee that the appropriate steps are taken to ensure uninterrupted electrical service.

Utility notification also is crucial to measuring PEV charging behavior. Though SDG&E does not require residential customers to notify them of their PEV purchase, they do have two methods for establishing communications with PEV owners: 1) PEV owners can opt-in at time of purchase through the vehicle manufacturer, or 2) When PEV owners apply to change their utility rate. Though utility notification is also not required for commercial EVSE installations, it is common practice for commercial property owners and local contractors to contact SDG&E early in the EVSE installation process.

SDG&E time-of-use rates

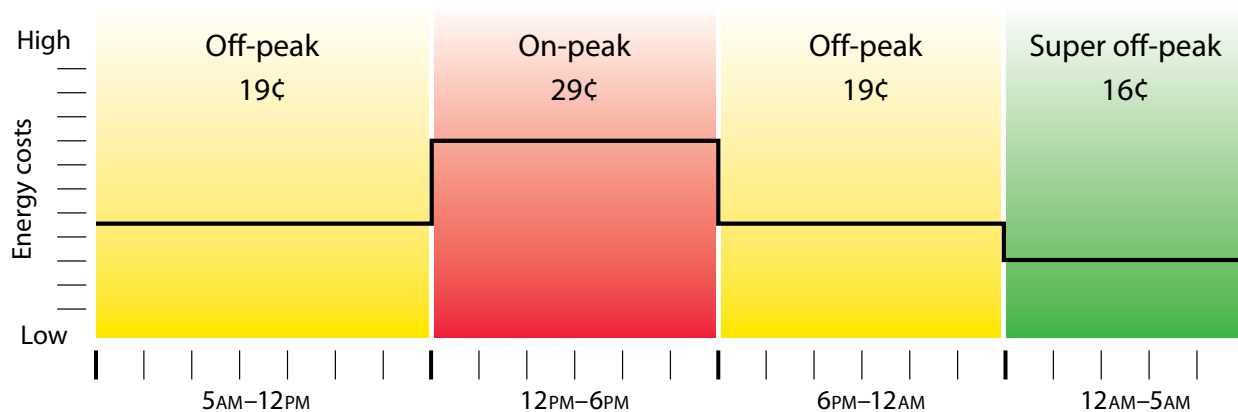
To minimize the impact of PEV charging to the grid, utilities can implement various rate structures to incentivize off-peak charging. The added electricity

demand of charging a PEV may drastically increase electricity costs to residential customers with traditional tiered pricing. Time-of-use (TOU) rates incentivize night or off-peak charging. Some utilities offer TOU rates specific to PEV owners, which allow them to charge early in the morning or late at night to avoid adding further demand to the grid during peak use.

SDG&E offers customers two EV TOU rates: 1) EV TOU 2 combines all electricity consumed by a household on a single meter; all PEV and household electricity would use the same meter and benefit from high electricity usage during off-peak hours, and 2) EV TOU allows households to install a separate meter for their PEV, tracking PEV electricity usage separately from the rest of the home. The following figure reflects SDG&E's TOU rates as of September 1, 2013.

To benefit fully from TOU rates, it is best for PEV owners to install a second meter dedicated to the EVSE; it helps to differentiate electricity used by household electronics and appliances from PEV charging. A California investor-owned utility report has found that there are significant energy benefits when PEVs can set an "end charge" time. Customers that program their vehicle's "end charge" time allows the vehicle "start charge" times to be staggered throughout the evening, minimizing grid impacts and increasing system reliability.

Figure 7.5: SDG&E's Time-of-Use Rates



Rate prices listed represent the summer EV-TOU-2 (whole house) rate as of September 1, 2013 and are per kilowatt-hour.

Find current rates at sdge.com/evrates.

Minimizing grid impacts

Consumer outreach

For any of these strategies to be effective, it is vital that consumers receive the information they need to feel comfortable participating. Consumer outreach and education must align with the rate of PEV adoption to be effective. Partnerships with local governments, original equipment managers (OEMs), dealerships and other stakeholders can help disseminate information and provide consumers with the resources they need to make safe, cost-effective and sustainable choices. These partnerships also establish the collaborative relationships needed to further PEV readiness in the region.

“We have driven electric cars since 1996 (a retrofitted 1975 Porsche with 22 golf cart batteries then later two EV1s in 1999). Our home has a larger than needed photovoltaic array that charges the Leaf and still creates a net credit from the utility. So we thumb our noses at both gas pumps and electricity created from carbon combustion.”

– New PEV Owner

Renewable energy options for PEV owners

PEV owners may have alternative electricity generation options. There are renewable and smart grid technologies that could lessen the impact of EVSEs on the electricity grid.

Using battery storage from solar panels is a common way for PEVs to reduce their grid impact and electricity costs. The San Diego Zoo has installed 10 stand-alone solar canopies with a 90-kilowatt solar photovoltaic system and five EV chargers. The solar system also has 100 kilowatt-hours of battery storage, which helps to charge electric vehicles and offset peak power demands on the grid.

Owners of solar photovoltaic systems can prewire their system to allow EVSE to draw power directly from the battery storage.

Remaining questions

Utility policy development is dynamic and challenging; however, the integration of PEV charging with renewable

energy sources may not be far off. Many utilities have already implemented or explored the possibility of a separate “green” energy option. Smart grid technologies continue to evolve and are an ideal sector for growth. SDG&E has been involved in pilot projects to explore these and other possibilities to manage PEV charging into the future.

One of SDG&E’s latest projects includes filing an energy storage procurement proposal to the California Public Utilities Commission (PUC). SDG&E is required by the PUC to procure 165 megawatts of energy storage by the end of 2024. The procurement target would optimize grid performance, integrate renewable energy into SDG&E’s portfolio and contribute toward reducing the region’s greenhouse gas emissions. However, PEV charging is considered by the PUC to have an impact on the procurement of energy storage. SDG&E will need to consider how to regulate energy storage requirements for PEV charging in their territory.

Education and outreach

As described previously, the safe, reliable and cost-effective integration of PEVs in the region requires continued effort in informing and training PEV drivers, fleet managers, government staff and others about electricity rates, as well as other opportunities available to all regional EVSE stakeholders about SDG&E’s solutions for PEVs. Consumers and local government officials should be encouraged to visit SDG&E’s website to learn more about electric vehicle rates. SDG&E is actively pursuing outreach through its website, public education workshops, informational inserts with the statewide Clean Vehicle Rebate Project (CVRP) and brochures for San Diego car dealerships selling PEVs. SDG&E has been at the forefront of MUD property management and tenant outreach and education and has developed best practices for MUD stakeholder engagement.

For more information on how SDG&E can help PEV owners and local government officials, visit <http://www.sdge.com/electric-vehicles>.

8. The Road Ahead

8.1 Overview

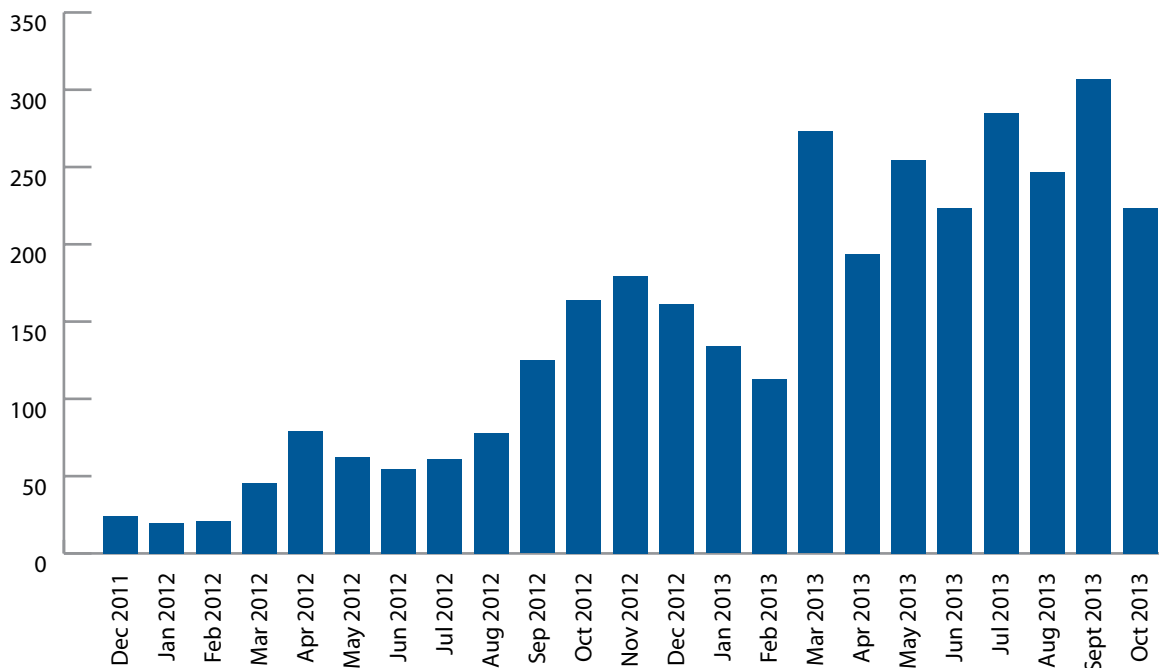
The San Diego region has taken great strides toward integrating PEVs and EVSE into existing policies, processes and lifestyles, but there is still a long way to go. The EV Project was the critical building block to establishing the San Diego region's charging network. The REVI provided a platform for expanding that effort and for identifying and overcoming barriers for installation and obstacles to broader PEV adoption. There are still a number of challenges and barriers stifling EVSE installation and hindering PEV adoption, such as those described in this Plan. To ensure progress continues, sustained collaboration is crucial for a cohesive regional charging network and for consistent and streamlined deployment.

Charging equipment and vehicle technologies continue to evolve at a rapid pace and it is necessary to understand the equipment demands as well as the needs and wants of the public. Monitoring and applying policies uniformly will help all of the public agencies, contractors, PEV drivers, local businesses and manufacturers address gaps, emerging trends and future needs.

8.2 Increased PEV Presence

The San Diego region has taken great strides in becoming a leader in PEV adoption and in establishing a charging network. The wide adoption of this technology offers industry leaders an incentive for continuing to use the region's well-established infrastructure for new opportunities.

Figure 8.1: San Diego Regional PEV Adoption Growth



8.3 Estimating Future Demand for EVSE in the Region

The future demand for EVSE in the San Diego region will likely correlate with the future adoption rates of PEVs. Clearly, PEV ownership has experienced a rapid increase in the past three years – in 2010, fewer than 20 people owned a PEV. By the end of 2012, there were more than 1,700 PEVs on San Diego roads. The number of PEVs increased rapidly between January and October 2013, adding over 2,200 PEVs to the region.

To fully capture PEV driver motivations and to quantify PEV adoption rates, tools to measure and comprehend purchasing behaviors should be employed. One such opportunity would be to collaborate with the Department of Motor Vehicles' process for High Occupancy Vehicle (HOV) permits given for PEVs. The renewal process could include a survey or other measuring tool to be returned in conjunction with the other required documentation and would serve as a means for informing policy.

“The San Diego Regional Clean Cities Coalition works to accelerate the adoption of alternative fuel and advance technology vehicles. PEV readiness efforts help to ensure this region can support the growing number of plug-in vehicles and encourage widespread adoption of these vehicles.”

– Kevin Wood, San Diego Regional Clean Cities Coalition

Future PEV growth estimates vary; some projections indicate that the California PEV population could reach 100,000 by 2014-2015 and 500,000 by 2018-2020. A critical factor in predicting future PEV adoption is the decline in PEV sale prices associated with falling battery costs. In addition, the California Air Resources Board (ARB) ZEV mandate affirms that the State of California will continue to create policies and incentives to ensure that PEV sales reach 50,000 per year by 2019 and 150,000 per year by 2022.

If these predictions are correct, there is a strong case for more EVSE in public spaces. Charging with Level 1 equipment at home will likely satisfy the average daily driving needs of a PHEV driver, according to National

Household Travel Survey data. However, BEV drivers must be allotted more diverse options for charging. Level 2 charging at home is critical for a BEV driver, but may not be accessible for those that live in multi-unit dwellings. Therefore, it is vital to place EVSE at locations in which BEV drivers will stay for long periods: workplaces and other public places such as schools, retail centers, gyms and medical locations. This will enable BEV drivers to complete their daily commute and possible side trips without fear of depleting their battery.

DC fast charging infrastructure would also need to be expanded both within the metropolitan region as well as throughout countywide highway corridors in order to better suit the long-range driving needs of PEV owners. According to a University of California, Irvine study, DC fast charging provides a “safety net” for BEVs that need charging immediately. The study estimates that a network of 290 strategically located fast chargers throughout California would enable 98% of drivers to adopt BEVs based on average daily vehicle miles traveled.

There is a large PEV population in the San Diego region that continues to increase in size. In order to foster the market's rapid growth, a robust EVSE network needs to be built. As the region moves forward, mandates and incentives will prove to be essential to encourage PEV growth. Though we cannot predict how much EVSE will suit the region's future needs, we know the regional barriers that impede further PEV growth. To become an exemplary market, we must overcome these barriers to facilitate future charging infrastructure growth and to enable further PEV adoption.



SAN DIEGO REGIONAL PLUG-IN ELECTRIC VEHICLE (PEV) READINESS PLAN

APPENDIX A

Contents:

San Diego Regional Electric Vehicle Infrastructure Working Group Members (p. 1)

SAN DIEGO REGIONAL ELECTRIC VEHICLE INFRASTRUCTURE WORKING GROUP

REPRESENTATION	MEMBER	ALTERNATE
South County Subregion	Brendan Reed City of Chula Vista	Chris Helmer City of Imperial Beach
North County Coastal Subregion	Ramsey Helson City of Del Mar	Mike Grim City of Carlsbad
North County Inland Subregion	Kathy Winn City of Escondido	Vacant
East County Subregion	City of Santee Kathy Valverde	Scott Munzenmaier City of La Mesa
City of San Diego	Jacques Chirazi	Vacant
County of San Diego	Peter Livingston	Susan Freed
San Diego Association of Governments	Susan Freedman, Chair	Allison King
San Diego Regional Airport Authority	Paul Manasjan	Brett Caldwell
Caltrans, District 11	Chris Schmidt	Vacant
Unified Port District of San Diego	Michelle White	Jenny Lybeck
San Diego Gas & Electric	Joel Pointon	Randy Shimka
California Center for Sustainable Energy	Mike Ferry, Vice Chair	Colin Santulli
University of California, San Diego	Dave Weil	Jim Ruby
Miramar College, Advanced Transportation Technology and Energy Program	Greg Newhouse	Vacant
San Diego Electric Vehicle Network	Randy Walsh	Vacant
National Electrical Contractors Association	Karen Prescott	Tim Dudek
International Brotherhood of Electrical Workers Local 569	Micah Mitrosky	Vacant

ADVISORY MEMBERS	
San Diego Air Pollution Control District	Mike Watt Nick Cormier
Department of Defense	Chris Parry
Metropolitan Transit System	Claire Spielberg
City of Coronado	Bill Cecil
City of Encinitas	Diane Langager
City of National City	Ray Pe
City of Solana Beach	Dan King
City of Vista	Lyn Dedmon
Ecotality	Andy Hoskinson
Car2go	Mike Cully
AeroVironment	Charlie Botsford
Coulomb Technologies	Colleen Quinn
General Electric	David Wang

SAN DIEGO REGIONAL PLUG-IN ELECTRIC VEHICLE (PEV) READINESS PLAN

APPENDIX B

Contents: Fact Sheets

Plug-in Electric Vehicles & Charging: Getting Started (p. 1)

Resources for Public Agencies in San Diego (p. 2)

Regional Planning for Public Charging in San Diego (p. 4)

Resources for Fleet Managers in San Diego (p. 6)

Charging at Condos, Apartments and Community Living Areas (p. 8)

Workplace Charging for Businesses in San Diego (p. 10)

Resources for Electrical Contractors in San Diego (p. 12)

Electric Vehicle Charging Station Installation Guidelines: Residential and Commercial Locations (p. 14)

Plug-in Electric Vehicles

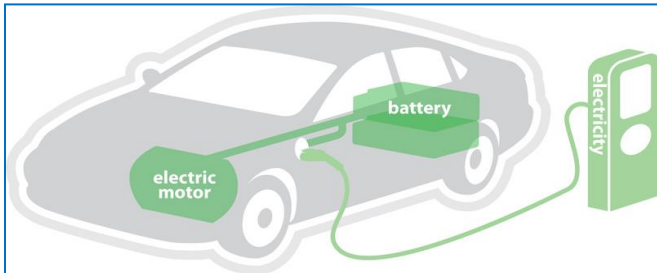
Plug-in Electric Vehicles & Charging: Getting Started

California is leading the nation in plug-in electric vehicle (PEV) adoption, and about 20% of PEVs in California are in the San Diego region. Interested in learning more about these new vehicles on our roads and highways? Here are some answers to your questions about the basics of PEVs, benefits of PEVs, charging options, and available incentives.

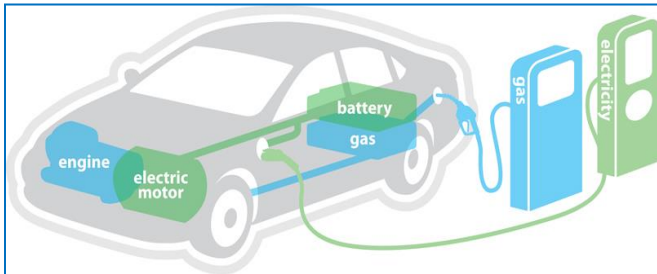
What is a plug-in electric vehicle?

A plug-in electric vehicle (PEV) is the generic term for cars that operate, fully or partially, on battery power and that are charged from the electricity grid. There are two main types of PEVs: battery electric vehicles and plug-in hybrid electric vehicles.

Battery Electric Vehicle (BEV) - Runs on electricity stored in batteries and has an electric motor rather than an internal combustion engine.



Plug-in Hybrid Electric Vehicle (PHEV) - Plugs into the grid and operates on electricity as well as an internal combustion engine.



What are all the options?

There are currently more than **16 different PEV models** on the market, offered by a variety of manufacturers. Check out an EV buying guide at <http://www.driveclean.ca.gov>.

How far can I drive?

Battery electric vehicles can generally go 60 – 120 miles on a full charge, which is plenty of range for most people (the average Californian travels less than 30 miles a day). If more range flexibility is needed, a plug-in hybrid might be a better choice. They can generally run on battery alone for 10 – 40 miles, and then continue for up to 400 miles as a gasoline-electric hybrid.

Why should I drive a PEV?

- Help to reduce emissions and improve air quality
- Lower fueling costs
 - ✓ Save money and charge your vehicle overnight with SDG&E's time-of-use rates. Learn more at <http://www.sdge.com/evrates>.
- Lower maintenance costs
 - ✓ No more oil changes, fewer tune-ups



How do I charge?

Most PEV drivers will do the majority of their charging at home, but the availability of public charging stations is growing. Public stations offer drivers more charging options. A list of public charging locations can be found at <http://www.afdc.energy.gov/afdc/locator/stations>.

How long does it take to charge?

Charging times depend on three primary factors: the size of the battery, the onboard vehicle charger, and the type of charging equipment. The onboard charger is located in the vehicle and determines the amount of power that can enter the vehicle from the grid. Generally, BEVs have a larger battery compared to PHEVs. Three types of charging equipment are described in the table below:

Type of Charger	Miles of Range for 1 hour of charge	Where to charge?
Level 1 (120 volt)	3 to 4	Standard three-pronged outlet
Level 2 (240 volt)	8 to 20	At-home or public charging station
DC Fast Charger	50 to 60	Few public DC Fast Chargers

Are there incentives for buying or leasing a PEV?

For a limited time, rebates and tax breaks are available for PEV purchasers and lessees. Incentives include a state rebate of up to **\$2,500**, a federal tax credit of up to **\$7,500**, and HOV lane access.

- Find incentives available in your area at <http://driveclean.ca.gov/pev/Incentives.php>.

Tax credits are also available for charging stations and allow consumers to claim up to 30% of the cost of hardware and installation, find out more at <http://www.afdc.energy.gov/laws/law/US/10513>.



Plug-in Electric Vehicles

Resources for Public Agencies in San Diego

Plug-in electric vehicles (PEVs) are becoming more common, and local permitting agencies should be prepared for the growing PEV market and understand how PEVs can help agencies' achieve climate and sustainability goals. This fact sheet was developed by the San Diego Regional Electric Vehicle Infrastructure¹ (REVI) working group and offers San Diego's public agencies resources and technical training information as they become PEV ready.

Zero-Emission Vehicle (ZEV) Community Readiness Guidebook



The Office of Planning and Research's (OPR) *Zero-Emission Vehicles in California: Community Readiness Guidebook* contains vital information to help communities across the state make the switch to zero-emission vehicles. Full text available at: http://opr.ca.gov/docs/ZEV_Guidebook.pdf.

Did you know?

- The San Diego region represents more than 20% of the California PEV sales market.
- Roughly 1 of every 35 new cars bought or leased in California during Q1 of 2013 was a PEV.

Building Support - engineers, plan checkers, project managers and building officials

Permitting

Electric vehicle charging systems are relatively new to permitting departments and are often permitted through existing processes and permits. The Cities of Oceanside and San Diego have developed guidance documents to aid with the permitting, installation, and inspection processes.

- City of Oceanside *Residential Electric Vehicle Charger Guidelines*
<http://www.ci.oceanside.ca.us/civica/filebank/blobload.asp?BlobID=30053>
- City of San Diego *Information Bulletin 187: How to Obtain a Permit for Electric Vehicle Charging Systems*
<http://www.sandiego.gov/development-services/pdf/industry/infobulletin/ib187.pdf>
- The PEV Collaborative has developed *Streamlining the Permitting and Inspection Process for Plug-in Electric Vehicle Home Charger Installations*, which includes statewide codes and standards, recommended permitting fees, and background information on EVSE hardware.
http://www.evcollaborative.org/sites/all/themes/pev/files/PEV_Permitting_120827.pdf
- Department of Energy's Alternative Fuels Data Center EVSE permitting template for jurisdictions
http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf

Regional Permit Fees

From mid-2011 to early 2013, the EV Project² reported that the median cost for permitting a residential EVSE installation was \$226. Permitting fees vary by jurisdiction, so it is a good idea to contact the permitting agency for specific fees.

Building & Electrical Codes

The National Electrical Contractors Association provides a common set of electric vehicle terminology and code in the presentation linked below³. Pacific Gas & Electric offers a condensed version of code requirements for EVSE installations, from disability requirements to PEV signage, at

<http://www.pge.com/includes/docs/pdfs/shared/environment/pge/cleanair/ev5pt3.pdf>.

¹ <http://energycenter.org/programs/pev-planning/san-diego>

² San Diego REVI meeting, *The EV Project: Initial Findings On Charging Behavior*, April 18, 2013. <http://www.theevproject.com/>

³ <http://iae-western.org/Files/2011/Programs/NECA%20EVSE%20Presentation%20NECA%20SD%202011%20Western%20IAEI%20Section.pdf>

Planning Department Staff - planners

Addressing Accessibility for PEV Chargers

Assuring charging systems are accessible to all drivers is critical for public adoption. The OPR, in conjunction with the Department of the State Architect, is developing a guidance document to help public agencies standardize accessibility opportunities for PEV charging. To view or download copies of the draft guidelines, visit http://opr.ca.gov/docs/PEV_Access_Guidelines.pdf.

The City of San Diego has developed a comprehensive technical policy guide addressing accessibility and PEV parking at <https://www.sandiego.gov/development-services/pdf/industry/tpolicy11b1.pdf>.

Parking Guidelines

The California Green Building Standards Code (CALGreen) includes standard statewide Residential and Non-Residential Voluntary Measures for PEV and EVSE listed in Appendix 5A of CALGreen: http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf

CALGreen Code Sections for PEV and EVSE:

- A5.106.5.1 Designated parking for fuel-efficient vehicles
- A5.106.5.3.1 Electric vehicle supply wiring
- A5.106.6 Parking capacity

Parking Enforcement

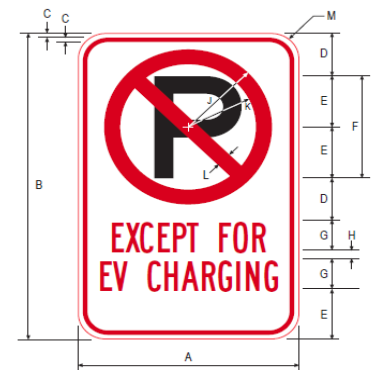
The City of Santa Monica has adopted an electric vehicle parking ordinance. This ordinance offers an example for other local agencies interested in incorporating and enforcing PEV parking into existing policy documents.

- 3.12.835 Electric vehicle parking (adopted at Santa Monica City Council Meeting 07/24/2012)⁴

The California Department of Motor Vehicles has codified electric vehicle parking enforcement with Vehicle Code (VC) Section 22511 *Off-Street Parking: Electric Vehicle*, a standard template available for use by local jurisdictions.⁶

PEV Signage

The California Manual on Uniform Traffic Control Devices has released a statewide traffic operations policy directive on zero-emission vehicle signs and pavement markings standardizing signs and markings for PEV charging stations and parking stalls.⁵



Safety Training for First Responders



The ATTE program trained SANDAG's Freeway Service Patrol (FSP) drivers.

Firefighters, police officers and other first responders encounter PEVs when responding to incidents. For their safety and the safety of the public, it is essential that they receive PEV training.

National Alternative Fuels Training Consortium – First responder safety training
<http://afvsafetytraining.com>

National Fire Protection Association – Online first responder safety training
<http://www.evsafetytraining.org/training.aspx>

Miramar College: Advanced Transportation Technology and Energy Program (ATTE) - Technical education, training and resources
<http://www.attemiramar.com/>

First Responder Guides for Tesla Vehicles
<http://www.teslamotors.com/firstresponders>

⁴ <http://www.smgov.net/departments/council/agendas/2012/20120724/s2012072407-A-1.htm>

⁵ <http://www.dot.ca.gov/hq/traffops/signtech/signdel/policy/13-01.pdf>

⁶ <http://www.dmv.ca.gov/pubs/vctop/d11/vc22511.htm>

Regional Planning for Public Charging in San Diego

As plug-in electric vehicle (PEV) adoption increases in San Diego region, local and regional governments and public agencies need to develop land use policies and transportation plans that integrate electric vehicle supply equipment (EVSE) into the infrastructure network. Supporting PEVs helps advance local government and public agency efforts to achieve goals for greenhouse gas emission reduction while cutting their fuel use and costs.

Why plan at all?

- Near-term needs
 - Identify method to best site PEV chargers
 - Use visual tools through GIS mapping
 - Plan for 1,500 publicly accessible chargers
- Long-term goals
 - Select public sites with the most regional benefit
 - Reduce driver range anxiety
 - Develop interregional network
 - Enhance future siting capabilities

What is the EV Project?

- ECOTality received \$230M funding from Dept. of Energy and partner matches
- Deploying chargers in major cities and metropolitan areas across the U.S.
- Collecting and analyzing data to evaluate EVSE infrastructure
- Identifying lessons learned and establishing streamlined deployment strategies

What's been done?

San Diego EV Project Stakeholder Advisory Committee (ESAC)

- Participants: Local governments and public agencies, nonprofits, universities, utilities and private businesses
- Purpose: Provide input to ECOTality on the local context, history and motivation for EV adoption. Determine and rate factors to be used in siting Level 2 and DC fast charging (DCFC) EVSE.
 1. Characteristics of optimal Level 2 EVSE locations:
 - High number of users
 - High frequency of vehicle turnover (stay times of 45 minutes to 3 hours)
 - Significant availability (maximize hours and days of operation)
 2. Characteristics of optimal DCFC locations:
 - High number of users
 - Very high frequency of vehicle turnover (stay times of 5 to 30 minutes)
 - Significant availability
 3. All locations assessed against the land use suitability factor
 4. Weighted factors applied to the master geographic reference areas (MGRAs) and normalized to provide a score for each MGRA
 5. MGRAs mapped and focus placed on the highest scoring areas to identify potential locations for Level 2 EVSE – 3,333 MGRAs were targeted¹

DC Fast Charging on Transportation Corridors

The ESAC provided additional guidance on DCFC along transportation corridors and determined that the following specifications should be documented and taken into account in site selections:

- Major transportation corridors are defined as freeways and highways
 1. Interstate Freeways 5, 8, 15 and 805
 2. State Highways 52, 54, 56, 67, 78, 125, 163 and 905
- Approximately half of the transportation corridor DCFCs should be located at very high volume designed interchanges, with the remaining at slightly lower volume designed interchanges
- Consider characteristics of the host site use that match the typical charge times of 5 minutes to 25 minutes, such as a coffee shop, convenience store or other such businesses
- Spacing of DCFC should consider the potential of additional travel distance (up to 80 miles in 30 minutes)

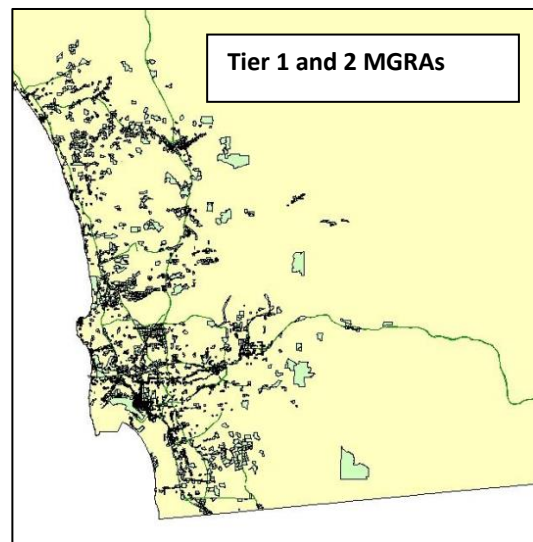
- DCFC spacing should include locations on the periphery of the San Diego EV Project boundary. In addition, DCFCs should be deployed 30–50 miles beyond the boundary along the same transportation corridors.

EV Project Installations

- Installations¹
 - April 2011–May 2013: 435 nonresidential AC Level 2 EVSE units including 321 publicly accessible at 121 sites and 114 workplace/fleet EVSE units at 39 sites; 4 DCFC units in the region
- Installations vs Plan¹
 - Analysis done for 3,333 units within ¼ mile (walking) of the highest scoring MGRAs
 - Several charging units were placed within ¼ mile of more than one MGRA
 - 1,138 (34%) MGRAs served by a deployed publicly accessible EVSE
 - 10 units installed in areas outside a targeted MGRA (not within ¼ mile).
 - 3 units installed far from the nearest MGRA, serving as a means to extend trips.

EV Project Conclusions to Date²

- Charge events per public EVSE continue to increase
- 74% of all charging events are residential
- 27% of all public charging events are from Car2Go
- 19% of all electricity consumed is from publically accessible Level 2 and DC fast charge events



What's next?

The EV Project was integral in establishing the region's EVSE infrastructure, however, a number of barriers still challenge the deployment of a complete regional EVSE network, including

- Challenges to implementation?
 - Education
 - Incentives/rebates — money
 - Clear legislative and regulatory direction
 - Better integration into local policies and activities
 - More cohesive infrastructure network — connectivity between regions

We can work to overcome these obstacles by

- Further incorporating EVSE infrastructure into planning and development policies
- Considering PEVs in project design and as standard conditions of approval
- Continuing to coordinate with local, regional and neighboring communities/agencies/jurisdictions to link EVSE infrastructure networks
- Informing state agencies about regional challenges, concerns, considerations and impacts from policy and regulatory developments
- Getting the word out and continuing to educate leadership, community leaders and the public



Zero-Emission Vehicle (ZEV) Community Readiness Guidebook

The Office of Planning and Research has information about identifying PEV infrastructure needs in communities in its document, *Zero-Emission Vehicles in California: Community Readiness Guidebook*, found at: http://opr.ca.gov/docs/ZEV_Guidebook.pdf.

¹The EV Project: *Lessons Learned – The EV MICRO-CLIMATE Deployment Process in San Diego*
www.theevproject.com/cms-assets/documents/112390-451046.mcproc-sd.pdf

²The EV Project: *Q2 2013 Quarterly Report*
www.theevproject.com/cms-assets/documents/127233-901153.q2-2013-rpt.pdf

Plug-in Electric Vehicles

Resources for Fleet Managers in San Diego

Plug-in electric vehicles (PEVs) offer government fleet managers opportunities to decrease fuel and operating costs while supporting goals mandated by local, state and federal policies to significantly reduce greenhouse gas (GHG) emissions.

PEVs in Local Public Agency Fleets

Cleaner fleets can play a sizeable role in meeting local and state GHG emissions reductions goals. Local agency fleets that have successfully adopted PEVs include:

- Port of San Diego:
<http://www.portofsandiego.org/environment/1520-nissan-electric-car-debuts-in-san-diego.html>
- University of California, San Diego:
<http://sustainability.ucsd.edu/initiatives/transportation-alternatives.html>

Benefits of PEVs

Reduced petroleum use, GHG emissions and operating costs

Government incentives

Reduced dependence on imported oil

PEVs in Private Fleets

Integrating clean vehicles in private fleets can help companies achieve their sustainability goals. Private fleets that have deployed PEVs in the San Diego region include:

- Frito-Lay: <http://www.fritolay.com/about-us/press-release-20120810.html>
- FedEx: <http://news.van.fedex.com/fedex-expands-hybrid-electric-fleet-50-percent-groundbreaking-conversion-program>
- car2go: <https://www.car2go.com/en/sandiego/>

Vehicle Incentives and Rebates

- Local governments and public agencies can take advantage of PEV rebates offered by the Clean Vehicle Rebate Project for up to 20 vehicles per year.¹
- The California Hybrid Truck and Bus Voucher Incentive Program is available to public entities purchasing a hybrid or electric truck or bus. Find out more at <http://www.californiahvip.org/>.
- The Goods Movement Emissions Reduction Program Proposition 1B provides funding for California truck owners to replace their old vehicles with newer, cleaner equipment.²

Choosing the Right PEV

Choosing the right PEV for your fleet requires a thorough understanding of current vehicle use.

- Fleet data logs can help determine which fleet vehicles can be replaced by PEVs.
- Fleet vehicles that travel fewer than 100 miles per day can be replaced with battery electric vehicles (BEVs-100% electric).
- Fleet vehicles that need extended range can be replaced with plug-in hybrid electric vehicles (PHEVs).
- The Department of Energy maintains a website of currently available PEVs at http://www.afdc.energy.gov/vehicles/electric_availability.html.

Charging PEVs at a Fleet Facility

An important consideration when planning for PEVs is the need for charging equipment, known as electric vehicle supply equipment (EVSE). San Diego Gas & Electric (SDG&E) can help plan for fleet charging. Learn more at <http://www.sdge.com/clean-energy/business/fleet>.

- SDG&E will help fleet managers understand their historic electricity use (demand and timing) to determine the most cost-effective plan for charging. Commercial customers will receive information on their facility's electrical capacity for charging.

¹ <https://energycenter.org/programs/clean-vehicle-rebate-project>

² San Diego fleet managers can keep up to date with funding for this program by visiting <http://www.sdapcd.org/homepage/grants/grants.html>.

- Fleet managers must determine the number, location and types of EVSE for their PEVs. The different levels of charging (Level 1: 120-volt, Level 2: 240-volt) offer different charging speeds and have different up-front and operating costs.
- Placing charging infrastructure near electrical utility equipment can reduce installation costs.

Considerations for Fleet Managers

- Collect drive cycle data to understand fleet needs and which PEV would best meet those needs.
- Determine which fleet vehicles are optimal for replacement by PEVs.
- Consider future PEV fleet size and EVSE siting/needs when installing charging infrastructure.
- Inform drivers on ways to maximize fuel efficiency/battery life (reduce speeding, use of GPS route planning).
- Offer test drive opportunities to staff members and fleet drivers to promote and exhibit new technology.
- Share successful experiences with electric fleets and infrastructure installation among other regional fleet managers.
- Take into account the capital required for EV charging equipment and installation when planning for a new electric fleet.

Resources

California Energy Commission: Resources for fleet managers interested in upgrading to a clean vehicle fleet can be found at <http://www.energy.ca.gov/drive/upgrade/fleets.html>.

California Air Resources Board: Resources for incentives, grants, and funding for fleet managers interested in greening their fleet can be found at http://www.driveclean.ca.gov/pev/Resources_For_Fleets.php.

Department of Energy Clean Cities: A Plug-In Electric Vehicle Handbook for Fleet Managers is available online at http://www.afdc.energy.gov/pdfs/pev_handbook.pdf

Idaho National Laboratory Report: A brief report comparing energy costs per mile for electric and gasoline-fueled vehicles by the Idaho National Laboratory is found at <http://avt.inel.gov/pdf/fsev/costs.pdf>.

Department of Energy: The DOE's tool, eGallon, calculates fuel savings by using electricity instead of gasoline at <http://energy.gov/articles/egallon-how-much-cheaper-it-drive-electricity>.

Charging at Condos, Apartments and Community Living Areas

By 2050, half of the San Diego region's population is expected to be living in multi-unit dwellings (MUDs). When it comes to accommodating EV chargers, each MUD has its own unique set of circumstances and challenges to address. Below are some of the most common challenges and ways that local apartment buildings, homeowner associations (HOAs) and condos have addressed them. This document is designed to be used in conjunction with SDG&E's fact sheet on installing PEV charging stations in multi-unit dwellings titled, *Prepping Multi-Units for Plug-in Vehicles*.

Reaching Out to Building Management or HOA

Since EV chargers will likely be installed in common areas, it is important to engage the building management or HOA early in the process. Identify any existing rules in the covenants, conditions and restrictions (CC&Rs) that could affect the installation of charging stations. It is best to be prepared and aware of any potential hurdles or opportunities by doing the research before approaching building management.

Determining Demand for EV Charger Installations

Survey residents to gauge their interest in purchasing a plug-in electric vehicle (PEV). This survey will help determine the number of charging units and/or amount of conduit to install and in what layout(s). Identify demand for Level 1 versus Level 2 charging. Planning ahead by installing extra capacity for future charging units can save on costs down the road.

The PEV Collaborative has developed a sample survey for MUD residents. Both print and electronic survey options are available at http://www.driveclean.ca.gov/pev/Charging/Home_Charging/Multi-unit_Dwellings.php#survey

Allocating Costs

It is important to establish how EV charger installation, operations, maintenance, insurance and electricity bills will be paid. How costs are allocated will depend on how the chargers are installed. Potential options include:

- **Chargers in assigned spots:** Individual meters installed for each charging station and resident covers the actual charger cost, billing, insurance and maintenance of the unit. Installation costs for the meters, panel upgrades and conduit can either be covered by management, the resident or shared.
- **Common area chargers for residents only:** Building management installs electric vehicle supply equipment (EVSE) in common area and recoups costs from residents through a billing system in the charger.
- **Common area chargers for residents and general public:** Building management installs EVSE in public common area and recoups costs from residents and public through a billing system in the charger.

Siting EV Chargers

Identify the location and type of electric metering and wiring in the parking area. Determine if existing supply is adequate or if a meter/panel upgrade is needed. If an upgrade is required, consider the capacity needed to accommodate additional PEV chargers in the future. Contact the building/planning department to discuss any permits or requirements that should be considered when siting chargers.

Tips for approaching building management about EV Charging

- Talk to other residents about their interest in EV charging and build a coalition of support
- Look for incentives for chargers available in your area:
<http://www.driveclean.ca.gov/pev/Incentives.php>
- Review the parking layout in relation to electrical supply and propose possible arrangements
- Contact SDG&E to help determine necessary

Power supply for EV chargers

- The closer the EVSE is to the power supply, the lower the installation costs will be.
- Installation costs will increase if a panel upgrade or meter installation is necessary. The power supply needs for Level 1 and Level 2 EVSE are as follows:
 - **Level 1:** Dedicated branch circuit with NEMA 5-15R or 5-20R receptacle
 - **Level 2:** Dedicated branch circuit hardwired to a permanently mounted EVSE with 240VAC/single phase, 4-wire

Assigned vs. unassigned parking spaces

Consider which assigned and unassigned parking spaces could accommodate PEV charging equipment. Key factors include:

- Proximity to electric meter; can avoid costly trenching through concrete. Soft landscapes or locations near the electric meter are preferred.
- Location for charging stations and bollards (short vertical post) to ensure EVSE cord does not present a tripping hazard

Accessibility to EV Chargers

See the City of San Diego EVSE accessibility guidelines for sample EVSE configurations:

<http://www.sandiego.gov/development-services/industry/pdf/tpolicy11b1.pdf>

Policy Considerations

Legislation has been adopted in California to reduce barriers to the installation of EVSE in multi-unit dwellings. SB 880 prohibits common interest developments (e.g., condo/apartments) from restricting the installation of EVSE in a deeded/contracted parking space. If the charging unit is installed in a common area, the law does state that certain conditions can be imposed, including a \$1 million home owner liability policy that names the HOA as an additional insured.

Resources for MUDs

San Diego Gas & Electric – <http://www.sdge.com/clean-energy/residential/apartments-and-condos>

SDG&E Quarterly MUD Vehicle Charging Workshops – <http://www.seminars.sdge.com>

Plug-in Electric Vehicle Resources Center –

http://www.driveclean.ca.gov/pev/Charging/Home_Charging/Multi-unit_Dwellings.php

eVgo for Multi-Family Buildings – <http://www.evgonetwork.com/own-or-manage-multi-family-communities>

PEV Collaborative's *Plug-in Electric Vehicle Charging Infrastructure Guidelines for Multi-unit Dwellings* –

http://www.pevcollaborative.org/sites/all/themes/pev/files/MUD_Guidelines4web.pdf

The Office of Planning and Research's *Zero-Emission Vehicles in California: Community Readiness Guidebook* –

http://opr.ca.gov/docs/ZEV_Guidebook.pdf

Workplace Charging for Businesses in San Diego

As the number of plug-in electric vehicle (PEV) owners grows, businesses can offer workplace charging to help employees meet their commuting needs. Making workplace charging available to employees allows them more environmentally-friendly transportation options, demonstrates commitment to the community, helps attract and retain employees, and contributes toward green certifications.

Key Considerations for Workplace Charging

The sections below describe the following key considerations for businesses interested in installing EV charging:

- Does your business own or lease its facilities?
- What type of charging is needed?
- What are different ways to pay for charging?

What are other businesses saying?

A survey of local businesses with EV Chargers revealed the following:

Why did your company decide to invest in chargers?

- Achieve goals in company's sustainability plan
- Provide additional service to customers

What benefits do you see from investing in chargers?

- Positive impact and association with the company brand
- Increased visitation
- Employee attraction and retention

Survey conducted by CCSE in 2012 of institutions in San Diego County that have installed public and workplace EVSE.

Does your business own or lease its facilities?

Building Owners

Employers that own their facility and parking area encounter fewer challenges when developing a plan for vehicle charging.

- ✓ Engage key stakeholders in the process, including PEV drivers, operations supervisors, building/facility manager, facility technicians, and legal counsel

Building Tenants

Employers that do not own their facility will likely be required to obtain an agreement from the building or property owner.

- ✓ If an agreement cannot be reached with the owner, look to partner with a neighboring parking lot owner or another business to develop a cooperative PEV charging program

What type of charging is needed?

Employers should determine the appropriate charging levels based on the electrical capacity available at their facility.

- ✓ Vehicles generally park at the workplace for 8-9 hours, which makes Level 1 charging an easy and cost-effective option
- ✓ Consider a hybrid approach with Level 1 serving the needs of most employees, and one or two charge-per-use Level 2 chargers available for those who need a quicker charge
- ✓ Installing in proximity to existing electric utility equipment is cheaper than adding new circuits and conduit that can increase capital costs significantly
- ✓ Incorporate PEV charging in future infrastructure plans and development

Levels of Charging

*Level 1 – 120 volt
(standard household outlet)*

*Level 2 – 240 volt
(large home appliances)*

Who will pay for the charging?

Employers can choose to cover electricity costs and allow employees to charge their vehicles for free, or an employer may want to recoup some or all of the electricity costs by requiring employees to pay for their charging.

Option 1: Free to employees

Many businesses offer PEV workplace charging for free to their employees.

Here are some reasons why:

- ✓ It offers an incentive to employees to support PEV adoption
- ✓ It simplifies the employee charging policy and reduces administrative time and expense
- ✓ Free charging could be considered a reportable employee benefit

However, there are some risks with offering free charging:

- ✓ Businesses could incur demand charges that become prohibitively expensive with greater PEV adoption
- ✓ May create workplace friction among non-PEV owning employees not receiving reimbursement for gasoline costs
- ✓ Employees with home charging may choose to charge exclusively at work

Option 2: Employees pay for charging

Billing employees for PEV charging can help recuperate capital and operational costs over time. Some considerations:

- ✓ Bill for exact usage (kWh), which may require more expensive equipment
- ✓ Set up a monthly/yearly subscription rate based on estimated usage
- ✓ Employ a third-party administered turn-key model that fully covers installation, maintenance, operation, and employee billing

Resources

SDG&E: San Diego Gas & Electric (SDG&E) helps employers through the process of choosing and installing EV charging at their business. They offer workplace charging seminars, assistance in evaluating billing impacts, and other helpful tips for businesses. Visit: <http://www.sdge.com/clean-energy/business/employers-and-property-owners>.

Employer EV Initiative: Read about best practices, case studies and more from employers across the state. Visit: <http://www.evworkplace.org>.

San Diego REVI: Find a Request for Proposal (RFP) template for public agencies or businesses interested in EVSE. Visit: <http://energycenter.org/plug-in-and-get-ready>.

eVgo: Local businesses can benefit from eVgo's Ready for Electric Vehicle (REV) Program for California office buildings and corporate complexes. They offer 100% free EV charging equipment and electricity reimbursement. Visit: <http://www.eVgoNetwork.com>.

Zero-Emission Vehicles in California: Community Readiness Guidebook: This resource from the Office of Planning and Research offers useful information about workplace charging. Visit: http://opr.ca.gov/docs/ZEV_Guidebook.pdf.

Steps to Workplace Charging

1. Engage PEV owners, facility staff, managers, and legal council
2. Survey employee interest in workplace charging
3. Discuss findings and PEV charging needs among employees and company decision-makers
4. Conduct a site assessment with a contractor to determine ideal charging locations and costs
5. Contact SDG&E to determine the potential billing impacts of PEV charging
6. Examine different charger options and compare the benefits and costs (e.g. Level 1, Level 2)
7. Determine equipment ownership— building/parking lot owner, EVSE vendor or lessee
8. Establish company policies for employee access, define employee benefit and cost recovery
9. Explore existing incentives or rebates for workplace chargers
10. Select equipment, obtain multiple installation quotes
11. Present installation plan and budget to management for approval
12. Purchase equipment and hire a licensed electrical contractor for permitting, installation and inspection
13. City/county inspection of the charger installation
14. Install signage, alert employees
15. Publicize and share with the community

Adapted from the Calif. PEV Collaborative
Workplace Charging Installation Guideline

Resources for Electrical Contractors in San Diego

San Diego accounts for more than 20% of total statewide plug-in electric vehicle (PEV) sales and has the largest all-electric vehicle car-sharing program in North America. With every PEV purchase, the need for charging infrastructure expands and the demand for local electrical contractors grows.

Electrical Vehicle Supply Equipment Training

The PEV industry and local governments want to ensure contractors are completing safe and reliable electric vehicle supply equipment (EVSE) installations for their customers and constituents.

The International Brotherhood of Electrical Workers, in conjunction with the National Electrical Contractors Association, offers statewide EVSE installation training courses. The Electric Vehicle Infrastructure Training Program (EVITP) is designed for and available to all electrical contractors addressing best practices for residential, commercial, public, and fleet installations.

EVITP training is offered at regional community colleges and electric training centers. For information and a list of EVITP training opportunities, visit <http://www.evitp.org/training-programs> or email info@evitp.org.

Training benefits to electrical contractors include:

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

Electric Vehicle Supply Equipment Options

There are numerous EVSE product manufacturers and retailers. Many EVSE products are safety tested and certified by Underwriters Laboratories (UL). For a complete list of currently approved EVSE, visit <http://goelectricdrive.com/index.php/find-an-ev-charger>.

Electrical Vehicle Supply Equipment Installation and Maintenance

Every EVSE installation is different. The following resources address EVSE safety as well as technical and consumer issues electrical contractors and inspectors may encounter.

Regulatory Compliance

The City of San Diego requires EVSE installations in public areas to be made accessible to persons with disabilities. The City of San Diego Technical Policy 11B-1 applies to the installation of EVSE in both new and existing construction. More information can be found at: <https://www.sandiego.gov/development-services/pdf/industry/tpolicy11b1.pdf>.

For installations outside the City of San Diego, contact the local permitting office for accessibility guidelines.

The Alternative Fuels Data Center (AFDC) lists California laws, state incentives, and regulations related to PEVs and other advanced vehicles, which is found at: http://www.afdc.energy.gov/laws/state_summary/CA.

Nearest EVITP training centers:

1. San Diego Electrical Training Trust
www.positivelyelectric.org
858-569-6633
4675 Viewridge Ave.
San Diego, CA 92123
2. Cuyamaca College
<http://www.cuyamaca.edu/>
619-660-4000
900 Rancho San Diego Pkwy.
El Cajon, CA 92019
3. Orange County Electrical JATC
www.ocett.org
714-245-9988
717 South Lyon Street
Santa Ana, CA 92705

Installation and Inspection

The EVSE installation process begins with a site assessment and identifying the EVSE.

The City of San Diego has developed an information bulletin that describes the permitting and inspection process for EVSE on an existing site or building, found here: <http://www.sandiego.gov/development-services/pdf/industry/infobulletin/ib187.pdf>.

Common EVSE installation steps are also included in Advanced Energy's document, Charging Station Installation Handbook for Electrical Contractors and Inspectors.¹

Load Calculations

Load calculations are a required component of most electrical permit submittals. The National Electric Code (NEC) considers EVSE a continuous load. EVSE-specific information can be reviewed in NEC Article 625 by visiting http://www.advancedenergy.org/transportation/charging_station_forum.

The City of Oceanside has developed an EVSE load calculation worksheet and included it within the *Residential Electric Vehicle Charger Guidelines* (see *Residential Installations*).

Residential Installations

Most PEV charging takes place at home, overnight using Level 1 (120 volt) or Level 2 (240 volt) EVSE. EVSE is most often installed in a garage. EVSE installations for a single-family residence that can accommodate Level 2 EVSE is usually simple and straightforward. Installations may become more complex if an electrical service upgrade is required. Charging at multifamily developments offer additional considerations and often comes with higher cost estimates.

The cities of Oceanside and San Diego have developed guidance documents to help streamline the electric vehicle charger permitting process.

- City of Oceanside *Residential Electric Vehicle Charger Guidelines*
<http://www.ci.oceanside.ca.us/civica/filebank/blobload.asp?BlobID=30053>
- City of San Diego *Information Bulletin 187: How to Obtain a Permit for Electrical Vehicle Charging Systems*
<http://www.sandiego.gov/development-services/pdf/industry/infobulletin/ib187.pdf>

Nonresidential Installations

Nonresidential EVSE locations include vehicle fleet facilities, workplaces, retail stores, parking lots, commercial garages, and other government-owned public spaces. The following sections in the *EV Project's San Diego EVSE Guidelines for public and commercial EVSE installations* provide more information about various installations²:

- Installation process for commercial fleet operations (p. 27)
- Installation flowchart for public charging (p. 34)

The Clean Cities Coalition *Electric Vehicle Handbook* includes detailed information on all of these topics and more at <http://www.afdc.energy.gov/pdfs/51228.pdf>.

¹ http://www.bc3sfbay.org/uploads/5/3/3/9/5339154/charging_handbook.pdf

² <http://www.theevproject.com/downloads/documents/Electric%20Vehicle%20Charging%20Infrastructure%20Deployment%20Guidelines%20for%20the%20Greater%20San%20Diego%20Area%20Ver%203.2.pdf>

Plug-in Electric Vehicles

Electric Vehicle Charging Station Installation Guidelines: Residential and Commercial Locations

Streamlining the Permitting and Inspection Process of Residential and Commercial Electric Vehicle Charging Station Installations¹

Purpose



This guideline has been developed to streamline the permit and installation process of residential and commercial plug-in electric vehicle (PEV) charging stations, also known as Electric Vehicle Supply Equipment (EVSE). This guide can be used by jurisdictions as a template to provide clear information to homeowners and electrical contractors as to residential and commercial EVSE permitting requirements. Jurisdictions within the San Diego region are encouraged to use this document directly or modify it to reflect the specific requirements of their agency.

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

The type of PEV a person chooses to purchase may determine the way they charge their vehicle. A homeowner may plug their vehicle into a conventional 120-volt household outlet (three-pronged outlet) or install a 240-volt circuit for faster charging. PEVs come with a 120-volt charging cord that enables PEV owners to charge their PEV with a conventional 120-volt outlet. This is a very practical solution for owners of plug-in hybrid electric vehicles (PHEV), such as a Toyota Plug-in Prius or Chevrolet Volt.

On the other hand, a person that purchases a battery electric vehicle (BEV) like a Nissan LEAF may choose to charge using a Level 2 charging station. Level 2 charging stations use 240 volts, which takes about half the time to charge compared with 120 volts. Level 2 charging generally requires the installation of a dedicated circuit and a charging station at your home (usually in the garage). In this case, the homeowner will be required to obtain a permit from their local jurisdiction.

The table illustrates the charging time associated with the most popular BEV and PHEV on the market.

Charging Level	Power Supply	Charger Power	Miles/Hour of Charge	Type of PEV	
				Nissan LEAF	Chevrolet Volt
Level 1 	120 VAC	1.4 kW (onboard charger)	~3–4 miles	~17 hours	~9 hours
Level 2 	240 VAC	3.3 kW (onboard charger)	~8–10 miles	~7 hours	~3 hours
		6.6 kW (onboard charger)	~17–20 miles	~3.5 hours	~1.5 hours

Source: California PEV Collaborative

Commercial Charging

Workplace Charging for Businesses in San Diego² offers guidance for the installation of EVSE at non-residential locations. It includes information about how to assess the charging needs and potential of a commercial site and relevant resources.

¹Adapted from the City of Riverside's *ELECTRIC VEHICLE (EV) CHARGER INSTALLATION GUIDELINES* and the City of Oceanside's *Residential Electric Vehicle Charger Guidelines*.

²<http://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-diego/fact-sheets/Workplace%20Fact%20Sheet.pdf>

What do I need to provide to the permitting jurisdiction in order to obtain a permit?

Residential EVSE Permits

The following are submittal requirements to obtain a permit for the installation of a typical residential EVSE.

Supporting Documentation	Description
Plot Plan	Identify the complete layout of existing parking spaces and proposed location of EVSE parking space(s) with respect to existing building and structures.
Electrical Load Calculations	Home electrical load calculation that estimates if an existing electrical service will handle the extra load from a residential EVSE and wiring methods based on the California Electrical Code (See sample load calculation attached).
Electrical Plans	Single line diagrams showing the system, point of connection to the power supply and the EVSE. (See sample electrical plan attached)
EVSE Information	The EVSE manufacturer's installation instructions and charger specifications.

(Note: Jurisdictions may need to modify this list to reflect their specific requirements)

In most cases, homeowners or contractors simply need to submit the documentation outlined above to the local permitting office (usually the building and safety division) for review and permit issuance. PEV owners and contractors are encouraged to check their local jurisdiction's permitting website to see if this process is available online. If not, they will likely need to visit the permitting office for an over-the-counter review and permit issuance.

If all of the information is provided and the proposal complies with the applicable codes, the review and approval process occurs shortly thereafter. It is important to note that load calculations per California Electrical Code, Article 220, are required if the existing service panel is rated less than 200 amps. Electrical panel upgrades and electrical wiring shall be in conformance with the current edition of the California Electrical Code (CEC).

Commercial EVSE Permits

Installation of EVSE at commercial locations can be more complex than residential installations and may require additional permits or submittal documentation. The following are some additional considerations for commercial EVSE installations:

- ✓ Zoning Requirements
- ✓ Community or Design Guidelines
- ✓ Existing Use Permits
- ✓ Electrical Source / Metering
- ✓ Parking and Signage Requirements
- ✓ Permit and Inspection Fees

A simple commercial EVSE installation may have similar permitting requirements as a residential installation with the addition of a Tenant Improvement (TI) Electrical Permit. A more complex commercial installation may require a modification to an existing Use Permit or a Site Plan addressing specific community or zoning design criteria. It is important to meet with staff from the building and, if necessary, planning departments of the permitting jurisdiction to fully understand all of the necessary requirements and fees prior to when permits are submitted.

Do I need to get my charging station inspected by the permitting jurisdiction?

All jurisdictions in the San Diego region require an inspection of an installed EVSE. When the installation is complete, an inspection of the work is scheduled with the Building Inspector upon request. Generally, inspections occur less than one week after the request. Typically, the home or property owner (or tenant) will need to be present during the inspection so that the Inspector can access the location of the charging station and any other electrical or structural change. Please see the attached *EVSE Inspection Checklist*, which has been designed to serve as a guide for local Building Inspectors and has been endorsed by the National Electrical Contractors Association. A residential checklist being used in the cities of Oceanside and San Diego is also included.

How do I install a charging station?

Residential Installations

Installing a residential EVSE may require changes to the home's electrical wiring and utility electricity rates.

- For a step-by-step installation guideline, please view the attached *Plug-in and Get Ready* document. For more information on PEV charging stations currently available on the market, visit www.GoElectricDrive.com.

Commercial Installations

Commercial EVSE installations are often location and use specific. It is advisable to consult the permitting and/or planning agency before breaking ground.

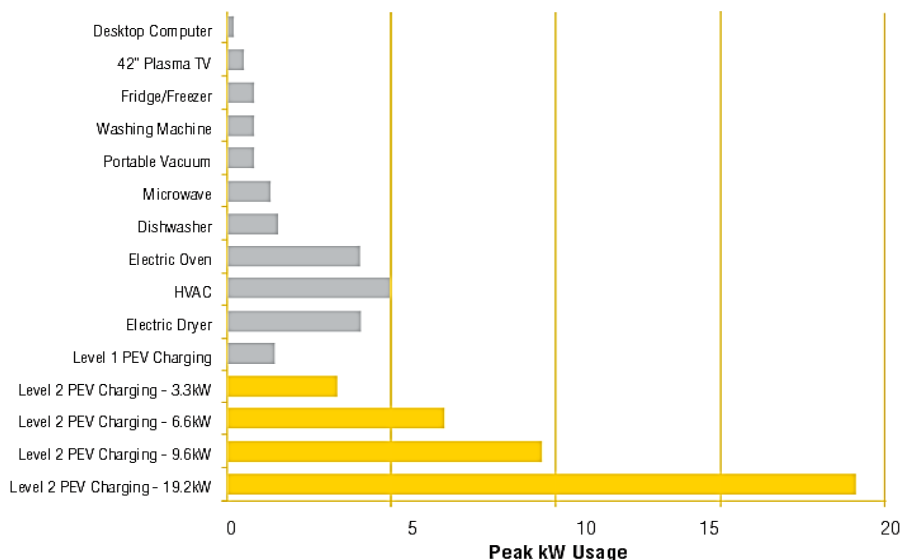
When installing a home or commercial charging station, property owners are encouraged to choose a local electrical contractor with the proper expertise, information, tools and training for installing EVSE to ensure a high quality and efficient installation experience. Please reference the wiring methods based on the California Electrical Code attached.

Why would SDG&E need to know about your charging station?

SDG&E needs to be able to accurately track the number of PEV charging stations installed to properly plan for local increases in electricity demand due to PEV charging. The combined effect of several chargers in the same area could result in overloads on utility secondary wires and transformers. Therefore, utility notification is an important component of providing safe, reliable electricity to all SDG&E customers.

SDG&E can help businesses understand pricing options for employees. They also help businesses identify potential EVSE rebates and incentives.

SDG&E's Clean Transportation Program has created the figure below that displays the significant load difference of a residential EVSE as compared with typical household appliances. According to SDG&E, a PEV charging at 9.6kW may double or triple a household's prior peak load. Additionally, PEV owners who notify SDG&E of a residential EVSE installation will be informed of SDG&E's PEV time-of-use rates (EV TOU). These rates provide a significantly lower cost of electricity for PEV owners that charge during the night, when demand is lower.



Visit SDG&E's website for more information about their Electric Vehicle Programs:
<http://www.sdge.com/electric-vehicles>

Source: San Diego Gas & Electric

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE) INSPECTION CHECKLIST

Key Concerns for Electric Vehicle Supply Equipment Inspections

1. Is the appropriate permit secured and is there a plan and calculation as required by the AHJ?
2. What type of electric vehicle supply equipment (EVSE) is being installed (i.e. Level 1, Level 2, other)?
3. Where is the EVSE located in relation to the charging location and the service or supply source?
4. Is the EVSE listed by an NRTL and are the installation instructions available for reference?
5. Is the EVSE going to be cord-and-plug connected (and so listed) or direct wired to an individual branch circuit?
6. What amount of voltage and current is required for the type of EVSE (nameplate information)?
7. Is the EVSE securely mounted to the structure and individual branch circuit wiring installed per NEC?
8. Is the properly sized equipment grounding conductor connected and proper overcurrent protection provided?
9. Does the service or source have adequate capacity for the load served?
10. Are separate utility meter(s) and/or service disconnecting means installed for special utility rates?

INSPECTION CHECKLIST (non-inclusive)

EVSE Inspection Activity Details				
Item	Inspection Activity	Code Reference	Comments	
1.	Verify permit is posted and all plans, calculations and installation instructions are available as required. May require use of examples in NEC Chapter 9. A calculation may be required to determine adequate capacity.	Local Regulations and NEC 90.8, 220.12, 220.14, 220.16, 220.82		
2.	Verify that the EVSE is listed by an NRTL and installation instructions are provided.	NEC 90.7, 625.5, 110.3(B)		
3.	Verify the EVSE location and that it is securely fastened to the structure and guarded from physical damage as required.	NEC 110.13, 110.27(B), 625.29, 625.30		
4.	Determine if EVSE is directly wired to the branch circuit or is cord-and-plug connected. Must be listed for cord-and-plug connection. Individual receptacle reqd.	NEC 110.3(B), 625.13, 625.18, 625.19, 625.29		
5.	Verify an individual branch circuit is installed for the EVSE. Applies to Level 1, Level 2, and fast chargers. Branch circuit and feeders (if applicable) must be sized 125% of nameplate current.	NEC Article 100 continuous load, 210.19(A)(1), 215.2(A), 625.21		
6.	Verify installed branch circuit wiring method is listed and securely fastened to the structure. Listed wiring and fittings must be installed. Check fished and surface wiring.	NEC 300.11 and the applicable .30 section of article		
7.	Verify the size of the branch circuit overcurrent protection is per nameplate and protects the conductors.	NEC 110.3(B), 240.4		
8.	Verify circuit conductors are sized not less than 125% of EVSE nameplate current. Be sure that the conductor ampacity complies with the rating of the overcurrent protection.	NEC 210.19(A)(1), 215.2(A), 110.3(B), Table 310.15(B)(16), 310.15(B).		
9.	Verify properly sized equipment grounding conductor is installed with the branch circuit and connected at the EVSE and to panelboard or service. Verify the equipment grounding conductor is identified.	NEC 250.110, 250.112, 250.114, 250.120, 300.3(B), 250.119, 250.122.		

10.	Check the electrical connections of the circuit conductors and equipment grounding conductor connections.	NEC 110.14, 250.148(A) Annex I	
11.	Verify disconnecting means is provided and properly located for EVSE rated greater than 60 amperes and 150 volts.	NEC 625.23	
12.	Verify installation of EVSE is in a neat and workmanlike manner.	NEC 110.12, NECA 1, NECA 413	
13.	Verify existing service conductors are of adequate size. For Level 2 EVSE installations, identify any existing service conductor sizes that might have been installed using NEC 310.15(B)(7) and Table 310.15(B)(7)	NEC 230.31, 230.42, 310.15(B)(7) and Table 310.15(B)(7)	
14.	Verify circuit breaker compatibility with existing panelboard or service equipment. Must be manufactured by the panelboard or service equipment manufacturer.	NEC 110.3(B), Article 240 Part VII, Article 408 part I	
15.	Branch circuit device and any disconnects must be identified as to the use.	NEC 408.4(A), 110.22(A)	
16.	Where separate utility metering and enclosures are installed, verify NEC compliance for service equipment and conformance to applicable utility regulations.	Utility company regulations and NEC Article 230	
17.	Verify equipment is suitable for connection to the line side of the service disconnecting means.	NEC 230.82	
18.	Verify sufficient working space is provided at EVSE, Panelboards, service equipment, and disconnects.	NEC 110.26	
19.	Verify additional service disconnects (if installed) are grouped.	NEC 230.72	
20.	Verify the maximum number of service disconnects has not been exceeded	NEC 230.71	
21.	Verify that any additional service disconnect is properly rated.	NEC 230.79	
22.	Verify the wiring method used for the additional service conductors installed.	NEC 230.43	
23.	Verify that additional service disconnects are properly identified.	NEC 230.70(B)	
24.	Verify service disconnect is listed as suitable for use as service equipment.	NEC 230.70(C)	
25.	Verify the overcurrent protection for any newly installed service equipment and conductors.	NEC 230.90, 230.91	
26.	Verify grounded conductor (neutral) is brought to the service disconnect and bonded to the enclosure.	NEC 250.24(C)	
27.	Verify metal service equipment enclosures and raceways are bonded together effectively.	NEC 250.92, 250.92(B)	
28.	Supply-side bonding jumpers are sized properly	NEC 250.102(C), 250.66	
29.	Verify existing service grounding and bonding.	NEC 250.50, 250.104(A) and (B)	
30.	Verify EVSE that is intended to be used as interactive systems, bi-directional, or optional standby systems be listed for that purpose.	NECA Articles 702 and 705	

** Note: These items included in the checklist are non-inclusive and are to serve as a guide or basis for inspection. They do not include any local Code requirements or regulations.*

LEVEL 2 ELECTRIC VEHICLE CHARGER - SERVICE LOAD CALCULATION

INSTRUCTIONS: Review the list of electrical loads in the table below and check all that exist in the home (don't forget to include the proposed Level 2 EV Charger). For each item checked, fill-in the corresponding "Watts used" (refer to the "Typical Usage" column for wattage information). Add up all of the numbers that are written in the "Watts Used" column. Write that number in the "Total Watts Used" box at the bottom of the table and proceed to the next page.

(Loads shown are rough estimates; actual loads may vary – for a more precise analysis, use the nameplate ratings for appliances and other loads and consult with a trained electrical professional.)

<input checked="" type="checkbox"/> Check All Applicable Loads	Description of Load	Typical usage	Watts used
GENERAL LIGHTING AND RECEPTACLE OUTLET CIRCUITS			
<input checked="" type="checkbox"/>	Multiply the Square Footage of House X 3	3 watts/sq. ft.	
KITCHEN CIRCUITS			
<input checked="" type="checkbox"/>	Kitchen Circuits	3,000 watts	3,000
	Electric oven	2,000 watts	
	Electric stove top	5,000 watts	
	Microwave	1,500 watts	
	Garbage Disposal under kitchen sink	1,000 watts	
	Automatic Dish washer	3,500 watts	
	Garbage Compactor	1,000 watts	
	Instantaneous hot water at sink	1500 watts	
LAUNDRY CIRCUIT			
<input checked="" type="checkbox"/>	Laundry Circuit	1,500 watts	1,500
	Electric Clothes Dryer	4,500 watts	
HEATING AND AIR CONDITIONING CIRCUITS			
	Central Heating (gas) and Air Conditioning	6,000 watts	
	Window mounted AC	1,000 watts	
	Whole-house or attic fan	500 watts	
	Central Electric Furnace	8,000 watts	
	Evaporative Cooler	500 watts	
OTHER ELECTRICAL LOADS			
	Electric Water Heater (Storage type)	4,000 watts	
	Electric Tankless Water Heater	15,000 watts	
	Swimming Pool or Spa	3,500 watts	
	Other: <i>(describe)</i>		
	Other:		
	Other:		
ELECTRIC VEHICLE CHARGER CIRCUIT			
	Level 2 Electric Vehicle Charger rating*		
(Add-up all of the watts for the loads you have checked ✓) TOTAL WATTS USED →			

*Use name plate rating in watts or calculate as: (Ampere rating of circuit X 240 volts = Watts)

INSTRUCTIONS: Apply the ***Total Watts Used*** number from the previous page to the Table below to identify if the Existing Electrical Service Panel is large enough to handle the added electrical load from the proposed Level 2 EV Charger. If your electrical service is NOT large enough, then you will need to install a new upgraded electrical service panel.

Table based on NEC 220.83 (A).

✓Check the appropriate line	Total Watts Used	Minimum Required Size of Existing 240 Volt Electrical Service Panel (Main Service Breaker Size)	Identify the Size of Your Existing Main Service Breaker (Amps)**
	up to 24,000	60 amp	
	24,001 to 48,000	100 amps	
	48,001 to 63,000	125 amps	
	63,001 to 78,000	150 amps	
	78,001 to 108,000	200 amps	
	108,001 to 123,000	225 amp	

**Please note that the size of your Existing service MUST be equal to or larger than the Minimum Required Size identified in the Table above or a New Upgraded electrical service panel will need to be installed (separate permit required for new service).

CAUTION: This table is **NOT** to be used to determine the size of a **NEW UPGRADED** Electrical Service Panel if your existing panel is too small or overloaded according the Table above. In order to determine the size of a NEW or UPGRADED Service Panel, there is a completely different load calculation methodology that applies. Sizing of a NEW or UPGRADED Electrical Service Panel should only be done by a qualified Electrical Contractor or Electrical Engineer.

STATEMENT OF COMPLIANCE

By my signature, I attest that the information provided is true and accurate.

Job Address: _____
(Print job address)

Signature: _____ (Date) _____
(Signature of applicant)

In addition to this document, you will also need to provide a copy of the manufacturer’s installation literature and specifications for the Level 2 Charger you are installing.

Please note that this is a voluntary compliance alternative and you may wish to hire a qualified individual or company to perform a thorough evaluation of your electrical service capacity in lieu of this alternative methodology. Use of this electrical load calculation estimate methodology and forms is at the user’s risk and carries no implied guarantee of accuracy. Users of this methodology and these forms are advised to seek professional assistance in determining the electrical capacity of a service panel.

OTHER HELPFUL INFORMATION FOR EV CHARGER INSTALLATIONS:

The Table below illustrates the type and size of wire and conduit to be used for various Electric Vehicle Charger circuits.

Size of EV Charger Circuit Breaker	Required minimum size of Conductors (THHN wire)	Conduit Type and Size***		
		Electrical Metallic Tubing (EMT)	Rigid Nonmetallic Conduit – Schedule 40 (RNC)	Flexible Metal Conduit (FMC)
20 amp	#12	1/2"	1/2"	1/2"
30 amp	#12	1/2"	1/2"	1/2"
40 amp	#10	1/2"	1/2"	1/2"
50 amp	#8	3/4"	3/4"	3/4"
60 amp	#6	3/4"	3/4"	3/4"
70 amp	#6	3/4"	3/4"	3/4"

*****Based on 4 wires in the conduit (2-current carrying conductors, 1-grounded conductor, 1-equipment ground).**

As an alternate, Nonmetallic Sheathed Cable (aka: Romex Cable or NMC) may be used if it is protected from physical damage by placing the cable inside a wall cavity or attic space which is separated from the occupied space by drywall or plywood.

The Table below illustrates the required supports for various types of electrical conduit or cable.

Conduit Support	Electrical Metallic Tubing (EMT)	Rigid Nonmetallic Conduit – Schedule 40 (RNC)	Flexible Metal Conduit (FMC)	Nonmetallic Sheathed Cable (NMC)
Conduit Support Intervals	10'	3'	4-1/2'	4-1/2'
Maximum distance from box to conduit support	3'	3'	1'	1'

In addition to the above noted requirements, the California Electrical Code contains many other provisions that may be applicable to the installation of a new electrical circuit. Installers are cautioned to be aware of all applicable requirements before beginning the installation. For additional information or guidance, consult with the Building and Safety Division staff or a qualified and experienced Electrical Contractor.

SAN DIEGO REGIONAL PLUG-IN ELECTRIC VEHICLE (PEV) READINESS PLAN

APPENDIX C

Contents:

San Diego REVI Comments on the Plug-in Electric Vehicles: Universal Charging Access Guidelines and Best Practices (p. 1)

Request for Proposals Template: Installation and Operation of Electric Vehicle Charging Stations (p. 16)

San Diego Regional Clean Cities Coalition Dealership Outreach Pamphlet (p. 22)

CCSE Guide to Plug-in and Get Ready (p. 26)

Electric Vehicle Charging for Regional Park-and-Ride Lots and Transit Stations (p. 27)

Building Codes Summary (p. 29)

Towing Alternative Fuel Vehicles Presentation (p. 32)

San Diego Plug-in Electric Vehicle Community Seminar: The Electric Vehicle Infrastructure Training Program (EVITP) Summary (p. 34)

San Diego Regional Nonresidential Charging Infrastructure Study (p. 39)

June 6, 2013

File Number 3200800

Ken Alex, Director
Governor's Office of Planning and Research
1400 10th Street
P.O. Box 3044
Sacramento, CA 95812-3044
ZEVfeedback@opr.ca.gov

SUBJECT: San Diego REVI Comments on the *Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices*

Dear Director Alex:

The San Diego Regional Electric Vehicle Infrastructure Working Group (REVI) is pleased to submit these comments regarding Plug-In Electric Vehicles (PEV): Universal Charging Access Guidelines and Best Practices (Guidelines) prepared by the Governor's Office of Planning and Research (OPR) and the Division of the State Architect (DSA). The REVI serves as the San Diego region's PEV Coordinating Council (PEVCC) and is developing a regional PEV readiness plan through California Energy Commission and San Diego Association of Governments (SANDAG) funding. Our member list is included as Attachment 1. The REVI is glad that OPR and DSA are updating the DSA 97-03 interim guidelines, and we appreciate the opportunity to provide comments for your consideration (Attachment 2).

The San Diego region has been at the forefront of PEV deployment and REVI members have experience addressing accessibility for electric vehicle (EV) charging station installations, particularly through the EV Project. In April 2012, the City of San Diego issued *Technical Policy 11B-1 on Accessibility to Electrical Vehicle Charging Stations (CSD-TP11B-1)* to address the uncertainty faced by charging station hosts and suppliers regarding accessibility (Attachment 3). Local jurisdictions have been using CSD-TP11B-1 as a best practice since its release, and it has enabled a significant increase in PEV charger installations.

The primary recommendation in our comments is to add flexibility to the ADVISORY for EVG-250.1 by making it consistent with CSD-TP11B-1 and allowing accessible EV charging stations at existing accessible parking spaces. Some REVI members went as far as suggesting that OPR replace its Guidelines with the City of San Diego's. The Guidelines state that accessible EV charging stations are not to be reserved exclusively for the use of persons with disabilities. The City's CSD-TP11B-1 allows for accessible EV chargers at existing accessible parking spaces with limitations. This flexibility has facilitated EV charging station installations at existing facilities that would otherwise not be able to accommodate an accessible EV charging station due to their mandated parking requirements. We provide more explanation for this, as well as other suggestions, in our attached comments.

Thank you for your consideration in developing these Guidelines. If you have any questions, please contact me at SANDAG, 401 B Street, Suite 800, San Diego, CA 92101; (619) 699-7387; or Susan.Freedman@sandag.org.

Sincerely,

A handwritten signature in black ink, appearing to read "Susan Freedman". The signature is fluid and cursive, with a large loop at the end.

SUSAN FREEDMAN, CHAIR
San Diego Regional Electric Vehicle Infrastructure Working Group (REVI)

Attachments

1. San Diego REVI Member List
2. REVI Comments and Recommendations on Draft Guidelines
3. City of San Diego Technical Policy 11B-1: Accessibility to Electrical Vehicle Charging Stations

SAN DIEGO REGIONAL ELECTRIC VEHICLE INFRASTRUCTURE WORKING GROUP

REPRESENTATION	MEMBER	ALTERNATE
South County Subregion	Brendan Reed City of Chula Vista	Chris Helmer City of Imperial Beach
North County Coastal Subregion	Ramsey Helson City of Del Mar	Mike Grim City of Carlsbad
North County Inland Subregion	Kathy Winn City of Escondido	Vacant
East County Subregion	Kathy Valverde City of Santee	Scott Munzenmaier City of La Mesa
City of San Diego	Jacques Chirazi	Vacant
County of San Diego	Peter Livingston	Susan Freed
San Diego Association of Governments	Susan Freedman, Chair	Allison King
San Diego Regional Airport Authority	Paul Manasjan	Brett Caldwell
Caltans, District 11	Chris Schmidt	Vacant
Unified Port District of San Diego	Michelle White	Jenny Lybeck
San Diego Gas & Electric	Joel Pointon	Randy Shimka
California Center for Sustainable Energy	Mike Ferry, Vice Chair	Colin Santulli
University of California, San Diego	Dave Weil	Jim Ruby
Miramar College, Advanced Transportation Technology and Energy	Greg Newhouse	Vacant
San Diego Electric Vehicle Network	Randy Walsh	Vacant
National Electrical Contractors Association	Karen Prescott	Tim Dudek
International Brotherhood of Electrical Workers Local 569	Micah Mitrosky	Vacant
ADVISORY MEMBERS		
San Diego Air Pollution Control District	Mike Watt	Nick Cormier
Department of Defense	Chris Parry, US Navy	
Metropolitan Transit System	Claire Spielberg	
City of Coronado	Bill Cecil	
City of Encinitas	Diane Langager	
City of National City	Ray Pe	
City of Solana Beach	Dan King	
City of Vista	Lyn Dedmon	
Ecotality	Andy Hoskinson	
Car2go	Mike Cully	
Aerovironment	Charlie Botsford	
Coulomb Technologies	Colleen Quinn	
General Electric	David Wang	

**SAN DIEGO REVI COMMENTS AND RECOMMENDATIONS ON OPR'S AND DSA'S
PLUG-IN ELECTRIC VEHICLES: UNIVERSAL CHARGING ACCESS GUIDELINES AND BEST PRACTICES**

General Comments:

1. Recommended changes to specific language in the draft guidelines are provided here in BOLD RED. Removal of language is shown in STRIKETHROUGH.
2. The guidelines component and regulations component of the document should use consistent terminology and definitions.
3. Revise all existing parking stall figures to show the preferred location of the electric vehicle charging station and cord. Refer to the figures in City of San Diego's Technical Policy 11B-1: Accessibility to Electric Vehicle Charging Stations for clear examples. (Attached to these comments.)
4. Replace references to the 2013 California Building Code with "current edition of the California Building Code" where applicable.
5. Include definitions for all uses of the term "maximum extent feasible" and "available right-of-way."

Comment 1: Alter ADVISORY EVG-250.1 to offer more flexibility at existing sites.

Explanation

The City of San Diego Technical Policy 11B-1 (CSD-TP11B-1) allows for use of existing ADA spaces for EV charging. In this case, the space remains ADA first and EVSE second. Non PEV users of ADA spaces are encouraged, but not required, to park in other ADA spaces before taking an ADA space that also has access to an EV charger. CSD-TP11B-1 was created to address actual experiences faced by businesses and agencies interested in hosting EVSE at their sites, but were unable due to how the EVSE impacted their parking requirements (counts of stalls, etc.). Prior to this technical policy, the EV Project experienced uncertainty and hosts backing out of the project because the addition of EVSE could not be reconciled with mandatory parking requirements.

OPR is encouraged to allow for flexibility here, to answer challenges in finding locations for accessible EV charging stations. Less ideal options, other than using an existing ADA parking space at existing sites and locations, include:

1. Convert an existing ADA parking space to an accessible EV charging space, and remove signage and coloring for ADA parking. (This is not a likely solution as most parking lots cannot remove an ADA parking space without consequences due to number counts of parking spaces.)
2. Convert a standard parking space into an accessible EV charging space. (This is a challenging solution as many parking lots adhere to the exact number of parking spaces they are required to provide. They do not have an excess number of spaces to enlarge a standard parking space and thus take away a second parking space.)
3. Place an EV charger between an ADA parking space and a standard space to allow access by either a person with disabilities or a vehicle without the ADA placard. (This can be a solution in

some locations (including the parking structure at SANDAG’s office building); however, many large stores have the ADA parking spaces clustered together near the front of the building, so an adjacent standard space is not always available.)

Recommended Revision to ADVISORY: EVG-250-1

ADVISORY: EVG-250.1 General. While there is no positive requirement to provide electric vehicle charging stations, when they are provided a portion of them should be accessible. When co-located with parking spaces, electric vehicle charging is considered the primary function of these ~~stations~~ **spaces**, not parking. **For new construction, electric vehicle charging when co-located with parking spaces is considered the primary function of these stations, not parking. Accessible electric vehicle charging stations are not to be reserved exclusively for the use of persons with disabilities. They should not be identified with signage that would mistakenly indicate their use is only for vehicles with placards or license plates for individuals with disabilities. For installations at existing sites and locations, existing ADA spaces can also be used as electric vehicle charging stations if the site or location would fall out of compliance with its required parking counts by reconfiguring parking stall(s) into an accessible electric vehicle charging station. In this case, the space remains ADA first and an electric vehicle charging station second. Users of ADA spaces are encouraged, but not required, to park in other ADA spaces before utilizing an ADA space that provides access to an electric vehicle charging station. The space must continue to be identified with ADA signage.**

Comment 2: We support inclusion of a “programmatic” option in EVG-250.5.2 to address the difficulty in siting on-street electric vehicle charging, and the scope of a programmatic option should be determined at the local level.

Explanation

- The interpretation of “programmatic basis” should be left to the discretion of the public entity because in some cases it could refer to just a few blocks, a neighborhood or an entire city.
- Include a definition for “maximum extent feasible.”

Recommended Revision to ADVISORY: EVG-250.5.2

The required total number of electric vehicle charging stations complying with EVG-250.2 and EVG-250.3 may be provided on a combined basis using both on-site locations **owned or controlled by a state or local governmental jurisdiction** and on-street locations within a public right-of-way owned or controlled by a state or local governmental jurisdiction. On-street electric vehicle charging stations within the public right of way shall be integrated with on street parking to the maximum extent feasible. **Maximum extent feasible is defined as _____.**

Comment 3: Provide clarification to EVG-250.6 to denote the purpose as Path of Travel and defining “cost of compliance” and “path of travel” using the definitions provided in 2013 CBC 11B-202.4 (pages 17-19 of OPR draft).

Explanation

The narrative, EXCEPTION, and ADVISORY are difficult to comprehend at times and should be written clearer.

Recommended changes:

1. Revise the opening narrative to read, **“Path of travel provisions for alterations at existing facilities solely for the purpose of installing electric vehicle charging stations shall be limited to the actual scope of work of the project and shall not be required to comply with section 11B-202.4 of the current edition of the California Building Code.”**
2. Revise the EXCEPTION to read, **“EXCEPTION: Alterations solely for the purpose of installing EV charging stations at sites where vehicle parking or storage is the sole and primary use of the facility shall comply with the current edition of the California Building Code section 11B-202.4 Path of Travel Requirements in Alterations, Additions and Structural Repairs to the maximum extent feasible. The cost of compliance with 11B-202.4 shall be limited to twenty percent of the adjusted construction costs of the work directly associated with the installation of the electric vehicle charging equipment. For the purposes of this exception, the adjusted construction costs of alterations, structural repairs or additions shall not include the cost of alterations to path of travel elements required to comply with 11B-202.4.**

Adjusted construction costs are determined on a three-year period. If an area has been altered without providing an accessible path of travel to that area, and subsequent alterations of that area or a different area on the same path of travel are undertaken within three years of the original alteration, the total cost of alterations to the areas on that path of travel during the preceding three-year period shall be considered in determining whether the cost of making that path of travel accessible is disproportionate.

3. Omit the last sentence of ADVISORY EVG-250.6 (page 8): ~~“For projects with basic costs above the CBC valuation threshold of \$139,964, the cost above which path of travel alterations would become disproportionate has been aligned with the federal requirements of twenty percent (20%).”~~ It creates unnecessary confusion regarding projects valued under \$139,964.

Comment 4: For EVG-812.3, insert language stating that an access aisle shared between an accessible parking space and an EV charging station that enables use of the EV charger from the accessible space can be counted as an accessible EV charger as long as the EV charger's cord does not impede the accessible path of travel. Include figures to identify where the electric vehicle charging station and its cord should be located in this situation.

Explanation

Placing an EV charger between an ADA parking space and a standard space allows access by either a person with disabilities or a vehicle without the ADA placard. This set-up offers flexibility for utilization of the EV charging station. The City of San Diego Technical Policy 11B-1 allows for this.



THE CITY OF SAN DIEGO

Development Services

Division of Building, Construction & Safety

Technical Policy 11B-1

Subject: Accessibility to Electrical Vehicle Charging Stations

Code Section: N/A

Code Edition: 2010 California Building Code

Issue Date: April 19, 2012

Approved by: Signed copy on file
Afsaneh Ahmadi, Chief Building Official P.E.

The 2010 California Building Code (CBC) requires public accommodations and services to be made accessible to persons with disabilities. The 2010 CBC includes accessibility standards for card readers at gasoline fuel-dispensing facilities but does not include regulations for accessibility at electric vehicle (EV) charging stations. The Division of the State Architect has developed a guideline titled "Interim Disabled Access Guidelines for Electrical Vehicle Charging Stations" and published Policy #97-03 (see copy attached). City of San Diego Technical Policy 11B-1 has been adapted from the State guidelines and State standards for access to card-reader devices at fuel-dispensing equipment to ensure uniform and consistent enforcement by review and inspection staff.

When the CBC requires that parking in existing or new construction be accessible, the required parking is designed to serve the building and shall be used exclusively for parking of appropriately identified vehicles. Accessible EV charging stations provide a service available to disabled and non-disabled persons using electric vehicles and are provided based on an availability basis.

This policy applies to the installation of EV Charging Stations in both new and existing construction.

EV charging stations located in non-public areas and used to charge vehicles managed by fleet services such as rental car agencies, EV car dealerships etc. are not required to be accessible since they do not serve persons with disabilities.

I. Where Required:

1. **New Construction.** When provided in conjunction with new buildings or parking facilities such as surface parking lots or parking garages, the accessible EV charging station(s) must be located in close proximity (DSA recommends within 200 ft) to a major facility, public way or a major path of travel on the site.

Accessible EV charging stations not provided in conjunction with accessible parking spaces need not be provided immediately adjacent to the major facilities on the site since the primary purpose of the stations is to provide the charging as a service, parking is not intended to be the primary use of the EV charging stations.

An accessible path of travel is required from the accessible EV charging station to other services provided at the site such as buildings, parking facilities, etc.

2. **Existing sites.** When provided at existing sites, the accessible charging station need not be located in close proximity to other services at the site.

An accessible path of travel connecting the accessible EV charging station to a major facility, public way or major path of travel on the site is required to the extent that the cost of providing such path does not exceed 20% of the cost of the EV equipment and installation of all EV charging stations at the site over a three-year period, when such valuation does not exceed the threshold amount referenced in CBC Section 1134, Exception 1.

In lieu of providing detailed information on the plans to demonstrate compliance with the CBC accessibility requirements for the existing parking and path of travel, the following two notes can be added to the plan(s) to certify that the existing facilities complies with the CBC. The notes shall be as follows.

- a. Add and sign the following certification note "I am the designer/owner in responsible charge of this EV charging station project; I have inspected the proposed location for the proposed accessible EV charging station and have determined that the accessible route of travel to the EV charging station shown on the site plan complies as an accessible route of travel as is required by the California Building Code. Signature: _____

Print Name: _____
Date: _____."; and

- b. "If the Building Inspector determines noncompliance with the above statement he/she shall require complete, detailed plans clearly showing all existing non-complying conditions and the proposed modifications to meet current accessibility provisions for the parking space and accessible route of travel to the EV charging station to the extent required by the California Building Code. The revised plans must be resubmitted to the Structural review section for approval."

Accessible EV charging stations in existing accessible parking spaces: When the CBC requires that parking in existing or new parking facilities be accessible, the required parking is designed to serve the building and shall be used exclusively for parking of appropriately identified vehicles. Accessible EV charging stations provide a service available to disabled and non-disabled persons using electric vehicles and are provided based on an availability basis.

When a new accessible EV charging station is installed in an existing accessible parking space, not less than one additional EV charging station shall be provided.

Not more than one accessible EV charging station shall be located in an existing accessible parking space unless more than one accessible EV charging station is required.

When more than one accessible EV charging station is required and are placed in existing accessible parking spaces, the EV charging stations shall be reasonably distributed throughout the parking lot or parking structure.

When an EV charging station is placed in conjunction with an existing accessible parking space the identification sign required in subsection (d) below shall be omitted.

II. **Specifications for Disabled Accessible EV Charging Stations:**

Vehicular spaces provided for accessible EV charging stations shall allow for persons with disabilities to exit an electric vehicle, to access the charging unit and place the charging cable on the vehicle. While the space designated for the accessible EV charging station is not required to be striped and identified as is required for accessible parking spaces, the space shall be designed to comply with the following requirements.

- (a) **Number of Accessible EV Charging Stations Required:** Not less than one EV charging station shall be accessible to persons with disabilities.

When the number of EV charging stations proposed exceeds 25, they shall be provided at a rate of one accessible EV charging station for every 25 stations proposed. Not more than a total of 4 accessible EV charging stations is required on the same site.

- (b) **Dimensions for Accessible EV Charging Stations:** The EV charging station shall include a space to place the electric vehicle that is not less than 9 foot wide by 18 feet deep to accommodate the vehicle. The space shall also include a 5 ft wide access aisle that extends the full depth of the vehicular space and located on the passenger side of the vehicle. Alternatively, the access aisle can be located between an accessible parking space and an accessible EV charging station. See figures 1, 2 and 3 for possible configurations.

- (c) **Identification for Accessible EV Charging Stations:**

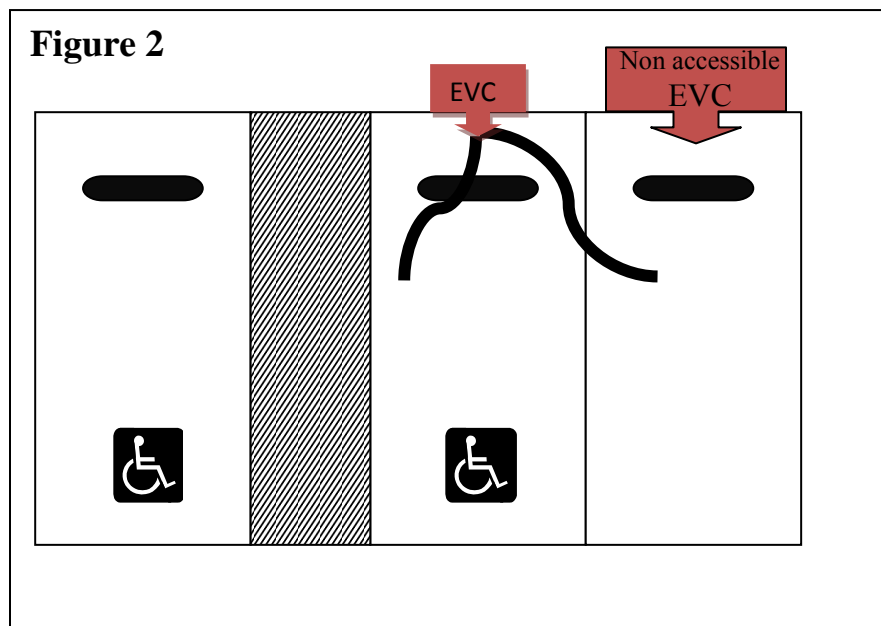
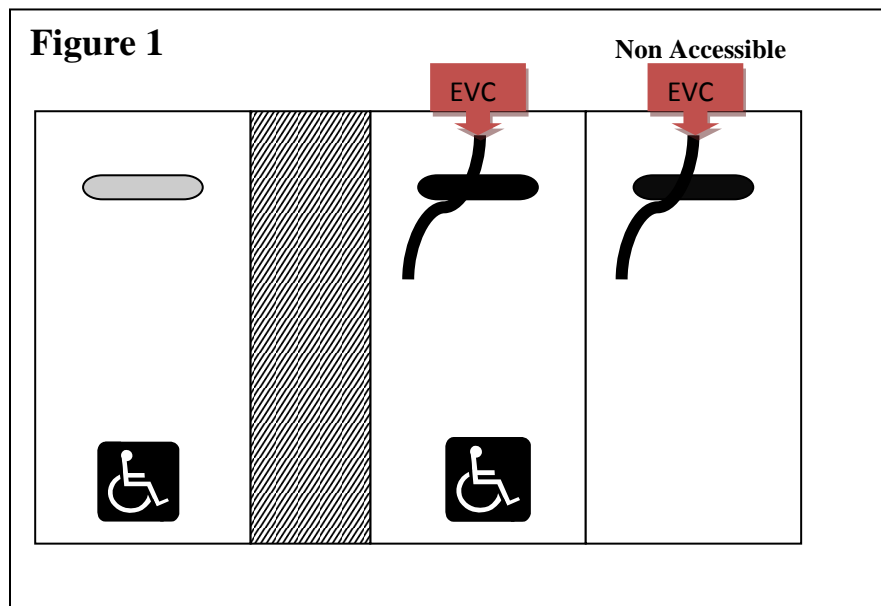
The accessible EV charging station shall be identified.

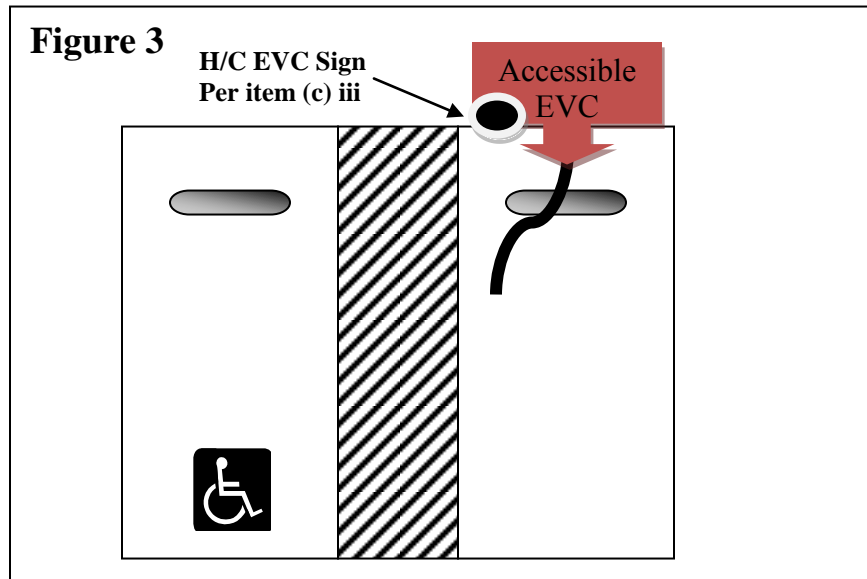
- (i) The accessible EV charging station and its access aisle need not be striped or provided with signage as required for an accessible parking space.
- (ii) When an EV charging unit is installed in an existing accessible parking space, the signage at the accessible parking space shall remain in conformance with the requirements of the CBC.
- (iii) To identify an accessible EV charging station an informational sign must be posted which reads, "Parking for EV Charging Only; This Space Designed for Disabled Access; Use Last." When an EV charging station is placed in conjunction with an accessible parking space this sign shall be omitted.

(d) **Disabled Access to Accessible EV Charging Equipment:**

Charging equipment serving accessible EV charging stations shall be accessible.

- (i) The charging equipment, and when applicable card readers, must meet all applicable reach range provisions of CBC Section 1118B and Ch 11C for a 30 by 48 inch wheelchair space used for side or front approach.
- (ii) A clear path of travel measuring not less than 36 inches in clear width shall be provided to access the charging equipment.





**Interim Disabled Access Guidelines for
Electrical Vehicle Charging Stations**

97-03

Effective 4-30-97
Revised 6-5-97

This policy is applicable to projects under DSA jurisdiction only. DSA's Access Compliance jurisdiction encompasses state-funded buildings, facilities and universities, as well as publicly-funded elementary schools, secondary schools, and community colleges. Local jurisdictions may or may not adopt similar methods of administering current code requirements, determining equivalent facilitation, or defining acceptable parameters as necessary in enforcing the existing California Building Standards Code as allowed under Government Code Section 4451(f)] of the California Code of Regulations.

Issue: In state funded projects with electrical vehicle, charging stations must be accessible. Electric Vehicles are being slowly introduced to the consumer market over the next three years as a result of an agreement between auto makers and the State of California. The zero emission vehicles as well as the equipment to charge them are continuing to develop and change at a rapid pace. Yet to successfully serve new electric vehicle customers, public charging is essential. Public charging sites that are developed now are likely to see significant technology changes before electric vehicles are fully commercialized. Based on a rule adopted by the California Air Resources Board, beginning in 2003, 10% of vehicles sold in California must be zero emission.

Public charging stations will be installed in public places such as shopping centers, parking lots and garages of companies or municipalities. They are provided as a convenient charging location for Electric Vehicle owners while they work or shop. Full charging of an Electric Vehicle takes between two to three hours.

Resolution: Representatives of the Division of State Architect, California Electric Transportation Coalition, Edison EV, The California Building Officials, Department of Rehabilitation and members of the disabled community have held meetings for the purpose of developing interim guidelines to address the issue of disabled access to these charging stations. The following guidelines have been developed and agreed upon by these organizations:

ARE EV CHARGING STATIONS REQUIRED TO BE ACCESSIBLE?

Yes. EV Charging Stations are required to be accessible because they offer a service to the general public. When EV charging is coupled with regular parking, the EV charging is considered the primary service. (See Item V for further discussions.)

WHAT PERCENTAGE OF THE EV CHARGING STATIONS MUST BE MADE ACCESSIBLE?

The following table shall be used in determining the required number of accessible charging stations:

# of charging stations provided at a site	# of accessible charging stations required
1 to 25	1
50	2
51 to 75	3

WHAT PERCENTAGE OF THE EV CHARGING STATIONS MUST BE MADE ACCESSIBLE?

The following table shall be used in determining the required number of accessible charging stations:

# of charging stations provided at a site	# of accessible charging stations required
76 to 100	4

WHAT SPECIFICATIONS MUST THE ACCESSIBLE EV CHARGING STATION COMPLY WITH?

- a. A 9 foot wide space by 18 feet deep space is required. An access aisle of 5 feet on the passenger side is required. One in every eight accessible charging stations, but not less than one, shall be van accessible with a 8 foot access aisle.
- b. The accessible EV charging station and its access aisle need not be striped or provided with signage as required for an accessible parking space. An information sign must be posted which reads, "Parking for EV Charging Only; This Space Designed for Disabled Access; Use Last."

MUST ACCESSIBLE EV CHARGING STATIONS BE RESERVED EXCLUSIVELY FOR THE USE OF PERSONS WITH DISABILITIES?

No. The primary function of these stations is the charging of Electric Vehicles. Parking is not intended to be the primary use of the charging station.

ARE THERE ANY RESTRICTIONS RELATIVE TO THE LOCATION OF THE ACCESSIBLE EV CHARGING STATIONS?

For installations associated with new construction, the accessible charging station must be located in close proximity to a major facility, public way or a major path of travel on the site. Note: 200 feet is the maximum distance recommended. However, the charging stations need not be provided immediately adjacent to the major facilities since, again, the primary purpose of the stations is to provide the charging as a service, and parking is not intended to be the primary use of the stations.

For installations at existing sites, the accessible charging station need not be located in close proximity to other services at the site.

IS AN ACCESSIBLE PATH OF TRAVEL REQUIRED FROM THE ACCESSIBLE EV CHARGING STATION TO OTHER SERVICES PROVIDED AT THE SITE?

Yes, for installations associated with new construction. As for other facilities on the site, an accessible path of travel is required between facilities.

For installation at an existing site, an accessible path of travel is required to the extent that the cost of providing such path does not exceed 20% of the cost of the EV equipment and installation of all EV charging stations at the site, when such valuation does not exceed the threshold amount referenced in Exception 1 of Section 1134 of Title 24. The accessible path of travel shall connect to a major facility, public way or major path of travel on the site.

WHAT SPECIFICATIONS MUST THE CHARGING EQUIPMENT MEET?

The charging equipment must meet all applicable reach range provisions of Section 1118B of Title 24. A clear path of travel measuring 36 inches in clear width to the charging equipment is required.

DOES THE INSTALLATION OF CHARGING STATIONS AT AN EXISTING SITE TRIGGER PATH OF TRAVEL IMPROVEMENTS SUCH AS PRIMARY ENTRANCE TO OTHER FACILITIES, RESTROOMS, TELEPHONES, OR DRINKING FOUNTAINS?

No, unless the above features are located in the parking lot, are accessed directly from the parking lot and designed for use with the parking lot.

HOW DOES THE THREE-YEAR VALUATION ACCUMULATION APPLY TO THESE INSTALLATIONS?

The valuation of other improvements at the site over the last three years need not be added to the cost of the installation to determine application of the exception referenced in item VI above. The cost of installation of other EV charging stations at the site over a three-year period must be used in determining compliance with the exception.

Approving Authority:



Michael J. Mankin, AIA
Manager, Access Compliance Program

San Diego County Sample RFP Template

REQUEST FOR PROPOSAL (RFP) TEMPLATE:

Installation and Operation of Electric Vehicle Charging Stations

The following is a Request for Proposal (RFP) template that provides recommended headings and proposal language to assist in the issuance of an RFP for Electric Vehicle Charging Stations. In the outline, a brief summary is provided for each heading and this information can and should be customized for each individual RFP.

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

1. Overview of the Project

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

2. Acronyms/Definitions

A glossary of the necessary acronyms and definitions used throughout the RFP (e.g. “Supplier” – Organization/individual submitting a proposal in response to this RFP)

EVSE – Electric Vehicle Supply Equipment

3. Scope of Project

The Scope of the Project is as follows:

- Provide attractive and well-maintained EVSE.
- Cover all costs associated with installation, maintenance, and electricity for the EVSE. The supplier may establish a service charge and method of payment collection to recoup these costs as well as any operating profit from EVSE users.
- Provide proper EV parking signage and reconfiguration of any parking stalls for EV parking.

- o Market the project as well as provide product advertisement.
- o Offer options for EVSE when the agreement expires (e.g. charging unit removal, transfer of ownership, contract renewal options).
- o The <insert jurisdiction> to provide the required parking spaces to accommodate the EVSE within the parking facilities at no cost to the supplier.

4. Additional Considerations

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

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

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

5. Submittal Instructions

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

Proposal Evaluation Process Timeline

<u>TASK:</u>	<u>DATE/TIME:</u>
Deadline for submitting questions	<Insert date>
Answers to all questions submitted	<Insert date>
Pre-Submission conference/meeting	<Insert date>
Deadline for submission of proposals	<Insert date>
Evaluation period	<Insert date>
Selection of supplier	<Insert date>

MANDATORY SITE VISITS

Site visits are scheduled as follows for potential EVSE suppliers to gather data and further assess proposed sites. The dates and times identified will be the only opportunity to view the proposed sites. Failure to attend the mandatory site visits will result in automatic disqualification with no further consideration for award.

<u>PROPOSED SITE</u>	<u>DATE OF VISIT</u>	<u>TIME</u>	<u>CONTACT</u>
----------------------	----------------------	-------------	----------------

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

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

<Insert Jurisdiction Name>

<Insert Contact Name>

<Insert Address>

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

REQUEST FOR PROPOSAL NO.: <insert proposal number>

FOR: Electric Vehicle Charging Stations

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

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

Proposal Format:

Supplier Information:

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

Supplier Background & Work Experience:

- A list of all communities within the San Diego Gas & Electric (SDG&E) service territory in which the supplier has provided and maintained publicly-available EVSE during the last five years, if applicable. Please list communities with active EVSE and communities where EVSE have been removed. Also include the following information for each community:
 - Name of the organization that contracted with you for EVSE sites. Please include the name of a contact person and phone number.
 - Was the contract/franchise exclusive or nonexclusive?
 - Number of EVSE provided.
 - Time period that the EVSE were installed.
 - Reporting sales & usage (sample reports)

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

Scope of Work:

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

Additional Items:

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

6. Proposal Evaluation & Award Process

Proposals will be evaluated based on the following criteria (please reference attached *RFP Criteria Review Template*):

- Current and past supplier performance in similar contracts with other agencies.
- Financial stability of the proposer as reflected in a certified financial statement or other certified statement, including but not limited to a Dun and Bradstreet financial rating.
- EV customer rate structure and method of customer payment that will be used to charge customers.
- Description of metering configuration.
- Process and schedule to reimburse the jurisdiction in order to recoup cost of electricity used to provide EVSE (if applicable).
- Maximum public benefit (i.e., in terms of affordability and customer support).
- Strength, quality, durability, advanced technology, future flexibility, and aesthetic appeal of proposed EVSE.
- Proposed maintenance, repair and replacement schedule including response times for malfunctioning EVSE (e.g. supplier’s proximity to the <insert jurisdiction> and number of proposer’s employees performing maintenance functions).
- Possible commitment to providing additional EVSE at other <insert jurisdiction> owned parking facilities (desirable but not required).
- Supplier’s specific marketing strategy that includes product advertising.
 - EVSE installation marketing plan.
 - Description of the supplier’s available marketing resources.
- Proposed options for EVSE (e.g. system removal, transfer of ownership, contract renewal options)when the agreement expires and potential costs to the jurisdiction.

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

7. Project Specifications

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

8. Subcontractor Information and Business License

Does this proposal include the use of subcontractors?

Yes _____ No _____ Initials _____

If “Yes”, supplier must:

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

BUSINESS LICENSE

<Insert Jurisdiction> requires all businesses operating in the <insert jurisdiction> to pay a business license tax. In some cases the <insert jurisdiction> may require a regulatory permit and/or evidence of a State or Federal license. Prior to issuing a business license, certain business types will require the business license application and/or business location to be reviewed by the Development Services, Fire, Health, and/or Police Departments.

9. Cost

- N/A

10. Terms, Conditions and Exceptions

<Insert project specific terms, conditions and exceptions>

To view an example, please reference section 9 of the City of Long Beach RFP No. PW12-016.

<Insert individual public liability and insurance requirements for your agency>

Plug-in Electric Vehicle Benefits

Incentives available

Fun driving experience

Low fuel and maintenance costs

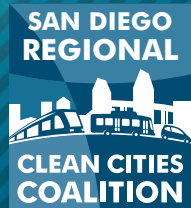
Minimal environmental impacts

Reduced dependence on oil

*Different sizes and ranges
to meet your needs*

*Learn more about the
advantages of driving electric:*

sdcleancities.org/ev



PLUG-IN.

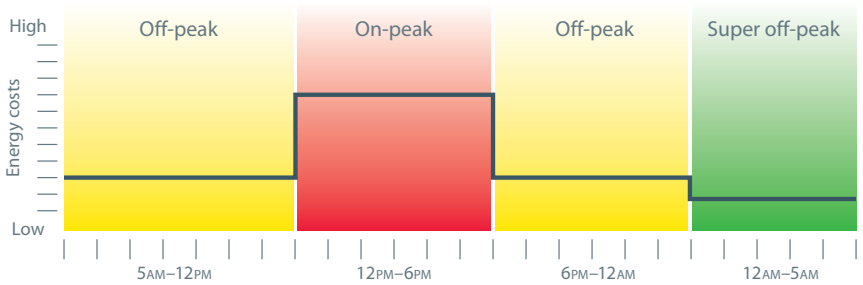


SAVE MONEY. DRIVE ELECTRIC.

It matters *when* you charge your electric car.

San Diego Gas & Electric's electric vehicle (EV) rates will help you pay the lowest price for your EV fuel, when charging from midnight to 5 a.m.

Sign up for an EV time-of-use rate and program your car to charge when electric rates are at their lowest – during the **“off-peak”** and **“super off-peak”** hours.



Connect with SDG&E® first when purchasing an EV, by visiting: sdge.com/ev



A  Sempra Energy utility™

SDG&E supports the adoption of EVs while ensuring safe and reliable service.

PLUG-IN.



SAVE MONEY. DRIVE ELECTRIC.

California EV drivers qualify for *major incentives!*

Clean Vehicle Rebate Project



State cash rebates of up to \$2,500! Qualifying is easy...

- Purchase or lease a new eligible plug-in electric vehicle and register it in California
- Minimum 36 month lease term or ownership required
- Available to California residents, businesses and public entities

Funding based on availability and is first-come, first-served.

Federal Tax Credit



Get money at tax time!

Federal tax credits range from **\$2,500** to **\$7,500** based on battery capacity.

DMV Clean Air Vehicle Sticker



EV drivers can use the carpool lane as a single occupant.

Learn more by visiting:
energycenter.org/ev



California Environmental Protection Agency
 **Air Resources Board**

PLUG-IN.



SAVE MONEY. DRIVE ELECTRIC.

Planning for *EV charging* across San Diego

The San Diego Association of Governments (SANDAG) is the 18 cities and county government and serves as a forum for regional decision-making and the region's planning and transportation agency. sandag.org/energy

SANDAG is helping to facilitate EV charging and to resolve barriers to EV charger installations through the San Diego Regional EV Infrastructure (REVI) Working Group:

Diverse Membership

- Local governments and public agencies
- Public utility and private businesses
- Not-for-profits and educational partners

Learn more: energycenter.org/pluginready

A number of resources on EV charging are available, including

- Department of Energy – Alternative Fueling Station Locator: afdc.energy.gov/locator/stations
- National Renewable Energy Laboratory, Vehicles & Fuels Research – EV vehicle and charging information: nrel.gov/vehiclesandfuels
- California PEV Collaborative – A resource for statewide activities, tools, resources and information: pevcollaborative.org



PLUG-IN.



SAVE MONEY. DRIVE ELECTRIC.

Your Guide to Plug-In and Get Ready*






There are many different ways to charge your PEV. You can charge at public charging stations near your work or home, use the existing electrical outlets in your home (Level 1), or install a Level 2 charging station in your home.

Use this guide to help you decide if installing a Level 2 charging station in your home is the right choice for you and learn about the steps needed for Residential Electric Vehicle Supply Equipment (EVSE) installations. At this time, this guide is intended for use by single-family residences only. If you rent your home, be sure to discuss any home modifications with the property owner first and visit SDGE's website for more information.

Level 1 (120 volt) — PEVs come with a 120-volt charging cord that enables PEV owners to charge their PEV with any conventional 120-volt three-pronged outlet. While it takes longer to charge, Level 1 (L1) allows PEV drivers to plug in without the installation of a dedicated charging station.

Level 2 (208 to 240 volt) — This level of charging requires a charging station, also known as electric vehicle service equipment (EVSE), be purchased and installed and generally involves the installation of a dedicated circuit at either the PEV owner's home or where a public charging station is installed. Currently, Level 2 (L2) EVSE makes up the majority of public charging stations across California.

To learn more visit
www.energycenter.org/pluginready

 <p>Will you be charging your PEV at home?</p> <p>YES</p>	 <p>Do you have a designated parking place for your PEV, like a garage or parking space with access to an electrical outlet?</p> <p>YES</p>	 <p>Do you want to take advantage of reduced rates from your utility provider (if available) or Level 2 charging?</p> <p>YES</p>	<p>WWW</p> <p>A typical process to install Level 2 EVSE in your home would include these steps:</p> <ul style="list-style-type: none"> • Have a contractor check the electricity panel capacity and load balance • Contact your local utility provider to check rates and requirements (www.sdge.com/ev) • Get a permit from the City or County • Install the EVSE and submeters • Complete a building inspection <p>Visit www.energycenter.org/pluginready to learn more.</p>
<p>NO</p> <p>WWW</p> <p>Visit the AFDC website for a list of public charging locations where you can charge your PEV. Available at http://www.afdc.energy.gov/</p> <p>PLUG-IN & GET READY!</p>	<p>NO</p>  <p>To charge your PEV at home, start by contacting a C-10 licensed electrical contractor to discuss your needs. You can verify your electrical contractor is licensed by visiting CSLB.ca.gov or calling (800) 321-CSLB.**</p> <p>PLUG-IN & GET READY!</p>	<p>NO</p>  <p>You can use an existing electrical outlet (120 VAC, 15/20 A) to charge your PEV.</p> <p>PLUG-IN & GET READY!</p>	<p>PLUG-IN & GET READY!</p>

*Adapted from *Take Charge I: A First Step to PEV Readiness in the Sacramento Region*, a report from SACOG and the Capital Area PEV Coordinating Council on preparing the region for Plug-In Electric Vehicles

** When the electrician arrives, be sure and ask to see a copy of their state certification.

Electric Vehicle Charging for Regional Park-and-Ride Lots and Transit Stations

[NOTE: Any agency or company’s sustainability goal(s) could be placed here. This is SANDAG’s.]

The 2050 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), adopted by SANDAG in October 2011, included the following actions to be implemented:

“Support planning and infrastructure development for alternative fueling stations and plug-in electric vehicle (EV) chargers.”

“Integrate alternative fuel considerations into the development of the regional transportation network by, for example, integrating infrastructure for electric vehicle charging into regional park-and-ride lots and transit stations.”

To achieve this, it is recommended that any time a park-and-ride or transit station parking lot/structure is newly constructed or undergoing renovation, that SANDAG/ Caltrans/ MTS/ NCTD:

1. **At a minimum, pre-wire parking facilities for EV charger capabilities during construction,**
2. **Seek opportunities to install plug-in electric vehicle chargers at these sites, and**
3. **Investigate additional sustainability options like high efficiency lighting, solar photovoltaic (PV) shading structures, and water-efficient irrigation systems.**

EV readiness can be achieved for the very low cost of pre-installed conduit, and properly sized electric panels. This can be very cheap for new construction or for anytime a parking lot is repaved, sidewalks moved or replaced, or structures renovated.

The following tables provide general “rules of thumb” pertaining to plug-in EV chargers (technically referred to as electric vehicle supply equipment or EVSE). Charging equipment is now available from a variety of vendors. Again, *the most optimal time to install charging at the lowest possible cost is during parking lot resurfacing or new construction.* Here are some resources for finding charging equipment:

- Plug-in America <http://www.pluginamerica.org/>
- Go Electric Drive <http://goelectricdrive.com/>

Charging Equipment (EVSE)	Typical user profile	Equipment cost ¹ (avg. per unit)	Install cost ² (avg. per unit)
Level 1	Parked for 6-8 hours	\$300-\$700	<\$1,000
Level 2	Parked for 2-4 hours	\$1,000- \$2,500	\$3,000-5,000
DC Fast Charge (DCQ)	Quick stop for 5-30 minutes	\$25,000-\$35,000	\$14,000-20,000

1. Equipment costs will be more for 2-4 ports and combination units.
2. Installation cost is for minimal trenching needs and no service upgrades. Costs increase for sites requiring trenching and/or electrical panel upgrades.

Charging Basics

There are three basic levels to charge plug-in electric vehicles. The vehicles from every manufacturer are equipped with standardized connectors. How long it takes to charge at each level depends on how far a car is driven and the size of the battery on board. Charging speed is governed by the size of the on-board charger and power level of the charging equipment.

Charging Equipment (EVSE)	Power Supply	Charging Power	Miles of Range for 1 Hour of Charge
Level 1	120 VAC (volts AC) Single Phase	1.4 kW at 12 amp (on-board charger)	3-4
	240 VAC Single Phase	3.3 kW (on-board)	8-10
Level 2	Up to 19.2 kW (up to 80 amps)	6.6 kW (on-board)	17-20
DC Fast Charge (DCQ)	200-450 volts DC Up to 90 kW (~200 amps)	45 kW (off-board)	50-60

For Assistance

[Note: This section was written with SANDAG project managers in mind.]

For site specific installation information and power availability, contact Randy Schimka, San Diego Gas & Electric (SDG&E), RSchimka@semprautilities.com, (858) 248-3515. SANDAG's Energy Team can provide additional assistance related to other site considerations, standards, and RFP/RFQ language for EV chargers. Contact Susan Freedman, susan.freedman@sandag.org, (619) 699-7387.

Plug-in Electric Vehicles Building Codes Summary

CALGreen

The CALGreen code sections relevant to electric vehicle charging infrastructure installation and referenced below can be found in the California Building Standards Commission 2012 Supplement:¹²

EVSE Codes for Residential Buildings

The voluntary code calls for at least three percent of the total parking spaces, but not less than one, in low-rise multi-family dwellings be prepared to support electric vehicle charging infrastructure in the future. This entails installing any underground conduit that would be needed for future installations. Single/dual-family homes are suggested to install a raceway to accommodate a dedicated branch circuit.

A4.106.6.1 One-and two-family dwellings.

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

A4.106.6.2 Multifamily dwellings.

At least 3 percent of the total parking spaces, but not less than one, shall be capable of supporting future electric vehicle supply equipment (EVSE).

A4.106.6.2.1 Single charging space required.

When only a single charging space is required, install a listed raceway capable of accommodating a dedicated branch circuit. The raceway shall not be less than trade size 1. The raceway shall be securely fastened at the main service or subpanel and shall terminate in close proximity to the proposed location of the charging system into a listed cabinet, box or enclosure.

A4.106.6.2.2 Multiple charging spaces required.

When multiple charging spaces are required, plans shall include the location(s) and type of the EVSE, raceway method(s), wiring schematics and electrical calculations to verify that the electrical system has sufficient capacity to simultaneously charge all the electrical vehicles at all designated EV charging spaces at their full rated amperage. Plan design shall be based upon Level 2 EVSE at its maximum operating ampacity. Only underground raceways and related underground equipment are required to be installed at the time of construction.

EVSE Codes for Non-Residential Buildings

For non-residential development, it is mandatory to provide designated parking for low-emitting, fuel-efficient, and carpool/vanpool vehicles, including electric vehicles (A5.106.5.1). Voluntary standards identify designated parking spaces for 10 percent of parking spaces (Tier 1) or 12 percent (Tier 2).

Plug-in Electric Vehicles Building Codes Summary

A5.106.5.3 Electric Vehicle Charging.

Provide facilities meeting Section 406.7 (Electric Vehicle) of the California Building Code and as follows:

A5.106.5.3.1 Electric vehicle supply wiring.

For each space required in [Table A5.106.5.3.1](#), provide panel capacity and dedicated conduit for one 208/240V 40 amp circuit terminating within 5 feet of the midline of each parking space.

Table A5.106.5.3.1

Total number of parking spaces	Number of required spaces
1-50	1
51-200	2
201 and over	4

Assembly Bill 1092¹³, if adopted, would mandate PEV-ready standards for multi-family residential and non-residential new buildings to take effect in January 2017. The bill would also adopt CALGreen electric vehicle voluntary codes as mandatory state standards.

Building Code Resources

Many local jurisdictions in California have established mandatory building codes requiring conduit and wiring for EVSE to be installed during in the construction phase of a project. These policies enable communities to become more PEV-ready by removing the high construction costs from home and business owners. No jurisdiction in the San Diego region has yet to adopt building codes that require pre-wiring for EVSE. The following are examples from two southern California cities that have:

City of Los Angeles

Mandatory Green Building Code Standards for Newly Constructed Residential and Non-Residential EVSE:

Low-rise residential building: Electric Vehicle Supply Wiring 99.04.106.6.

- 1) For one- or two- family dwellings and townhouses, provide a minimum of:
 - a. One 208/240 V 40 amp, grounded AC outlet, for each dwelling unit; or
 - b. Panel capacity and conduit for future installation of a 208/240 V 40 amp, grounded AC outlet, for each dwelling unit
- 2) Residential occupancies where there is a common parking area, provide:
 - a. Provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), that is equal to 5% of the total number of parking spaces. The outlet(s) shall be located in the parking area; or
 - b. Panel capacity and conduit for future installation of electrical outlets. The panel capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, or a minimum number of 208/240 V 40 amp, grounded AC

Plug-in Electric Vehicles

Building Codes Summary

outlets, that is equal to 5% of the total number of parking spaces. The conduit shall terminate within the parking area; or

- c. Additional service capacity, space for future meters, and conduit for future installation of electrical outlets. The service capacity and conduit size shall be designed to accommodate the future installation, and allow the simultaneous charging, or a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5% of the total number of parking spaces. The conduit shall terminate within the parking area

Non-residential and high-rise residential building: *Electric Vehicle Supply Wiring 99.05.106.5.2*

- 1) Provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), that is equal to 5% of the total number of parking spaces. The outlet(s) shall be located in the parking area

City of Temecula

Circuits for electric vehicle charging stations shall meet all the requirements of California Electrical Code Article 62540. Residential garages shall have a minimum three quarter (3/4) inch metal flex conduit ran from meter box to the garage fire wall and terminated in a metal box at forty-two (42) inches above finished floor for future electric vehicle charging station.¹⁴

Towing Alternative Fuel Vehicles Presentation

Presented By: Greg Newhouse

Advanced Transportation Technology & Energy Program – San Diego Miramar College
gnewhous@sdccd.edu

Alternative Fuel Vehicles Provide a Key Value in relation to:

Public Health and Environment

- Lower greenhouse gas (GHG) emissions
- Lower particulate pollution
- Lower carcinogens

Energy Security

- Alternative Fuels Plentiful in U.S.
- Existing infrastructure

In Regards to Roadside Assistance- Safety is the Key Issue

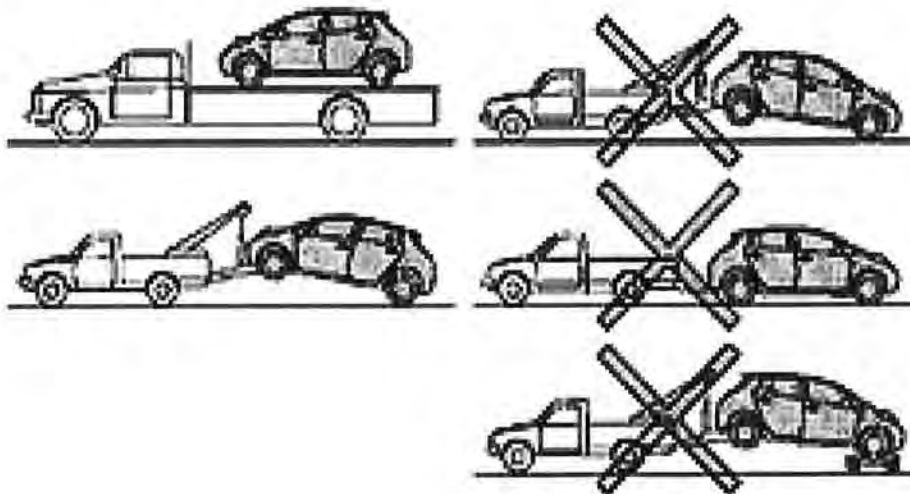
For Electric, Hybrid and Plug-in Hybrid

- Do not touch the orange wires
- Do not assume even if the vehicle has not been operated that the battery is fully discharged. High voltage capacitors can hold the electrical charge for up to 10 minutes after a vehicle shut down.
- Consider all orange coded cables to be energized until proven otherwise.

For Natural Gas

- Check whether or not there is a smell of natural gas – if there is, do not tow.

Towing – flatbed is the most recommended approach



RESOURCES – there are still many individual differences in all the alternative fuel vehicles – here are some resources:

- Honda Emergency Response Guide for CNG Civic
<https://techinfo.honda.com/rjanisis/pubs/web/Y0661.pdf>
- General Motors Emergency Response Guide for Volt
http://boronextrication.com/files/2010/11/2011-Chevrolet-Volt-Emergency-Response-Guide_ERG.pdf
- Toyota Prius Emergency Response Guide – Hybrid 2012
http://boronextrication.com/files/2010/11/2012_Toyota_Prius_V_Hybrid_Emergency_Response_Guide.pdf
- Honda EV Fit Emergency Response Guide
<http://evsafetytraining.org/~media/Electric%20Vehicle/Files/PDFs/Fit%20EV%20Response%20Guide.pdf>
- Ford Focus Electric – Emergency Response
http://boronextrication.com/files/2010/11/2012_Focus_Electric_Emergency_Response_Guide.pdf
- Nissan LEAF Emergency Response Guide
<http://boronextrication.com/2011/01/nissan-leaf-emergency-response-guide-erg/>
- Ford Wrecker Towing Manual
http://www.motorcraftservice.com/vdirs/quickref/2012_WreckerTowing_Manual.pdf

FireFighter Nation 2007

<http://my.firefighternation.com/profiles/blogs/889755:BlogPost:24782?q=profiles/blogs/889755:BlogPost:24782>

- **Alternative Fuel Emergency Response Guides:** [Download Hybrid Response Guide - Chevrolet Malibu](#)
[Download Hybrid Response Guide - Ford Escape](#)
[Download Hybrid Response Guide - Honda - All Models](#)
[Download Hybrid Response Guide - Lexus 450h](#)
[Download Hybrid Response Guide - Lexus RX400h](#)
[Download Hybrid Response Guide - Nissan Altima](#)
[Download Hybrid Response Guide - Saturn Aura](#)
[Download CNG Response Guide - Toyota Camry - CNG](#)
[Download Hybrid Response Guide - Toyota Camry](#)
[Download Hybrid Response Guide - Toyota Fuel Cell Hybrid Combo](#)
[Download Hybrid Response Guide - Toyota Highlander](#)
[Download Hybrid Response Guide - Toyota Prius - Generation 1](#)
[Download Hybrid Response Guide - Toyota Prius - Generation 2](#)
[Download Hybrid Response Guide - Toyota Rav4](#)

San Diego Plug-in Electric Vehicle Community Seminar *The Electric Vehicle Infrastructure Training Program*

Electric Vehicle Infrastructure Training Program (EVITP) Summary

On January 29, 2013, at SDG&E's Energy Innovation Center, there was a great turn-out for the Electric Vehicle Infrastructure Training Program (EVITP) seminar. Participants from electrical contractors, planners to inspectors and government officials all came by to learn more about Electric Vehicle (EV) infrastructure and upcoming public charging station projects in the San Diego region.

The following presentations were given during the course of the seminar:

- Introduction to EV Infrastructure Training and Instructors (Bernie Kotlier, EVITP)
- EV Codes and Standards (Rubio Rubio, EVITP)
- Site Assessments, Load Calculations, and Safety (Rubio, Rubio)
- EV Permitting (Bernie Kotlier and Tyler Petersen, CCSE)
- Introduction to Utility Notification (Bernie Kotlier)
- San Diego Gas & Electric Utility Presentation (Joel Pointon, SDG&E)
- "PEV-Ready" Policy Recommendations (Tyler Petersen)
- City of San Diego (Martin Montessoro, Development Services Department)
- City of Chula Vista (Andrew McGuire, Sustainable Communities Outreach Program)
- NRG Energy, eVgo San Diego Project (Jill Brandt)
- Charge Point America, MultiCharge San Diego project (Michael Jones)
- ECotality (Andy Hoskinson)
- The California Fleets and Workplace Alternative Fuels Project, San Diego (Kevin Wood, CCSE/San Diego Regional Clean Cities)

Attendees were given presentations that ranged from EV codes and standards, and information about on-site assessments to load calculations and safety guidelines for the installation of charging stations. Attendees learned about how and where electricians can be trained to properly install Electric Vehicle Supply Equipment (EVSE), the best practices of EVSE permitting and inspection, how cities can best accommodate EVs in their new policy, and what new EV projects are taking root in the San Diego region.

eVgo presenter, Jill Brandt, stated that San Diego will be the first region in California to see eVgo's "Freedom Stations", which will include a DC Fast Charger and level 2 charging options. ChargePoint America presenter, Michael Jones, provided audience members with an overview of the Multi-Charge San Diego project, which will install approximately 200 level 2 EVSE charging stations at multi-family locations within the County of San Diego. The project will also create a Load Research Monitoring pilot program that will provide data on load management and demands on transformers to aid utilities in developing capital infrastructure plans.

Additionally, during lunch time, attendees got a chance to look at EVs on display, such as the all-electric Toyota RAV-4 and the Ford C-MAX plug-in hybrid, and browse samples of charging equipment as well.

Lessons Learned

With the wide variety of presentations given from experts across the industry, the following are significant outcomes and lessons learned that attendees walked away with:

- The EVITP representatives highlighted the importance of having properly trained electricians to install EVSE's.
- With the assistance of Bernie Kotlier, Tyler Petersen of CCSE identified the need to streamline the permit and inspection process of residential EVSEs.
- Joel Pointon of SDG&E identified the importance of utility notification of an EVSE installation.
- Martin Montessoro and Andrew McGuire provided a municipality perspective and highlighted the internal benefit of adopting EVSE permitting and inspection best practices.

San Diego Plug-in Electric Vehicle Community Seminar

The Electric Vehicle Infrastructure Training Program

- Representatives from ECOTALITY, eVgo and ChargePoint displayed their businesses and identified their next steps towards the installation of EVSE's across San Diego County through projects such as the Multi-Charge San Diego project, The EV Project and "Freedom Station" installations.
- With the framework already in place in Houston Texas, eVgo highlighted the potential for a large amount of multi-unit dwelling installations across San Diego County.

Electric Vehicle Infrastructure Training Program (EVITP) Presentations

Introduction to EV Infrastructure Training and Instructors <i>EV Codes and Standards/Site Assessments, Load Calculations, and Safety Guidelines</i>	
Description	<p>The EVITP program is a structured platform for delivering training and certification for the installation of (EVSEs) in and around Residential, Commercial & Public Facilities. EVITP is a non-profit, volunteer, EV industry, collaborative training program that addresses the technical requirements, safety imperatives, and performance integrity of industry partners and stakeholders.</p> <p>The EVITP provides training on EV codes and standards, will teach electricians how to properly complete a site assessment and load calculation while highlighting safety as a top priority.</p>
Key Items	<p>The detailed EVITP program provides assurance that trained electricians will have the knowledge and skill to properly install an EVSE. Although all EVSE installations must be completed by a California State Licensed electrician, it currently is not a requirement that the electrician be EVITP certified.</p> <p>With the amount of detail and the associated skills needed to complete an EVSE installation, it is highly encouraged that all electricians working in the electric vehicle industry receive this training.</p>
Next Steps	<p>If you are interested in locating an EVITP certified electrician, please contact Bernie Kotlier directly to receive a list of contractors who employ these electricians.</p> <ul style="list-style-type: none"> • Bernie Kotlier, EVITP • lmccenergy@gmail.com

Permitting for Electric Vehicle Supply Equipment (EVSE) Installations*	
Description	<p>The typical cost of a residential EVSE installation ranges from \$300 to \$1,900 in California, according to Mr. Kotlier. Associated permit fees typically contribute to 5% - 20% of the total cost of the installation. According to national data from SPX, permit fees have ranged from \$0 to \$625, with the average permit fee in California among the highest in the nation.</p>
Key Items	<p>Because of the high and unpredictable cost of permits, it is imperative that the industry work to standardize processes in an attempt to provide consistency throughout all the different regions. According to the Plug-In Electric Vehicle Collaborative, a "Best Practice" permitting process for EVSEs would include the following elements:</p> <ol style="list-style-type: none"> 1. A Unique Permit Application 2. Online (if available) or Over-the-Counter Permit Process 3. Template Based Forms 4. A Unique EVSE Permit Fee 5. Avoid Electrician Required Attendance at Inspection 6. Develop Outreach and Training Plans
Next Steps	<p>For more information, please go to www.energycenter.org/pluginready for more information jurisdiction issuance time and permit cost for EVSE installations in the San Diego region.</p>

*EVSE is also referred to as electric vehicle supply stations

San Diego Plug-in Electric Vehicle Community Seminar
The Electric Vehicle Infrastructure Training Program

Introduction to Utility Notification/San Diego Gas & Electric Utility Presentation	
Description	While using electricity as a source to fuel electric vehicles, it is important that the utility be notified when an EVSE is being installed in their territory. As the infrastructure for EV's continues to grow, the demand on the grid will grow as well.
Key Items	<p>It is important that customers are aware of the different EV rates that are provided by the utility. San Diego Gas & Electric customers who have an EV can sign up for an Electric Vehicle Time-of-Use (EV-TOU) rate and receive lower rates for charging their vehicle during off-peak hours, between midnight at 5 A.M. EV-TOU rates are offered to encourage customers to limit daytime usage of electricity, when demand for electricity is highest.</p> <p>By opening up the communication lines between customers who install an EVSE and the utility, customers have a greater opportunity for learning about all the available electricity rates for EV owners.</p>
Next Steps	Download a copy of the For more information, please go to www.energycenter.org/pluginready

San Diego PEV Readiness Assessment & City PEV Projects Updates

"PEV-Ready" Policy Recommendations	
Description	<p>The San Diego Regional PEV Readiness Assessment was recently released. This assessment evaluates the regional state of PEV readiness focusing on five core issues:</p> <ol style="list-style-type: none"> 1. Zoning & Parking 2. Streamline Permitting and Inspection 3. Building Codes 4. Training and Education 5. Outreach to Local Businesses and Residents
Key Items	<p>Based on the research conducted, the following recommendations have been proposed:</p> <ul style="list-style-type: none"> • Implement consistent general service and regulatory signage for PEVs • Expand safety training for emergency first responders • Adopt/update rewiring for EVSE in residential and nonresidential new construction • Develop a PEV resources page on regional municipal websites
Next Steps	The complete assessment can be found at the following site: www.energycenter.org/pluginready

City of San Diego, Development Services Department	
Description	Martin Montessoro from the City of San Diego's Development Services Department presented to the group the city's Technical Policy 11B-1 along with a guide on "How to Obtain a Permit for Electric Vehicle Charging Systems". The City of San Diego is one of the first in the San Diego region to issue such policies.

San Diego Plug-in Electric Vehicle Community Seminar
The Electric Vehicle Infrastructure Training Program

Key Items	<p>Technical Policy 11B-1, “Accessibility to Electrical Vehicle Charging Stations” was issued on April 19, 2012. The City of San Diego’s policy applies to the installation of EV Charging Stations in both new and existing construction and is currently available for review. The policy also includes information on accessibility standards.</p> <p>The “How to Obtain a Permit for Electric Vehicle Charging Systems” is an informational bulletin that describes the permitting and inspection process for the installation of an Electrical Vehicle Charging system (EVCS) on an existing site or building.</p>
Next Steps	<p>The Technical Policy 11B-1 can be found at the following site: https://www.sandiego.gov/development-services/pdf/industry/tpolicy11b1.pdf</p> <p>The “How to Obtain a Permit for Electric Vehicle Charging Systems” can be found at the following site: http://www.sandiego.gov/development-services/pdf/industry/infobulletin/ib187.pdf</p>

City of Chula Vista	
Description	<p>In September of 2012, the City of Chula Vista submitted an informal request for quotes for a turn-key electric vehicle charging stations. The informal request for quotes were seeking service-oriented vendors to fully fund, install, operate, maintain, and market electric vehicle (EV) charging stations at municipal parking lots for public use.</p>
Key Items	<p>After reviewing the submittal proposals, the City of Chula Vista awarded ECotality with this project with whom they are currently working with to install EVSEs at the 24 potential sites.</p>

San Diego Regional Electric Vehicle Infrastructure Projects

NRG Energy, eVgo San Diego Project	
Description	<p>eVgo, a subsidiary of NRG Energy, has committed to build hundreds of eVgo Freedom Station sites and the infrastructure for thousands of individual eVgo Level 2 charging stations throughout the state. These installations will take place at offices, multi-family communities and more throughout major metropolitan cities California.</p> <p>Each eVgo’s Freedom Station site have installed – one L2 station, one DC fast charging station and one “pre-install” for a second DC fast charger.</p>
Key Items	<p>eVgo is just getting started in the California market so in order to install these chargers throughout the state, eVgo will need to make connections with local municipal staff and become educated on the permitting processes and build the necessary network in order to identify potential installation sites.</p>
Next Steps	<p>In order to expedite these installations, it is important for eVgo to connect with municipal staff to learn the permitting process for their respective jurisdiction and streamline the DC fast charger installations. At events such as this, eVgo was able to make these connections.</p>

San Diego Plug-in Electric Vehicle Community Seminar
The Electric Vehicle Infrastructure Training Program

Charge Point America, MultiCharge San Diego Project	
Description	Charge Point America received a California Energy Commission EVSE Infrastructure Grant for \$499,512 plus matching commitments. The program will begin in Q2 of 2013 through community outreach and request for applications. These installations are expected to begin in Q3 2013 and complete in Q2 2014.
Key Items	For this project, Charge Point is expecting to install approximately 200 L2 EVSE charging stations at multi-dwelling unit (MDU) locations within the County of San Diego. Additionally, with this funding, a Load Research Monitoring pilot program is being created in order to provide data on load management and demands on transformers to aid utilities in developing capital infrastructure plans.
Next Steps	Charge Point America highlighted the importance of collaborating with the City of San Diego, SDG&E and The San Diego Association of Governments in order to streamline the permitting process for installing EVSE infrastructure at MDU locations.

ECOtality, MultiCharge San Diego Project	
Description	Managing the largest deployment of electric vehicles and charging infrastructure in history, ECOtality provided a summary and update on The EV Project. In August 2009, ECOtality was awarded a \$99.8 million dollar grant from the U.S. Department of Energy which launched in October of 2009. As of today, more than 300 Blink stations have been installed in San Diego through The EV Project subsidies.
Key Items	The EV Project has given the industry a great jump start to the installation of EVSEs; however, it has also exposed barriers in the San Diego market that will need to be continually addressed in order to expand the PEV market.
Next Steps	The EV Project is in the process of completing the installations for its subsidy program in the San Diego region. The next steps will study the utilization of the charging stations in its network. These studies will likely be published as white papers on the EV Project website by Q4 2013.

The California Fleets and Workplace Alternative Fuels Project, San Diego	
Description	The California Fleets and Workplace Alternative Fuels Project are multiple efforts aimed at eliminating the barriers to deployment of alternative fuel vehicles. Best practices, training initiatives and market development and outreach are just a few steps that are being taken to reach the program goals.
Key Items	In order to reduce barriers, best practice toolkits are being created for the permitting of Natural Gas stations, hydrogen stations and fleet deployment of alternative fuel infrastructure. Additionally, it is imperative that training needs around alternative fuel and advanced technology vehicles be assessed and the appropriate trainings be coordinated.
Next Steps	At the first part of this year, the project is really focusing on training needs and assessments. Moving into the summer months, the focus will shift onto best practices development. In the Fall of this year, the program focus will transition to trainings and best practice workshops.

Plug-in Electric Vehicles

San Diego Regional Nonresidential Charging Infrastructure Study

As the market for plug-in electric vehicles (PEVs) develops, it will be critical that existing and potential charging infrastructure site hosts, industry stakeholders, and policy makers better understand the value of hosting a public or workplace charging station. The California Center for Sustainable Energy (CCSE) has produced a draft report that provides insight into the value proposition for companies and institutions in the San Diego region that install charging infrastructure, known as electric vehicle supply equipment (EVSE).¹

Study Scope and Design

CCSE's study of nonresidential charging infrastructure hosts was designed to answer three key questions:

- What is the cost of hosting Level 2 charging equipment?
- Are PEV drivers willing to pay sufficient fees to cover these costs?
- What is the significance of non-revenue benefits to charging infrastructure hosts?

Methods of Data Collection

To answer the above questions, CCSE leveraged several methods of data collection:

- A survey was administered to San Diego workplaces and public locations hosting Level 2 EVSE to analyze their motivations and costs incurred (43 locations contacted, 22 responded)
- Discounted cash flow modeling to analyze project economics²
- San Diego PEV owners were surveyed to gather data on their willingness to pay for nonresidential Level 2 charging (4,270 drivers contacted, 1,040 responded)



San Diego PEV Drivers' Willingness to Pay for Charging

The table below displays regional PEV owners' reported willingness to pay (WTP) for daily charging and occasional PEV charging based on two billing methods: \$ per one hour and dollars per kilowatt hour (kWh).

	WTP for Daily Charging	WTP for Occasional Charging
Median (\$/hour)	\$0.50	\$1.00
Median (\$/kWh)	\$0.15	\$0.30

For daily charging, survey respondents reported a median WTP of about \$0.15 per kWh, which is about a \$0.02 per kWh markup over the average California residential rates of \$0.13 per kWh. For occasional charging, survey

¹ CCSE's Research and Analysis team presented the draft report *Providing a Place to Plug In: The Value Proposition of Hosting Level 2 Nonresidential Electric Vehicle Supply Equipment and Drivers' Willingness to Pay for PEV Charging* at the March 19, 2013 REVI meeting. A copy of the presentation can be found at: <http://energycenter.org/programs/pev-planning/san-diego>

² The discounted cash flow model developed for this study estimates cash flows to the EVSE host – that is, a private company, public agency, or other institution – who purchases the EVSE equipment, pays for the equipment installation, operates the equipment, covers electricity costs associated with the EVSE, and covers the cost of billing users.

Plug-in Electric Vehicles

San Diego Regional Nonresidential Charging Infrastructure Study

respondents reported an average willingness to pay of about \$0.30 per kWh, which is about a \$0.17 per kWh markup over the typical California residential rates.

Utilization and Cost Recovery Assumptions

How much a host would have to charge to recover installation and operation costs largely depends on how often their EVSE are used. The study used the following assumptions to estimate the breakeven user fees needed for both a workplace and public utilization setting.³

- Public Level 2 setting assumes four charge events per day for 1.5 hours per charge event, or a 25 percent utilization rate
- Workplace Level 2 setting assumes three charge events per day for two hours a day, or a 17 percent utilization rate
- Hosts received no subsidies or tax credits for the EVSE

Non-Financial Benefits of Hosting Charging Infrastructure

The study examines the motivations of San Diego companies and public institutions that invest in EVSE, and what non-revenue benefits they experience by hosting charging infrastructure.

- The primary reasons companies invested in EVSE were to enhance part of an established sustainability plan and to provide a service to their customers/clients
- 90 percent of the hosts interviewed believe that the EVSE investment had a positive impact on the company or institution's brand
- Almost 60 percent reported that hosting EVSE increased visitation to their business

Key Conclusions

- Breakeven user fees are very sensitive to utilization rates of charging infrastructure
- PEV owners' WTP of \$0.30/kWh for "occasional charging" is in line with the breakeven user fees for hosts that invest in a lower cost EVSE⁴
- PEV owners' WTP of \$0.15/kWh for "daily charging" is not high enough to recoup EVSE costs
- Non-revenue benefits are important to early adopters of EVSE
- Hosts may be willing to subsidize charging costs to enjoy the non-revenue benefits of hosting EVSE

Resources

California Center for Sustainable Energy. (2012). California Plug in Electric Vehicle Owner Survey. Retrieved from <https://energycenter.org/programs/clean-vehicle-rebate-project/vehicle-owner-survey/july-2012-survey>

California Energy Commission. (2012). California Electricity Statistics. Retrieved Dec 19, 2012, from Statewide Electricity Rates by Utility, Class and other data: <http://energyalmanac.ca.gov/electricity/index.html>

U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. (2012). *Plug-In Electric Vehicle Handbook for Public Charging Stations Hosts* available at <http://www.afdc.energy.gov/pdfs/51227.pdf>

³ The discounted cash flow model was used to estimate the breakeven user fee.

⁴ A lower cost EVSE assume total equipment and installation costs at \$2,000, billing costs at \$0.40 per transaction and 3% user fee. A higher cost EVSE assume total equipment and installation costs at \$10,000, billing costs at \$0.50 per transaction and 7.5% user fee.

SAN DIEGO REGIONAL PLUG-IN ELECTRIC VEHICLE (PEV) READINESS PLAN

APPENDIX D

Contents: Resources and Terms

Resources (p. 1)

Glossary of Terms and Abbreviations (p. 2)

Resources

1. San Diego's Phase One Regional PEV Assessment, California Center for Sustainable Energy
CCSE received Department of Energy (DOE) funding to perform an assessment of the region's PEV readiness. It contains an evaluation of how prepared jurisdictions in the region are for PEV deployment. Regions across state took survey for DOE project.
www.energycenter.org/sites/default/files/docs/nav/programs/pev-planning/San_Diego_PEV_Readiness_Planning_Guide.pdf
2. Statewide and Regional PEV Readiness Reports, California PEV Collaborative
The California PEV Collaborative, a multi-stakeholder public-private partnership, is working together to ensure a strong and enduring transition to a PEV market in California.
www.pevcollaborative.org/pev-readiness-reports
3. The EV Project
The EV Project collects and analyzes data to characterize PEV use in diverse conditions, evaluates EVSE effectiveness, and conducts trials of various revenue systems for PEV chargers. The Project releases its analyses and quarterly reports on the status of PEV usage in its project areas, including San Diego.
www.theevproject.com/documents.php
4. Taking Charge: Establishing California Leadership in the Plug-In Electric Vehicle Marketplace, California PEV Collaborative
www.pevcollaborative.org/sites/all/themes/pev/files/docs/Taking_Charge_final2.pdf
5. Community PEV Readiness Toolkit, California PEV Collaborative
This statewide toolkit offers tangible best practices examples and case studies from communities and stakeholders throughout California and abroad.
www.pevcollaborative.org/sites/all/themes/pev/files/docs/toolkit_final_website.pdf
6. Ready, Set, Charge California: A Guide to EV-Ready Communities, Bay Area Climate Collaborative
This guide is intended to assist California governments with the planning of and development for deployment of PEV infrastructure through a consistent framework.
www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf
7. Ready, Set, Charge California! Linking EVs, Fast Chargers, & Storage to the California Grid, Bay Area Climate Collaborative
This supplement addresses strategies for charging site hosts to mitigate energy costs and the use of the electric vehicle battery in providing grid-linked services.
www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evfastchargestorage_grid.pdf

Glossary of Terms and Abbreviations

Glossary of Terms, Abbreviations, and Acronyms Abbreviation or Acronym	Description
A	Amperes or amps. The International System of Units base unit of electric current.
AB	Assembly Bill
AC	Alternating current. It is the flow of electric charge which periodically changes directions.
ADA	Americans with Disabilities Act of 1990, which prohibits discrimination based on disability.
ARRA	American Recovery and Reinvestment Act of 2009, which was an economic stimulus package developed as an effort to create and save U.S. jobs.
ATTE	Advanced Transportation Technology and Energy
BEV	Battery electric vehicle. A vehicle fueled entirely by electricity stored in the onboard battery. They often produce zero tailpipe emissions while operating. A BEV is a type of plug-in electric vehicle (see "Plug-in Electric Vehicle, PEV").
CalETC	California Electric Transportation Coalition
CALGreen	California Green Building standards
CAP	Climate Action Plan
CARB	California Air Resources Board
CCR, Title 24	California Code of Regulations, Title 24. Commonly known as the California Building Standards Code.
CEC	California Energy Commission
CCSE	California Center for Sustainable Energy
Charger	A device that is designed to charge batteries or other energy storage options within electric vehicles.
Charging level	Standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged and referred to as Level 1 (120 VAC), Level 2 (240 VAC), and Level 3 (or DC/AC Fast Charging).

Circuit breaker	A device that protects and electrical circuit from damage caused by overloaded electrical current or short circuit.
CNCDA	California New Car Dealers Association
CNG	Compressed natural gas
CPUC	California Public Utilities Commission
CVRP	California Air Resource Board's Clean Vehicle Rebate Project
DC	Direct current. Electric current that moves in one direction from anode to cathode.
DMV	Department of Motor Vehicles
DOE	U.S. Department of Energy
EAA	Electric Auto Association
EPRI	Electric Power Research Institute
EVITP	Electric Vehicle Infrastructure Training Program
EVP	The EV Project, managed by ECOtality
EVSE	Electric vehicle supply equipment. This includes the charging station itself and all components required for the installation and use of an electric vehicle charging station, such as: conductors, plugs, power outlets, wiring, ground connectors, etc.
EVSP	Electric vehicle service providers
FHWA	U.S. Department of Transportation Federal Highway Administration
GHG	Greenhouse gas. Any of the gases (e.g., carbon dioxide, methane, ozone, and fluorocarbons) emitted that contribute to the greenhouse effect by absorbing solar radiation once in the atmosphere.
HEV	Hybrid electric vehicle. A motor vehicle that is powered by both an electric propulsion system with a conventional internal combustion engine. A hybrid electric vehicle does not plug into an off-board electrical source.
HOA	Homeowners Association
HVIP	California Air Resource Board's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project

HOV	High occupancy vehicle
ICC	International Code Council
ICE	Internal combustion engine. An engine which combusts petroleum-based fuel to power a vehicle.
IOU	Investor owned utility
J1772	Industry-wide standard EV connector for Level 2 charging.
kW	Kilowatt. A unit of power equal to 1,000 watts.
kWh	Kilowatt hour. A unit of energy commonly used for measuring energy capacity. This is the commonly known billing unit for electricity customers.
LCFS	Low Carbon Fuel Standard
LEV	Low emission vehicle
MUD	Multi-unit dwelling or Multi-family dwelling unit
MOU	Municipally-owned utility
MUTCD	Manual on Uniform Traffic Control Devices
NEC	National Electrical Code
NREL	National Renewable Energy Laboratory
OEM	Original equipment manufacturer
PEV	Plug-in electric vehicle. Any motor vehicle for on-road use that is capable of operating only on the power of a battery (or other storage device that receives electricity from an external source, such as a charger).
PEVC	California Plug-in Electric Vehicle Collaborative
PHEV	Plug-in hybrid electric vehicle. A type of plug-in electric vehicle (see "PEV") that is fueled by both a battery and another fuel source, usually a gasoline-powered internal combustion engine.
Plan	Plug-in Electric Vehicle (PEV) Readiness Plan
Pre-wiring	The practice of providing sufficient basic infrastructure, such as conduits, junction boxes, adequate lot space, and adequate electrical panel and circuitry capacity, to meet anticipated future demand for EVSE.

the Region	San Diego Region
REVI	San Diego's Regional Electric Vehicle Infrastructure working group.
SAE	Formerly Society of Automotive Engineers
SANDAG	The San Diego Association of Governments
SCS	Sustainable Communities Strategy
SDG&E	San Diego Gas and Electric
TOU	Time-of-use. An electricity billing method with rates based upon the time of electricity usage during the day.
UL	Underwriters' Laboratory
VMT	Vehicle miles traveled
W	Watt. A unit of power, defined as one joule per second, which measures the rate of energy transfer.
ZEV	Zero-emission vehicle. A vehicle that emits no tailpipe pollutants from the onboard source of power.



California Center for Sustainable Energy
9325 Sky Park Court, Suite 100
San Diego, CA 92123
Phone: 858-244-1177



SANDAG
401 B Street, Suite 800
San Diego, CA 92101
Phone: 619-699-1900