SAN DIEGO REGIONAL ELECTRIC VEHICLE INFRASTRUCTURE WORKING GROUP

MEETING NOTICE AND AGENDA

Date: **Thursday, May 16, 2013**

Time: **1:00 p.m. to 2:30 p.m.**

Location: **San Diego Gas & Electric Energy Innovation Center**
4760 Clairemont Mesa Blvd.
San Diego, CA 92117

Staff Contact: **Tyler Petersen**
Tel: (858) 244-4876
Email: tyler.petersen@energycenter.org

AGENDA HIGHLIGHTS

- **BUILDING CODES AND PEV CHARGING**
- **PARKING GUIDELINES AND REVI COMMENTS**

In compliance with the Americans with Disabilities Act (ADA), CCSE will accommodate persons who require assistance in order to participate in San Diego REVI meetings. If such assistance is required, please contact CCSE at (858) 244-1177 at least 72 hours in advance of the meeting.

SANDAG Center for Sustainable Energy CALIFORNIA SAN DIEGO REGIONAL CLEAN CITIES COALITION

www.energycenter.org/pluginready

SAN DIEGO REVI

Thursday, May 16, 2013

ITEM # **RECOMMENDATION**

1. WELCOME AND INTRODUCTIONS

2. ANNOUNCEMENTS

Members of the public shall have the opportunity to address San Diego Regional Electric Vehicle Infrastructure Working Group (REVI) on any plug-in electric vehicle (PEV) issue that is not on this agenda. Public speakers are limited to three minutes or less per person. REVI members may provide information and announcements under this item.

+3. MEETING SUMMARY **APPROVE**

The REVI is asked to review and approve the April 18, 2013 meeting summary.

CONSENT ITEM

+4. REGIONAL PEV BARRIERS PROGRESS REPORT **INFORMATION**

The REVI barriers table is attached.

REPORT ITEMS

+5. BARRIER 2: BUILDING CODES AND PEV CHARGING STATIONS **DISCUSSION**

Ed Pike, Energy Solutions, will provide an overview of proposed updates to California's Title 24 energy code as it relates to electric vehicle supply infrastructure (EVSE). The building code chapter of CCSE's San Diego Regional PEV readiness assessment from 2012 is attached for reference. The building codes chapter from the Southern California (SoCal) Plug-in Electric Vehicle Readiness Plan is also attached for reference. The REVI is asked to discuss building code policies, including the recommendations from the CCSE and SoCal assessments, to determine what type of resource (a best practice, fact sheet, or other) would be most useful for our region.

+6. BARRIER 3: PARKING GUIDELINES AND REVI COMMENTS **DISCUSSION AND RECOMMENDATION**

Last month, the REVI discussed parking and zoning issues and was provided the Caltrans Policy Directive on Zero Emission Vehicle Signs and Pavement Markings and the Governor's Office of Planning and Research (OPR) public review draft of "Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices." The draft guidelines were developed by OPR and the Division of the State Architect (DSA). The REVI will continue the discussion on proposed comment areas (attached). The REVI is asked to consider submitting comments to OPR, which are due Friday, May 24, 2013.

+7. BARRIER 1: PERMITTING ISSUES FOR WORKPLACE, RETAIL AND OTHER CATEGORIES **DISCUSSION**

OPR is developing a Zero Emissions Vehicle (ZEV) Readiness Guidebook to help implement the Governor's 2013 ZEV Action Plan. One component will address permitting. OPR prepared background materials for local governments and others on addressing EVSE permitting for single- and multi-family residential, workplace, retail, public sector, and DC fast charge. These materials can serve as a basis for permitting considerations in REVI's PEV Readiness Plan. Members are asked to provide their feedback on these documents.

+8. BARRIER 9: INTEGRATING EVSE INTO PUBLIC PROJECTS **INFORMATION**

SANDAG has developed draft guidelines intended for program managers that oversee capital improvement projects that include parking. The purpose is to have EVSE (Levels 1, 2 and/or DC fast charge) included in project design for a variety of public sites including transit stations and park-and-ride lots. In March, the REVI endorsed an RFP template for use by public agencies and others to solicit bids for EVSE. This guideline would facilitate integrating EVSE into new and/or major retrofit construction projects.

9. MATTERS FROM MEMBERS **INFORMATION**

Time permitting, REVI members are encouraged to discuss additional topics of general interest.

10. NEXT MEETING **INFORMATION**

The next REVI meeting is scheduled for Thursday, **July 18, 2013**, at the SDG&E Energy Innovation Center, 4760 Clairemont Mesa Blvd., San Diego, CA 92117. Please note that there is no meeting in June.

11. ADJOURNMENT

+ next to an item indicates an attachment

Agenda Item 3

April 18, 2013 REVI MEETING SUMMARY

DRAFT

ITEM #1: WELCOME AND INTRODUCTIONS

Chair Susan Freedman, San Diego Association of Governments (SANDAG), called the meeting to order at 1:07 p.m. and welcomed everyone to the San Diego Regional Electric Vehicle Infrastructure Working Group (REVI).

ITEM #2: ANNOUNCEMENTS AND PUBLIC COMMENTS

Tony Williams, EVOasis, announced that the City of Encinitas City Council agreed to consider the use of City property for the installation of an EV charging plaza which would include multiple fast chargers.

Joel Pointon, San Diego Gas and Electric (SDG&E), announced that the SDG&E Energy Showcase is May 8, 2013, and will include an electric vehicle showcase and ride and drives.

Earth Day is Sunday, May 21, 2013.

ITEM #3: SUMMARY OF THE MARCH 21, 2013 MEETING

Mike Grim, City of Carlsbad, motioned to approve the meeting summary from March 21, 2013. Mr. Pointon seconded the motion. Motion carried without opposition.

CONSENT ITEM

ITEM #4: REGIONAL PEV BARRIERS PROGRESS REPORT

Ms. Freedman noted that the attached PEV barriers table contains updated information on REVI's progress.

REPORT ITEMS

ITEM #5: THE EV PROJECT: INITIAL FINDINGS ON CHARGING BEHAVIOR

Andy Hoskinson, ECOtality, presented information on the preliminary conclusions of charging behavior among EV Project participants. Mr. Hoskinson mentioned that the EV Project publishes quarterly reports that are available online at www.theevproject.com. The Q4 2012 (October-December) EV Project report contains information from over 21 major cities and metropolitan areas in nine states and the District of Columbia. Mr. Hoskinson focused his presentation on San Diego-specific information. In the 130 page report, the San Diego-specific pages are listed below:

- Overview: 1 page (p8)
- San Diego EVSE: 5 pages (p36 – p40)
- LEAFs in San Diego: 1 page (p105)

- Volts in San Diego: 1 page (p119)

Mr. Hoskinson noted that this report contains driver behavior results from Nissan LEAF and Chevy Volt drivers. He emphasized that having statistics on both LEAF and Volt drivers is important because the vehicles are different in battery size and range. According to Mr. Hoskinson, during Q4 2012, EV Project participants who drove the all-electric LEAF charged at home 76% of the time, averaging 1.1 charge events per day. Volt drivers charged at home 81% of the time, averaging 1.4 charge events per day. Mr. Hoskinson stated that the Volt drivers were probably charging more frequently in order to get the most electric miles from a smaller battery, which confirms initial thoughts about charging patterns and average daily driving distances for PEV drivers.

REVI members provided the following comments:

- Mike Ferry, California Center for Sustainable Energy (CCSE), agreed to provide Clean Vehicle Rebate Project (CVRP) data to the group about the number of PEVs in the San Diego region.

- Mr. Hoskinson noted that the San Diego region has the highest number of non-residential charge events for all cities involved in The EV Project. He stated that this could be expected due to 300 car2go vehicles in San Diego, but when car2go was excluded, the San Diego region still had the highest number of non-residential charge events.

- Mr. Hoskinson noted that roughly 850 permits have been issued for EVSE installations through The EV Project in the San Diego area, with the median permit fee for an EVSE installation at $226. This was higher than other California regions participating in The EV Project, such as San Francisco ($119 median permit fee) and Los Angeles ($65 median permit fee).

- Mr. Hoskinson explained that the significant increase in public charging events in Q2 2012 could be attributed to the implementation of Blink fees in Q3 2012, which caused a drop-off in non-residential charge events. In Q4 2012, charge events began to increase again. .

Mr. Hoskinson announced that there will be an opportunity for public comment on The EV Project in June 2013. He encouraged REVI members to provide their feedback at that time. Ms. Freedman commented that staff would coordinate with Mr. Hoskinson to notify the group when the public comment period is open. Mr. Hoskinson's presentation will be available on the CCSE Plug-in & Get Ready website after the meeting.

ITEM #6: BARRIER 6: EVSE AT MULTI UNIT DWELLINGS (MUDs)

Mr. Pointon presented information on the California Plug-in Electric Vehicle Collaborative (PEVC) MUD working group. The PEVC MUD working group is a statewide presence focused on addressing barriers to EVSE installations at MUDs. The working group will soon launch a public website with the following resources available for property managers and MUD tenants:

- MUD vehicle charging guide
- Region-specific resources for EVSE technologies and PEV groups
- PEV Driver & Charging Survey Opportunities
    - Property manager survey
    - MUD tenant survey

Mr. Pointon is the San Diego region's contact for the PEVC MUD working group. He encouraged REVI members to directly contact him or email, MultiUnit@SDGE.com with MUD EVSE installations in the San Diego region that SDG&E could document with a case study. SDG&E would assist all parties in writing the case studies and publish the final document on the PEVC MUD website.

Mr. Pointon presented on an EVSE installation at CityFront Terrace, a downtown San Diego condominium complex and the first MUD case study SDG&E has documented in the region (www.energycenter.org/pluginready). CityFront wanted to take property management out of the charging fee scenario. They elected to install 20 separate meters in a location close to the building's electrical room. By having separate meters installed for each PEV driver, property management was not responsible for covering the cost of electricity for charging the vehicles. Mr. Pointon noted that the total cost of the project was approximately $80,000. Each tenant would pay $4,000 to purchase a separate socket and the conduit to their dedicated parking space. The $4,000 also would cover installation of individual shut off boxes with a pad lock. Each tenant could purchase the EVSE of their choice. Additionally, each meter was assigned an EV time-of-use rate to take advantage of SDG&E's lower off-peak electricity rates.

Mr. Pointon noted that each MUD project is unique and the CityFront project isn't the answer for all MUD installations. He wants to focus on documenting multiple MUD installations and distributing the resulting case studies via the PEVC MUD website. Ms. Freedman stated that the REVI would circulate case studies as they became available and encouraged members to submit projects to staff, who would coordinate with Mr. Pointon.

Mr. Pointon announced that the next SDG&E MUD Vehicle Charging workshop will be on May 14, 2013 from 9:00AM - 10:30AM . Registration is available at www.seminars.sdge.com

ITEM #7: BARRIER 3: ZONING AND PARKING ISSUES FOR PEVS

Anna Lowe, SANDAG, opened the discussion on zoning and parking for PEVs by affirming that parking regulation is codified at the local jurisdiction level. Ms. Lowe directed the group to the attached document, Transportation Operations Policy Directive 13-01. She highlighted the updated specifications for uniform use by State and local government agencies to regulatory and general information signs and pavement markings for Zero-Emission Vehicles (ZEV). She emphasized that local jurisdictions can implement these policies at their own discretion.

REVI members provided the following comments:

- Chris Schmidt, Caltrans, commented that this is a directive that states these changes shall be effectively incorporated into the California Manual on Uniform Traffic Control Devices (CA MUTCD) in March 2013. However, the actual language won't likely be inserted into the CA MUTCD for a few years.

- Mr. Grim commented that this language could be adopted by local jurisdictions thorough ordinances as a way to implement these PEV parking policies. Ms. Lowe encouraged REVI members to share this information with their public works and planning colleagues to ensure that the updates are communicated to the appropriate individuals.

- Mr. Hoskinson requested that SANDAG staff distribute these guidelines to the other San Diego jurisdictions not represented by REVI. He emphasized that all authorities having jurisdiction (AHJ) in San Diego are represented at SANDAG, and suggested information be communicated at SANDAG's meetings with public works directors (Cities/County Transportation Advisory Committee) and planning directors (Regional Planning Technical Working Group).

- As EVSE providers, James Tillman, eVgo, and Mr. Hoskinson summarized challenges with public EVSE instillations. Mr. Tillman identified the following related to parking rules: point of service, van accessibility, ADA pathway, parking ratios, landscaping grab, available utilities, and financial feasibility.

- Mr. Tillman commented that for eVgo, its "Freedom Station" itself was the point of service, not the department store or the retail outlet where the EVSE is located. This is because each "Freedom Station" is equipped with a DC fast charger (DCFC) and it is assumed the DCFC site is the main attraction for eVgo users who would stop for a quick charge and continue on their way.

- Mr. Tillman stressed that for public DCFC, parking ratios are a challenge in dense locations. It has been difficult finding appropriate parking spaces without eliminating other, sometimes more valuable, spaces while also coordinating through the jurisdictional parking regulations and working within ADA guidelines. He has found that many jurisdictions in California strictly follow the 1997 State Architect ADA guidelines, which at least provide some level of consistency, but was not written with the EVSE siting needs of today. He commented that the draft guidelines out for review now could provide some relief but do not encompass all parking concerns.

Due to time constraints, Ms. Freedman recommended to table the conversation on the draft document *Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices*, currently being developed by the Governor's Office of Planning and Research (OPR). Ms. Freedman stated that SANDAG will set up a conference call next week to further discuss the OPR's draft ADA guidelines.

Mr. Hoskinson suggested the group focus on developing comments in response to the OPR Draft Guidelines. Mr. Hoskinson requested that SANDAG reach out to other jurisdictions to communicate REVI's intention to comment on the draft ADA guidelines.

ITEM #8: MATTERS FROM MEMBERS

REVI members and members of the public provided the following comments:

- Randy Walsh, San Diego Electric Vehicle Network, announced that a group of REVI members conducted a conference call a week earlier regarding PEV dealership outreach. Ms. Freedman invited other members to participate on future calls. Mr. Tillman expressed interest. Staff will coordinate with interested members to organize a follow-up call.

- Mr. Ferry commented that the high permit fees for EVSE installations in the San Diego region mentioned in Mr. Hoskinson's presentation is a barrier that REVI should address.

- Mr. Grim announced that the City of Carlsbad is currently drafting a Climate Action Plan and is developing language to encourage PEV adoption by reducing city permit fees for EVSE installations.

- Mr. Schmidt commented that six jurisdictions in the San Diego region have a contract with Esgil, a third party contractor, to review permits, which is artificially raising the cost of EVSE permits.

- Brendan Reed, City of Chula Vista, commented that permit fees exist to cover the cost of issuing the permit. He stressed that jurisdictions need to make the permit process more efficient.

- Mr. Hoskinson recommended that REVI explore a permitting process employed by the State of Oregon, which involves self-certification. Mr. Petersen commented that information on this program is available in the San Diego PEV Readiness assessment and staff will distribute to the group.

ITEM #9: NEXT MEETING INFORMATION

The next REVI meeting is scheduled for Thursday, May 16, 2013 from 1:00 p.m. to 2:30 p.m. at the SDG&E Energy Innovation Center, 4760 Clairemont Mesa Blvd., San Diego, CA 92117.

ITEM #10: ADJOURMENT

The meeting was adjourned at 2:40 p.m.

REVI Member Attendance on April 18, 2013

REPRESENTATION		NAME	MEMBER / ALTERNATE	ATTENDING
South County Subregion	City of Chula Vista	Brendan Reed	Member	YES
	City of Imperial Beach	Chris Helmer	Alternate	NO
North County Coastal Subregion	City of Del Mar	Ramsey Helson	Member	NO
	City of Carlsbad	Mike Grim	Alternate	YES
North County Inland Subregion	City of Escondido	Kathy Winn	Member	NO
	Vacant	Vacant	Alternate	-
East County Subregion	City of Santee	Kathy Valverde	Member	NO
	City of La Mesa	Scott Munzenmaier	Alternate	NO
City of San Diego		Jacques Chirazi	Member	NO
		Vacant	Alternate	-
County of San Diego		Peter Livingston	Member	YES
		Vacant	Alternate	-
San Diego Association of Governments		Susan Freedman, Chair	Member	YES
		Allison King	Alternate	YES

REPRESENTATION	NAME	MEMBER / ALTERNATE	ATTENDING
San Diego Regional Airport Authority	Paul Manasjan	Member	NO
	Brett Caldwell	Alternate	NO
Caltans, District 11	Chris Schmidt	Member	YES
	Vacant	Alternate	-
Unified Port District of San Diego	Michelle White	Member	NO
	Jenny Lybeck	Alternate	NO
San Diego Gas & Electric	Joel Pointon	Member	YES
	Randy Shimka	Alternate	YES
California Center for Sustainable Energy	Mike Ferry, Vice Chair	Member	YES
	Colin Santulli	Alternate	NO
University of California, San Diego	Dave Weil	Member	NO
	Jim Ruby	Alternate	NO
Miramar College, Advanced Transportation Technology and Energy Program	Greg Newhouse	Member	YES
	Vacant	Alternate	-
San Diego Electric Vehicle Network	Randy Walsh	Member	YES
	Vacant	Alternate	-
National Electrical Contractors Association	Karen Prescott	Member	NO
	Tim Dudek	Alternate	NO
International Brotherhood of Electrical Workers Local 569	Micah Mitrosky	Member	NO
	Vacant	Alternate	-
ADVISORY MEMBERS			
Department of Defense	Chris Parry		NO
San Diego Air Pollution Control District	Mike Watt		NO
	Nick Cormier		YES
Metropolitan Transit System	Claire Spielberg		NO
City of Coronado	Bill Cecil		NO
City of Encinitas	Diane Langager		NO
City of National City	Ray Pe		NO
City of Solana Beach	Dan King		NO
City of Vista	Lyn Dedmon		NO
Ecotality	Andy Hoskinson		YES
Car2go	Mike Cully		NO
Aerovironment	Charlie Botsford		NO
Coulomb Technologies	Colleen Quinn		NO
General Electric	David Wang		NO

Others in Attendance

James Tillman, NRG Energy
Anna Lowe, SANDAG
Tyler Petersen, CCSE
Jessica Thoma, CCSE
Lee Auerbach, public member
Justin Alvord, public member
Molly Ash, Cuyamaca Community College
Jim Mandler, public member
Patrick DePriest, public member
Tony Williams, Quick Charge Power
Dan Chappell, land developer
Lawrence Emerson, public member
Jens Knudsen, public member

Progress on Regional Plug-in Electric Vehicle (PEV) Barriers

Barrier	Progress on Solutions – Preparation of Guidance Materials	Action Items
1. Permitting/Inspection Lack of streamlined permitting and inspection processes and inconsistent (high) costs across jurisdictions.	• Residential permit and inspection guidelines accepted by REVI on 3/21/13. • Residential guidelines distributed to REVI and jurisdictions in 3/13, and posted online at www.energycenter.org/pluginready. • City of San Diego and Oceanside permitting guidelines served as examples.	• REVI provided OPR draft permitting documents to decide if any tailoring is needed before sharing with all governments and stakeholders. • State information addresses SF residential; MUD; workplace; retail and public sector; and fast charging.
2. Building Codes Lack of standard building codes that accommodate charging infrastructure or dedicate circuits for charging infrastructure in new construction and major renovations.	• REVI feedback on codes incorporated into CCSE's regional readiness assessment (DOE project), Nov-Dec. 2012.	• Discuss at 5/16/13 REVI meeting after presentation on Title 24 updates re: EVSE.
3. Zoning and Parking Rules Lack of standard regional ordinances that facilitate the installation and access to publicly available charging infrastructure.	• REVI topic at 4/18/13 and 5/16/13 meetings. • REVI feedback on parking incorporated into CCSE's regional readiness assessment (DOE project), Nov-Dec. 2012. • City of San Diego Technical Policy on addressing accessibility to EV charging stations presented/ distributed at May 2012 REVI.	• Stakeholders to review state guidance on EV charging station accessibility. • REVI to discuss sending comments to OPR at 5/16/13 meeting (due to OPR 5/24/13).
4. Training and Education for Municipal Staff and Electrical Contractors Lack of knowledge about PEVs and EVSE	• Training provided for municipal staff on PEV infrastructure on 1/29/13 at SDG&E EIC. • REVI feedback on training incorporated into CCSE's regional readiness assessment (DOE project), Nov-Dec. 2012.	• Use California PEV Collaborative's Toolkit to further address this item. • Greg Newhouse (Miramar College ATTE) to hold EV and AFV training for SANDAG's Freeway Service Patrol (tow-truck drivers) and CHP 6/29/13.
5. Lack of Public Knowledge of PEV and EVSE Municipal outreach to Local Residents and Businesses	• Discussed locally at PEV Workshop at CCSE on 6/14/12. • CVRP PEV owner survey conducted. Results at 9/20/12 REVI. • REVI feedback on public outreach incorporated into CCSE's regional readiness assessment (DOE project).	• CCSE developing fact sheet for REVI discussion.
6. 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.	*Region is recognized leader on this issue.* • REVI topic at 4/18/13 meeting. • SDG&E published case study in March 2013. • SDG&E published fact sheet on EVSE install process for MUDs. • SDG&E holds quarterly MUD workshops at EIC. • REVI discussed MUD issues at May and July 2012 meetings.	• Showcase SDG&E MUD activities and barrier busting in Readiness Plan. • Develop complementary materials (if needed) for MUD owners/ occupants that fill information gaps in what SDG&E can provide under CPUC rules.

Barrier	Progress on Solutions – Preparation of Guidance Materials	Action Items
7. Regional Planning for Public EVSE Siting Regional land use and transportation plans served as a basis to identify optimal public EVSE sites. In rollout of EV Project, experience was different from planning. Alternate approaches have been taken to increase public EVSE hosts and sites.	*Region is recognized innovator on this issue.* • REVI topic at 3/21/13 meeting. • SANDAG produced report on The EV Project's approach to identifying optimal sites for public EVSE based on local land uses and transportation network. • CCSE presented initials findings of CVRP survey and interviews with EVSE commercial/agency hosts. To release report at some point.	• SANDAG (1) producing fact sheet on regional EVSE planning from EV Project, (2) preparing maps of optimal Level 2 and DCFC EVSE sites for each local jurisdiction, and (3) preparing public agency guidelines for including EVSE in new construction. • CCSE (1) producing fact sheet on value proposition to host EVSE and (2) to release full report on same topic.
8. On Peak Charging – TOU Utility Rates A. Need to discourage charging when electricity supplies are in high demand and cost more. Support of time of use (TOU) pricing. B. High demand charges that impact EVSE host utility bills. Expensive metering options to access TOU rates.	*Region is recognized leader on TOU PEV rates.* • Local standout area for solution/ use of TOU rates that encourage off-peak charging. SDG&E holds regular workshops on EVSE hosting and PEV Rates.	• Obtain findings from SDG&E and EV Project to include (and showcase) in Readiness Plan.
9. Public Agency EVSE Installations Contracting issues have stalled many public agencies from taking part in The EV Project. Need to identify common project barriers and find solutions.	• RFP template for public agencies (and commercial entities) accepted by REVI at 3/21/13 meeting. • RFP template distributed to REVI stakeholders and uploaded to REVI website at www.energycenter.org/pluginready.	• Track progress of agencies/ institutions to site and install EVSE.
10. Commercial and Workplace Charging Lack of understanding regarding benefits and approaches to understanding workplace charging.	• REVI topic at 3/21/13 meeting and focus of CCSE analysis of value proposition of hosting EVSE. (see barrier 7)	• Ecotality to share initial EV Project findings on public and workplace charging. • CCSE to produce fact sheet (see barrier 7)
11. 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.	• CCSE reviewing local government CAPs for policies to support fleet purchases for local governments (spring 2013).	• Tbd.

SECTION 6: BUILDING CODES

This section focuses on the building code requirements for the installation of residential and nonresidential electric vehicle supply equipment (EVSE) in the San Diego region. The first section leverages results of the San Diego regional PEV readiness survey focusing on building code requirements to identify policy gaps and areas of improvement. The next section provides a summary of the actions taken to date to address barriers to PEV deployment with respect to building codes in the San Diego region. The final section provides suggested recommendations regarding PEV-friendly building code policies for jurisdictions throughout the San Diego region.

Policy Gaps and Areas of Improvement: Building Codes

From the PEV readiness survey of jurisdictions, 12 of the 19 jurisdictions in the San Diego region completed the building codes section of the survey. Based on feedback from the survey, none of the jurisdictions responding have adopted building code requirements for EVSE installations, nor does any jurisdiction have unique building code requirements specific for EVSE that apply for new construction and pre-existing buildings. That said, only 38% of the jurisdictions in the San Diego area responded that their planning agency requires further information to create building code requirements for EVSE. See the table below for more detail.

Participating Cities in the San Diego Region: **El Cajon**, **San Marcos**, **Chula Vista**, **Carlsbad**, **National City**, **Lemon Grove**, **Encinitas**, **Coronado**, **La Mesa**, **Imperial Beach**, **Oceanside**, **City of San Diego**

Note: The **City of Encinitas** had two individuals provide separate responses for their jurisdiction. Each of their responses was credited.

Assessing Building Code Requirements for EVSE

Percent*	Agency Assessment
0%	Agency has already adopted requirements for EVSE that we feel would be a best practice example for the state of California
8%	Agency is in the process of adopting requirements for EVSE (**Oceanside**)
8%	Agency is looking at other agencies' requirements for EVSE to determine what is best for their jurisdiction (**El Cajon**)
38%	Agency requires further information to determine requirements for EVSE (**San Marcos**, **Chula Vista**, **Carlsbad**, **Lemon Grove**, **Encinitas**)
15%	Agency has only started to consider how to adapt requirements for EVSE (**Coronado**, **Imperial Beach**)
31%	Agency has not started to look at how to adapt requirements for EVSE (**National City**, **Encinitas**, **City of San Diego**, **La Mesa**)

*All percentages are rounded to the nearest whole number; as a result, the total percentage may not equal 100%.

Addressing Policy Gaps and Areas of Improvement

As reported in the survey results, none of the responding municipalities in San Diego has adopted unique building code requirements specifically written for electric vehicle infrastructure. In this regard, information on best practices, such as the Green Building Codes adopted by the City of Los Angeles, has been introduced to municipal staff attending the San Diego PEV readiness workshop in June 2012, and other resources and examples of EVSE-friendly building codes have been made available on the *Plug-in & Get Ready* (**www.energycenter.org/pluginready**) website.

The majority of jurisdictions (92%) in the survey stated that it would be helpful to have other city or agency building code best practices available to reference. The **City of San Marcos**, however, stated that they are developing requirements using internal staff. In addition, over half of the agencies (54%) responded they would be willing to share best practice documents with regional partners, if they felt their building code requirements were identified as a best practice example in the state.

Regional Variation in Timeline and Administrative Process for Adopting New Building Code Requirements

The formal decision-making process for adopting EVSE-friendly building codes into local municipal codes and associated timelines needs to be clearly understood for each jurisdiction. This is evident in the survey results where the majority of agencies were uncertain how long it would take their jurisdiction to adopt new building code requirements. However there were three municipalities that identified the timelines and process necessary for updating these codes.

The **City of Lemon Grove** stated that updated building codes could be adopted within six months at the time of the survey. The **City of Oceanside** indicated that any building code requirements can be quickly adopted, but will have to be developed as a policy beforehand. The process for municipal code adoption for the **City of Oceanside** is 60 days, starting with policy development by internal staff. Once developed, the policy is vetted through the city attorney, formal city council meetings and then, eventually, voted on for approval. The **City of San Diego** specified that any formal code adoption would likely take one year because of the legislative process, which includes public hearings and outreach to relevant stakeholders. The **City of San Diego** also indicated a preference to work within current codes or updating the existing language rather than adopting new codes, citing that the process of proposing and approving new ordinances is very lengthy in general compared to updating existing codes and ordinances.

While not specific to EVSE, the **City of Chula Vista** has adopted requirements for PV system requirements[21] in all new residential units (Ordinance 15.24.065 Photovoltaic pre-wiring requirements). These systems include electrical conduit specifically designed to allow the later installation of a PV system that utilizes solar energy as a means to provide electricity. Building permits will not be issued unless these requirements are incorporated into the building plans.

Adoption of CALGreen Building Codes

Many jurisdictions have adopted only the basic CALGreen building codes requirements that designate 10% of parking be set aside for all alternative fuel and low emission vehicles, in public spaces. These include the cities of **Chula Vista**, **National City**, **Encinitas**, **Coronado**, **La Mesa**, **Imperial Beach**, **Oceanside** and **San Diego**. However, none of the cities in the San Diego region has adopted the voluntary measures for EVSE included in CALGreen that specifically recommend prewiring for EVSE in residential and nonresidential new buildings. Two of the survey respondents indicated that they feel there is not enough demand for PEV infrastructure in their city to focus on updating codes at this time (cities of **La Mesa** and **Imperial Beach**).

Recommendations for Regional Next Steps

Based on the feedback from the PEV readiness survey, we have identified that jurisdictions in the region do not have specific building codes for EVSE. However, jurisdictions across the region are interested in receiving information on

[21] http://www.codepublishing.com/ca/chulavista/html/ChulaVista15/ChulaVista1524.html

how other agencies have developed building codes. In addition, there is also uncertainty regarding the process each jurisdiction has to update building codes.

Through the lessons learned in San Diego and a review of national and state best practices, we have identified the following recommendations for the San Diego region. These recommendations are focused on understanding building code processes and potential barriers as well as prewiring for new construction. Furthermore, the recommendations in this section are organized into actions jurisdictions should take in the near to long term. Please reference the building code section in the Appendix for a complete list of best practices reviewed in preparation for this document.

Understanding Building Code Timelines and Processes

Recommendation: Leverage REVI members and additional local government stakeholders to prepare a building code review to better understand potential barriers to PEV deployment. As part of this review, develop a clear outline of the processes, decision-makers and timelines associated with updating building codes in each of the 19 jurisdictions across the San Diego region.

Benefits: Having a better understanding regarding building code processes and potential barriers will help in developing proposed solutions via building code updates.

Modify Existing Use/Discretionary Permitting Processes to Include EVSE

Recommendation: As a near-term goal, incorporate standardized project condition language that defines where or how to incorporate EVSE in project design and planning processes. Installation of EVSE should be identified as a greenhouse gas mitigation strategy per the California Environmental Quality Act (CEQA). Leverage existing major use and discretionary permitting processes in the region to accomplish this by utilizing the recommended language below:

For NONRESIDENTIAL AND RESIDENTIAL PROJECTS, include a *space dedicated in the electrical panel for a circuit for plug-in electric vehicle charging; and a label stating "PEV CAPABLE" shall be posted in a conspicuous place at the service panel or subpanel and next to the raceway termination point.*[22]

For NONRESIDENTIAL PROJECTS, ensure *each parking space required in the table below, provide panel capacity and dedicated conduit for one 208/240 V 40 amp circuit terminating within 5 feet of the midline of each parking space.*[23]

Total Number of Parking Spaces	Number of Required PEV Spaces
1 – 50	**1**
51 – 200	**2**
201 and over	**4**

For RESIDENTIAL PROJECTS (e.g. planned subdivisions), *provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), in both single-family and multifamily unit dwellings. The outlet(s) shall be located in the parking area and have a minimum of the following:*

- **Single-Family Dwellings**: 1 per unit
- **Multifamily Unit Dwellings**: 5% of parking capacity

Benefits: Incorporating this language into the conditions associated with the use/discretionary permitting processes allows municipalities to promote EVSE through existing methods. In addition, this language provides another option for developers to meet the requirements under CEQA. Further, prewiring during the construction of a building significantly reduces the cost associated with the installation of EVSE.

Adopt/Update Prewiring for EVSE in Residential and Nonresidential New Construction

Recommendation: As a long-term goal, update current building codes in each jurisdiction across the San Diego

[22] Language adapted from County of San Diego and CALGreen Voluntary Building Code A4.106.6.1.1

[23] Language adapted from CALGreen Voluntary Building Code A5.106.5.3.1

[24] Language adapted from County of San Diego and CALGreen Voluntary Building Code A4.106.6.1.1

region with the following language modified from the current voluntary CALGreen building code language (A5.106.5.3.1) as mandatory in ALL new nonresidential and residential construction.

Note: This is the same language as the previous recommendation but would update the building code and apply to all new construction, thus is a longer term goal for the region.

For NONRESIDENTIAL AND RESIDENTIAL PROJECTS, *include a space dedicated in the electrical panel for a circuit for plug-in electric vehicle charging; and a label stating "PEV CAPABLE" shall be posted in a conspicuous place at the service panel or subpanel and next to the raceway termination point.*

Total Number of Parking Spaces	Number of Required PEV Spaces
1 – 50	**1**
51 – 200	**2**
201 and over	**4**

For NONRESIDENTIAL PROJECTS, *ensure each parking space required in the table below, provide panel capacity and dedicated conduit for one 208/240 V 40 amp circuit terminating within 5 feet of the midline of each parking space* .[25]

For RESIDENTIAL PROJECTS (e.g. planned subdivisions), *provide a minimum number of 208/240 V 40 amp, grounded AC outlet(s), in both single-family and multifamily unit dwellings. The outlet(s) shall be located in the parking area and have a minimum of the following.*

- **Single-Family Dwellings**: 1 per unit
- **Multifamily Unit Dwellings**: 5% of parking capacity

Benefits: Uses an existing policy mechanism already endorsed by the State of California and the City of Los Angeles. Prewiring during the construction of a building significantly reduces the cost associated with the installation of EVSE.

[25] Language adapted from CALGreen Voluntary Building Code A5.106.5.3.1

How Many Business Days to Provide an Inspection After it is Requested

Days to Provide an Inspection	Jurisdiction
Same day	El Cajon, Poway
2-5 days	Lemon Grove, Carlsbad, Encinitas, Encinitas, Coronado, La Mesa, Imperial Beach, Oceanside, City of San Diego
6-10 days	-
3-5 weeks	-
More than 5 weeks	-
TBD (based on inspection/ranges)	San Marcos, Chula Vista

*Jurisdictions may have more than one method for requesting an inspection of EVSE installations.

Inspector Checklist for EVSE Installations by Jurisdiction

Do you have an inspector checklist for EVSE installation?	Jurisdiction
Yes	El Cajon, Coronado
No	San Marcos, Chula Vista, Lemon Grove, Carlsbad, Encinitas, Encinitas, Poway, La Mesa, Imperial Beach, Oceanside, City of San Diego

It is important to note that the **City of Oceanside** has created a general installation guideline for residential EVSE installations, including inspection recommendations, but not a specific inspector checklist for the installation of PEV infrastructure. The **City of San Diego** also was not sure if an inspector checklist was available to the city's inspectors. The **City of San Diego's** response was recorded as a "No".

Building Codes

Many regions across California and Canada have implemented building codes that establish the make it easier to install EVSE in an effort to promote the deployment of PEVs and charging infrastructure. For the most part, these regions have focused on "pre-wiring" buildings for EVSE infrastructure. The following section provides a brief description of policies and measures that other regions have implemented in regards to building codes.

Best Practices

The City of Los Angeles Green Building Code has been recognized as a best practice for promoting EVSE-friendly policies, and this is no exception when discussing the EVSE building code requirements in L.A.'s municipal code. Also in Southern California, the City of Santa Monica has adopted requirements for electrical services meant for charging PEVs in new buildings or structures. The California Green Building Standards Code (CalGreen) has created mandatory measures for nonresidential structures that require local municipalities to adopt specific parking measures for low-emitting, fuel-efficient and carpool/van pool vehicles which include PEVs.

CalGreen also includes voluntary building code measures that are specific to EVSE requirements. In Northern California, the County of Sonoma has used California Building Code (Title 24) as a template to adopt A.D.A. requirements for EVSE. Internationally, the City of Vancouver, British Columbia has revised the City's building bylaw to accommodate PEVs in new apartment buildings and other multi-family buildings.

Electric Vehicle Supply Wiring ("Pre-wiring Requirements")

The City of Los Angeles
L.A. Green Building Code: 99.04.106.6:[1] Effective as of January 1, 2011 which includes:
Non-Residential: 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.
Single Family Dwellings: 1 per unit.
Multi-Family Unit Dwellings: 5% of parking capacity.

California Green Building Standards Code[2]
Cal Green Nonresidential Voluntary Measures
The measures here are not mandatory unless adopted by a jurisdiction, but provides measures that designers, builders and property owners may follow during design and construction.

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

1) For each space, provide one 120 VAC 20 amp and one 208/240 V 40 amp, grounded AC outlets or panel capacity and conduit installed for future outlets for up to 10% of total designated parking spaces for low-emitting and fuel efficient vehicles, which includes PEVs.

City of Vancouver, British Columbia, Canada
13.2.1. Electric Vehicle Charging
13.2.1.2. Electrical Room

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

City of Vancouver, British Columbia, Canada
Office of Sustainability, Planning, Development Services and Engineering Services[3]
Green Homes Program[4]
The Vancouver City Council adopted the Green Homes Program which included a requirement within the building by-law to require provisions to accelerate EV charging infrastructure in all new single family dwellings. Specifically, the Green Homes Program states that a cable raceway be installed in new homes that runs from the building's electricity panel directly to the garage, to an empty outlet box.

Note: See the full recommendation from the City's Chief Building Office for the "Infrastructure Installation for Plug-in Electric Vehicles for New Dwellings"

EVSE and Designated Parking Requirements

The City of Santa Monica
9.04.10.08.050 Number of bicycle, vanpool and carpool parking spaces required. [5]

[1] http://ladbs.org/LADBSWeb/LADBS_Forms/Publications/LAGreenBuildingCodeOrdinance.pdf
[2] http://www.documents.dgs.ca.gov/bsc/CALGreen/2010_CA_Green_Bldg.pdf
[3] http://vancouver.ca/files/cov/green-homes-council-report.pdf
[4] http://vancouver.ca/home-property-development/green-home-building-policies.aspx
[5] http://www.qcode.us/codes/santamonica/view.php?topic=9-9_04-9_04_10-9_04_10_08-9_04_10_08_050&frames=on

New buildings or structures over fifteen thousand square feet shall provide bicycle parking at a rate of five percent of the automobile parking required pursuant to Section 9.04.10.08.040[6] (Number of parking spaces required) and shall provide a minimum of one electrical outlet which shall be accessible to the parking area for the purpose of recharging electric vehicles.

City of Vancouver: Infrastructure Installation for Plug-in Electric Vehicles

Policy Report from the Office of Sustainability, Planning, Development Services and Engineering Services to the City of Vancouver Standing Committee on Planning and Environment advocating the Green Homes Program. A subsection of this program includes a recommendation in the building by-law for EVSE "pre-wiring" requirements for all new single family homes.

Over the past 5 years there has been a growing market for electric bicycles and scooters. It is also expected that plug-in electric hybrid vehicles will be available to the public in the near future, followed soon after by the widespread availability of fully electric vehicles. The adoption of this technology represents a significant opportunity to further reduce GHG's in the Vancouver community. However, a primary challenge to their adoption is the fact that they require a charging station in the user's home. To that end, staff is recommending requiring the installation of a cable raceway from the building's electricity circuit panel to an enclosed outlet box in the home's garage or carport. In doing so, staff is ensuring that the home can be easily retrofitted at a later date to allow for the installation of electric vehicle charging facilities. This recommendation recognizes that infrastructure must be put in place at the time of construction in order to ease the adoption of emerging technologies by the homeowner at a later date.

L.A. Green Building Code Standards for Non-Residential and Residential EVSE Building Code Requirements

Mandatory measure for newly constructed 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 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

Mandatory measure for newly constructed 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

[6] http://www.qcode.us/codes/santamonica/view.php?cite=section_9.04.10.08.040&confidence=6

UCLA Luskin School of Public Affairs

Luskin Center FOR INNOVATION

Southern California Plug-in Electric Vehicle Readiness Plan

Prepared for the Southern California Association of Governments

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11 Building Codes for PEV Readiness

11.1 Introduction

Cities can use building codes to advance PEV adoption in a way that ensures safe, cost-effective installation of charging equipment. By updating building codes to require PEV-ready wiring in new construction, cities can help meet future demand for charging and reduce or eliminate the costs associated with later retrofitting. In addition to these benefits, PEV building readiness codes advance equity by ensuring access to charging for multi-family building residents and the disabled. Building codes related to PEVs can also provide guidance on a number of issues including (California Plug-in Electric Vehicle Collaborative 2012; Advanced Energy 2011):

- The number of circuits needed and service panel requirements
- Placement of electric meters
- Sourcing of electricity for on-street and lot parking
- The impact of charging infrastructure on building electrical loads and local electrical distribution
- Allocation and sizing of parking spaces to accommodate charging infrastructure
- Compliance with the Americans with Disabilities Act (ADA)

About two-thirds of local government agencies and utilities surveyed by the California Plug-in Electric Vehicle Collaborative have not adopted building code requirements for EVSE installations (California Plug-in Electric Vehicle Collaborative 2012). Of those that do have building code requirements for EVSE installations, 92% do not have unique code requirements for new construction in addition to requirements for pre-existing buildings.[33]

Codes provide construction standards according to building uses. These uses can be classified as residential or non-residential. Residential buildings are often classified into two categories: one- or two-family homes and townhouses, and multi-family (also called multi-unit) dwellings. Non-

33 California Plug-in Electric Vehicle Readiness Survey results reported as of September 4, 2012. Response rates to these questions ranged from 29–37%.

residential buildings can include business, industrial, institutional and mercantile (retail) uses. The types of building codes a city will need to prepare for PEV infrastructure will depend in part on the kinds of land uses and occupancies that are most commonly found in that city.

A building code's applicability generally falls along a continuum of scope and cost-effectiveness. The continuum ranges from new construction (the narrowest scope and the most cost-effective), to remodels involving a certain percentage of a structure, and finally to retrofits (the widest scope and potentially most costly, because it applies to existing buildings as well as new construction).

Planning for PEVs is an inherently uncertain exercise. The number of PEVs on the road in the future, their battery sizes and charging requirements, and the timeframe in which they will become more ubiquitous is difficult to predict with certainty. Vehicle and charging technology will evolve more quickly than the average lifespan of a building. What follows is a discussion of California's voluntary building code governing electric vehicle charging infrastructure and some examples of how cities have tailored this standard or strengthened it at the local level.

11.2 CALGreen

California's green building code provides guidance on *voluntary* measures municipalities can adopt if they want to require PEV charging readiness in newly-constructed buildings. A limitation of CALGreen is that its residential measures only apply to low-rise residential buildings of three stories or fewer. The California Department of Housing and Community Development has proposed extending CALGreen's provisions to cover high-rise as well as low-rise residential construction beginning in 2014. (California Department of Housing and Community Development 2012). Cities can adopt the measures in CALGreen or adapt them to reflect local priorities. For example, the City of Santa Monica has adopted the measures in CALGreen and has redefined "low-rise residential" to mean buildings of six stories or less (Santa Monica Municipal Code 2010).

For one- and two-family dwellings, the code calls for **installation of a raceway**[34] to accommodate a dedicated branch circuit. For multifamily residential dwellings of three stories or less, CALGreen also calls for a **minimum number of parking spaces** to be capable of supporting PEV charging. The CALGreen code language is excerpted below (California Building Standards Commission 2012 Supplement):

- ***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*

34 The term "raceway" is sometimes used interchangeably with "conduit." A raceway is a channel, often a rectangular wall-mounted tubular casing, designed expressly for holding wires or cables and protecting them from damage.(Davis 1998-2012)

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).*[35]
    - ***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*[36] *EVSE at its maximum operating ampacity. Only underground raceways and related underground equipment are required to be installed at the time of construction.*

CALGreen also offers municipalities a voluntary standard for PEV charging at **commercial**, **retail** and other **non-residential** locations, as excerpted here (California Building Standards Commission 2012 Supplement):

- ***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.*

35 Electric vehicle supply equipment may refer to charging stations, cords, or building wiring intended to power electric vehicles. The California Electrical Code defines EVSE as "conductors…and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of delivering energy from the premises wiring to the electric vehicle."

36 Charging levels refer to the voltage provided by charging unit. The higher the voltage, the more quickly a battery can be powered. Level 1 charging uses 120 volts to provide at least 12 amperes of current and 1.44-1.92 kilowatts of power. Level 1 charging is available through a standard household outlet. Level 2 charging uses 240 volts (or 208 volts in commercial locations) to provide up to 80 amperes of current and 19.2 kilowatts of power for battery use (U.S. Department of Energy 2012). Typical amperages for Level 2 current range from 15-40A. See Chapter 3 for a more detailed description of charging levels.

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

**In a parking garage, the total number of parking spaces is for each individual floor or level.*

11.3 Local ordinances in the South Coast region

Once adopted by cities, the CALGreen voluntary measures become requirements for new construction. Some cities in the Southern California Association of Governments (SCAG) region have adopted or adapted the voluntary EVSE measures presented in CALGreen. These ordinances require and prescribe standards for 1) panel capacity, outlets, conduits, meters and/or charging units, each of which represent progressively higher levels of PEV readiness; and 2) the number of parking spaces to be served by charging infrastructure. The higher the upfront commitment by a city to facilitating this type of charging access, the fewer costly retrofits[37] will be required in the long run, and the more flexible PEV drivers can be in their charging habits.[38]

11.3.1 Panel capacity and outlets

The most basic level of PEV readiness relates to electric service panel capacity. The ability of electrical panels to handle PEV charging load depends on the age and size of the building as well as what other load demands are placed on the panels. Existing 120-volt outlets in a parking area may be sufficient to provide charging, particularly for smaller-battery PHEVs, without the need for additional panel service. Many building codes require new buildings to provide 240-volt outlets, but cities should consider allowing 120-volt outlets, or a mix of 120- and 240-volt outlets, to serve a range of battery sizes and commutes. In particular, if cities are considering requiring PEV-ready retrofits, 120-volt outlets could be a more cost-effective

37 Published cost estimates for retrofits vary widely depending on site type and complexity of installation. Estimates for Level 2 single-family range from $1,500 - $4,000 (Ready, Set, Charge, California! A Guide to EV-Ready Communities 2011) while Level 2 in multi-unit dwellings and commercial settings can range from $3,600 - $11,000 (Peterson 2011).

38 Cities may also consider expanding the size of future electrical rooms to accommodate conduits for PEV charging. The City of Vancouver, Canada has adopted the following code language: “The electrical room in a multi-family building, or in the multi-family component of a mixed-use building that in either case includes three or more dwelling units, must include sufficient space for the future installation of electrical equipment necessary to provide a receptacle to accommodate use by electric charging equipment for 100% of the parking stalls that are for use by owners or occupiers of the building or of the residential component of the building.”(Ready, Set, Charge, California! A Guide to EV-Ready Communities 2011)

option. Incorporating more opportunities for 120-volt charging would also reduce the need for special 240-volt charging units, since 120-volt outlets can be used with the cords that currently come with PEVs. The lower voltage would allow for more outlets to be installed using the same amount of power (Balmin, Bonett, and Kirkeby 2012).

Alternatively, property owners can evaluate whether lower-cost charging can be provided through multiplex or multi-arm stations that can charge more than one car simultaneously, or in a programmed queue. While such solutions may present a higher upfront cost, the unit cost per driver is much lower.

The need to upgrade electrical panels in existing buildings may be reduced by the use of energy management software, which can balance the additional load brought by PEV charging. The National Electrical Code required electrical capacity for charging equipment to reflect the full load charging capability of the equipment, plus an additional 25% capacity buffer, in order to prevent circuit overload (National Fire Protection Association 2011). However, a tentative interim amendment to the code allows the maximum electric vehicle supply equipment load on a service panel or feeder to reflect the maximum load permitted by an automatic load management system (National Fire Protection Association 2011). Cities should consider updating local electrical codes to allow this potentially lower-cost alternative to adding capacity.

New construction provides an opportunity to examine the building's total projected load from PEVs and other sources and to offset this load with energy efficiency upgrades. Panel capacity can also be made available for PEVs by installing energy-efficient lighting and HVAC systems. A qualified electrical contractor should be retained to assess sites and calculate electrical loads, particularly for more complex installations that serve multiple vehicles in MUDs or commercial buildings. (Biddick et al. 2012; California Plug-in Electric Vehicle Collaborative 2012; Ready, Set, Charge, California! A Guide to EV-Ready Communities 2011)

11.3.2 Conduits and meters

The laying of conduit capable of carrying future wires or cables from the electrical room to the charging unit represents the next step in PEV building readiness. Codes requiring 120-volt outlets into which PEVs can plug in directly, or 240-volt outlets to connect Level 2 chargers to wiring and conduits, will bring buildings even closer to PEV readiness. Providing space in the electrical room for additional future meters will help multi-unit dwellers can take advantage of special utility rates for PEV charging. However, requiring additional meters at single-family homes can have unintended consequences, as they may enable conversion of properties to unapproved multi-family rentals or home businesses. Utilities are exploring the use of software that allows sub-metering of PEV charging on one meter.

11.3.3 Charging units

The City of Lancaster's code is notable in that it requires not only PEV-ready wiring in new construction, but even requires the installation of some ready-to-use charge stations. Cities may

wish to consider whether to require ready-to-use charge stations, when to require them, or how many to require. In doing so, they should strive to minimize cost and ensure that stations are not underused. They should consider evolving technology as well as current demand (see the Southern California PEV Atlas that accompanies this document for COG-level PEV projections).

Excerpted below are local building codes from the SCAG region that are mostly related to PEV readiness in wiring and parking space allocation. Los Angeles' code requires PEV-ready wiring for new single- and multifamily buildings and charging capacity for at least 5% of parking spaces (for multifamily buildings). Rolling Hills Estates' EVSE requirement nominally applies to all new residential units, but in practice was intended for single-family homes and townhouses with attached garages. The city of Temecula's ordinance is also intended for PEV conduits in single-family homes. Other considerations that may relate to building codes, such as PEV parking space design, signage, and ADA compliance, are reviewed in other chapters of this document.

11.3.4 Beverly Hills

Provide facilities meeting section 406.7 (Electric Vehicle) of the California building code and as follows:

One 120 VAC 20 amp and one 208/240V 40 amp, grounded AC outlets or panel capacity for one 120 VAC 20 amp and one 208/240V 40 amp, grounded AC outlet and conduit installed for future outlets for each dwelling unit. Electric vehicle supply shall be provided and may be installed in a stall provided to comply with the code minimum parking requirements. Dwelling unit shall be defined by the California building code.

Exception: Apartment buildings and apartment units. (Beverly Hills Municipal Code 2011)

11.3.5 Lancaster

New residential development shall provide for EVCS in the manner prescribed as follows:

1. *Garages serving each new single-family residence and each unit of a duplex shall be constructed with a gang box[39] (4 inches by 4 inches) connected to a conduit linking the garage to the electrical service, in a manner approved by the building and safety official, to allow for the future installation of electric vehicle supply equipment to provide an EVCS for use by the resident.*
2. *In new multiple-family projects of 10 dwelling units or less, 20% of the total parking spaces required (all of the 20% shall be located within the required covered parking) shall be provided with a gang box (4 inches by 4 inches) connected to a conduit linking the covered parking spaces or garages with the electrical service, in a manner approved by the building and safety official, to allow for the future installation of electric vehicle supply equipment to provide EVCSs at such time as it is needed for use by residents.*

39 The term "gang box" also refers to an electrical box, which "enclose(s) wire connections for applications such as a light switch, electrical outlet or light fixture" (The Home Depot).

EVCSs shall be provided in disabled person parking spaces in accordance with state requirements.

3. *In new multiple-family projects of more than 10 dwelling units, 10% of the total parking spaces required (all of the 10% shall be located within the required covered parking) shall be provided with a gang box (4 inches by 4 inches) connected to a conduit linking the covered parking spaces or garages with the electrical service, in a manner approved by the building and safety official. Of the total gang boxes provided, 50% shall have the necessary electric vehicle supply equipment installed to provide active EVCSs ready for use by residents. The remainder shall be installed at such time as they are needed for use by residents. EVCSs shall be provided in disabled person parking spaces in accordance with state requirements. (Lancaster Municipal Code)*

New commercial development shall provide for electric vehicle charging stations in the manner prescribed as follows:

a) New residential uses shall provide EVCSs in accordance with Section 17.08.150T.

b) New commercial, industrial, and other uses with the building or land area, capacity, or numbers of employees listed herein shall provide the electrical service capacity necessary and all conduits and related equipment necessary to ultimately serve 2% of the total parking spaces with EVCSs in a manner approved by the building and safety official. Of these parking spaces, 1/2 shall initially be provided with the electric vehicle supply equipment necessary to function as on-line EVCSs upon completion of the project. The remainder shall be installed at such time as they are needed for use by customers, employees or other users. EVCSs shall be provided in disabled person parking spaces in accordance with state requirements.

1. *Construction of a hospital of 500 or more beds, or expansion of a hospital of that size by 20% or more.*
2. *Construction of a post-secondary school (college), public or private, for 3,000 or more students, or expansion of an existing facility having a capacity of 3,000 or more students by an addition of at least 20%.*
3. *Hotels or motels with 500 or more rooms.*
4. *Industrial, manufacturing, or processing plants or industrial parks that employ more than 1,000 persons, occupy more than 40 acres of land, or contain more than 650,000 square feet of gross floor area.*
5. *Office buildings or office parks that employ more than 1,000 persons or contain more than 250,000 square feet of gross floor area.*
6. *Shopping centers or trade centers that employ 1,000 or more persons or contain 500,000 square feet of gross floor area.*

7. *Sports, entertainment, or recreation facilities that accommodate at least 4,000 persons per performance or that contain 1,500 or more fixed seats.*

8. *Transit projects (including but not limited to transit stations and park and ride lots). (Lancaster Municipal Code)*

11.3.6 City of Los Angeles

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 the future installation of a 208/240 V 40 amp, grounded AC outlet, for each dwelling unit.

The electrical outlet or conduit termination shall be located adjacent to the parking area.

2. For other residential occupancies where there is a common parking area, provide one of the following:

a) A minimum number of 208/240 V 40 amp, grounded AC outlets equal to 5 percent of the total number of parking spaces. The outlets shall be located within 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, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent 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, of a minimum number of 208/240 V 40 amp, grounded AC outlets, that is equal to 5 percent of the total number of parking spaces. The conduit shall terminate within the parking area.

When the application of the 5 percent results in a fractional space, round up to the next whole number. (Los Angeles Municipal Code 2010)

11.3.7 Rolling Hills Estates

Any new residential construction, including an addition to a residential structure of greater than fifty percent of the existing floor area, including the primary garage, and/or any demolition of greater than fifty percent of the lineal walls of a residential structure within a twelve-month period, shall require the installation of a two hundred twenty volt dedicated electrical outlet in the garage for the purposes of charging an electric vehicle. (Rolling Hills Estates Municipal Code)

11.3.8 Temecula

Circuits for electric vehicle charging stations shall meet all the requirements of California Electrical Code Article 625[40]. 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. (Temecula Municipal Code)

11.3.9 Torrance (proposed)

- *That all new residential units shall be equipped with the required electrical conduit to accommodate at least one Level 2 electric vehicle charging capability within designated parking areas for said unit(s). [Community Development Department staff requested that the Planning Commission also consider the CALGreen 3% requirement to avoid new findings, public noticing and additional local amendment proceedings].*

Residential parking development standards:

- *Charging units located with residentially developed properties must either be provided within an enclosed structure, affixed to a permitted structure or located adjacent to a required parking space, provided exterior charging units do not encroach into any required setback by more than 12 inches.*

Commercial industrial parking regulations:

- *an EV parking space requirement for new construction or properties significantly remodeled…and which provide 50 or more parking spaces, shall be required to provide and maintain at least 2% of available parking spaces as electric vehicle parking spaces equipped with either Level 2 or [higher] charging infrastructure.*
- *Required signage specifications for electric vehicle parking spaces, to clearly mark spaces as electric vehicle parking, contact information for charging station (Community Development Department Recommendations to the Torrance Planning Commission, June 6, 2012, Agenda Item No. 15A, Case No. LUS12-00001).*

11.4 Conclusion

The building codes we present in this chapter reflect early attempts to support PEV readiness. The steps taken by these municipalities to date reflect the impracticality, due to cost recovery and implementation issues, of mandating charging equipment installation in existing residential buildings. These codes will need to evolve over time and adapt to market conditions.

40 For the model California Electrical Code language on PEV charging, see http://rrdocs.nfpa.org/rrserver/browser?title=/NFPACA/CaliforniaElectricalCode2010

11.5 Recommendations

The following recommendations are intended to facilitate PEV charging through building codes. These recommendations should be adapted to reflect local land use opportunities for PEV charging and anticipated PEV demand, which may vary greatly among cities. Guidance on assessing local land use opportunities is provided in Chapter 4, Chapter 5, Chapter 6, Chapter 7, and Chapter 8. Additional resources on zoning and parking policies are provided in Chapter 10 and Chapter 13 of this document. Local jurisdictions should consult the Southern California PEV Atlas that accompanies this document for local PEV demand projections and maps of employment and commercial density.

1. Consider expanding the range of new buildings to which PEV readiness codes apply beyond CalGreen's low-rise designation.
2. Allow Level 1 or Level 2 charging capability to satisfy PEV readiness requirements in building codes.
3. Require the laying of conduit capable of carrying future wires or cables from the electrical room to the charging unit in new construction.
4. Consider present PEV charging demand in determining whether to require installation of ready-to-use charging stations in addition to PEV-ready wiring for new single and multi-unit dwellings.
5. Require a certain minimum percentage of parking spaces in new construction be wired to be PEV-ready for single-family homes or MUDs, if these land uses present significant opportunities locally.
6. Require a certain minimum percentage of parking spaces in new construction be wired to be PEV-ready in commercial or industrial buildings, if these opportunities represent significant opportunities locally.
7. Consider updating electrical codes to allow the sizing of electrical service to charging systems to reflect the load permitted by an automated energy management system.

11.6 Additional resources

There are many resources available for planners seeking detailed implementation guidance for PEV-ready buildings, including:

Ready, Set, Charge, California! A Guide to EV-Ready Communities (2011). http://www.baclimate.org/images/stories/actionareas/ev/guidelines/readysetcharge_evguidelines.pdf

- Section 3.5 (Building and Electrical Code Guidance)

- Section 3.6 (Signage)
- Section 5.3 (Electrical Requirements)

Building codes specify whether pre-wiring or installation of electric vehicle supply equipment (EVSE) is required for new construction or existing buildings. If cities decide to require EVSE readiness, they should do so in compliance with the standards specified in the California Electrical Code.

California Electrical Code (2010). http://rrdocs.nfpa.org/rrserver/browser?title=/NFPACA/CaliforniaElectricalCode2010

- Article 625, Electric Vehicle Charging System
- Article 626, Electrified Truck Parking Spaces

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The Home Depot. Buying Guide: Electrical Boxes. http://www.homedepot.com/webapp/catalog/servlet/ContentView?pn=Boxes_Covers_Fittings&storeId=10051&langId=-1&catalogId=10053.

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AGENDA ITEM 6

NOTES ON OPR UNIVERSAL ACCESSIBILITY GUIDELINES FOR EVSE

Notes below correspond to comments described in "Comments to OPR" document

General Points on Accessibility and EVSE

- EV charging is considered a program or service that must be accessible to and useable by individuals with disabilities. Accessible charging includes:
    - Physical dimensions and operable parts of the charging unit
    - Functionality of the 'self-contained, closed product' charging system
- EV charging is considered primary function of these stations, not parking
- Accessible EV charging stations are not to be reserved exclusively for the use of persons with disabilities
    - Signage should indicate that they should be used last, but not indicate that the charging station is reserved for a vehicle with a handicap placard.

Summary of Key Sections of OPR Guidelines

EVG-250.5 Locations of Accessible EV Charging Stations

- New construction:
    - Close to major facility, 200 feet maximum distance
    - Does not need to be immediately adjacent to facility
- Existing sites:
    - Technical factors may inhibit the charger from being located close to a major facility
    - EV Charging should be on an accessible route to the maximum extent feasible
- On-street:
    - Fully accessible EV chargers in the public right of way can be very difficult
    - EVG-250.5.2 allows a public entity to provide accessible EV charging on a programmatic basis. This involves using additional on-site accessible EV charging stations to meet the combined requirements for the number of both on-street and on-site locations within the public entity's jurisdiction.
        - *Note: Clarification required on what "programmatic" means – can local jurisdictions interpret? (See Comment 1)*

EVG-250.6 EV Charging Stations at Existing Facilities

- Path of Travel Requirements (California Building Code 11B-202.4)
    - EV Charging Stations are "alterations" not affecting a primary function area and "path of travel" upgrades would not be required.
    - EXCEPTION: Installations of EV charging stations at sites where vehicle parking or storage is the sole and primary use of the facility are required to comply with CBC 11B-202.4 Path of Travel Requirements to the maximum extent feasible.

        - Maximum extent feasible: the cost of compliance with 11B-202.4 shall be limited to 20 percent of the cost of the work directly associated with the installation of the EV charging equipment
        - *Note: Clarification needed on what costs are included in the "costs associated with the installation of the EV charging equipment." Does this include construction costs? Entire project costs? Just equipment? (See Comment 2)*

EVG-812 On-Site Electric Vehicle Charging Stations

- EVG-812.3 Access Aisle
    - Two EV Charging stations or one EV charging station and one accessible parking space shall be permitted to share a common access aisle.
        - *Note: Clarity required on whether a shared access aisle between an accessible parking space and an EV charger make the EV charger accessible. (Similar to City of San Diego's recommendation) (See Comment 3)*
- EVG-812.6 Identification
    - EV Charging stations shall not be identified as or provided with signage required for accessible parking spaces
    - EVG-812.6.1 Language:
        - "Designed for Disabled Access – Use Last" or if only one station, "Designed for Disabled Access"

EVG-813 On-Street Electric Vehicle Charging Stations

- Covers parallel and perpendicular/angled spaces, access aisles, narrow sidewalks, curb ramps, marking

EVG-814 Electric Vehicle Charging Station Equipment

- Covers location of equipment, operable parts, displays, and clear floor space

Helpful definitions from California Building Code 2013

ACCESSIBLE ROUTE. [DSA-AC] A continuous unobstructed path connecting accessible elements and spaces of an accessible site, building or facility that can be negotiated by a person with a disability using a wheelchair and that is also safe for and usable by persons with other disabilities. Interior accessible routes may include corridors, hallways, floors, ramps, elevators and lifts. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

PATH OF TRAVEL. [DSA-AC] See Chapter 11B, Section 1102B. An identifiable accessible route within an existing site, building or facility by means of which a particular area may be approached, entered and exited, and which connects a particular area with an exterior approach (including sidewalks, streets, and parking areas), an entrance to the facility, and other parts of the facility. When alterations, structural repairs or additions are made to existing buildings or facilities, the term "path of travel" also includes the toilet and bathing facilities, telephones, drinking fountains and signs serving the area of work.

	DSA 97-03	City of San Diego 11B-1	OPR/DSA 2013
New Construction: where accessible EVSE is required	Close proximity to major facility, public right way or major path of travel on site, 200 feet max	Close proximity to major facility, public right way or major path of travel on site, 200 feet max. Accessible EVSE not provided in conjunction with accessible parking spaces need not be provided immediately adjacent to major facilities.	Close proximity to major facility, public right way or major path of travel on site, 200 feet max.
Existing Sites: where accessible EVSE is required and path of travel upgrades	Need not be located in close proximity to other services Accessible path of travel to major facility is required to the extent possible Path of travel improvements not triggered, unless parking is primary use of site	Need not be located in close proximity to other services Accessible path of travel required	Need not be located in close proximity to other services Accessible path of travel to major facility is required to the extent possible Three categories: 1. Public Right of Way – no path of travel upgrades required 2. Sites where parking is not primary function – alterations not affecting a primary function would not require path of travel upgrades. 3. Parking/vehicle storage sites – alterations would affect primary function (parking), path of travel upgrades required
Accessible EVSE in existing Accessible parking spaces		Not more than one accessible EVSE shall be located in an existing accessible parking space unless more than one accessible EVSE is required	

Van Accessibility	One in every eight accessible EVSE, 8 foot access aisle		When plug-in vans are feasible, provisions for van accessible EVSE can be included
On-Street EVSE			EVG-250.5.2 For public agencies, the required total number of on-site and on-street accessible EVSE may be provided on a programmatic basis.

DSA = Division of the State Architect, OPR = Governor's Office of Planning and Research

COMMENT AREAS ON OPR'S PLUG-IN ELECTRIC VEHICLES: UNIVERSAL CHARGING ACCESS GUIDELINES AND BEST PRACTICES

EVG-250.5.2 On-Street Locations Within a Public Right-of-Way

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 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.

Comment 1:

This section acknowledges the difficulty in providing accessible on-street EV charging stations and allows public entities the flexibility to provide accessible EV charging on a programmatic basis by providing additional on-site accessible EV charging stations to meet the combined requirements for the number of both on-street and on-site locations within the public entity's jurisdiction.

Questions/Concerns:

- What is a "programmatic basis?" An entire city, a neighborhood, or just a few blocks within the project's vicinity?
- Can public entities interpret as they see fit?

EVG-250.5 Locations

ADVISORY: For installations at existing sites and locations, the accessible EV charging stations may not be located in close proximity to other services due to technical factors such as the availability of electric power or terrain, but they should be on an accessible route to the maximum extent feasible

EVG-250.6 Electric Vehicle Charging Stations at Existing Facilities

Alterations solely for the purpose of installing electric vehicle charging stations shall be limited to the actual scope of work on the project and shall not be required to comply with section 11B-202.4 of the current edition of the California Building Code.

***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 2013 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 cost of the work directly associated with the installation of the electric vehicle charging equipment.*

Comment 2:

- If accessible route or path of travel updates are required, what constitutes the "maximum extent feasible," and what costs are included in the cost of compliance limitations associated with 11B-202.4?
- Should these costs include only construction costs or all costs associated with the project?

EVG-812.3 Access Aisle

Access aisles serving vehicle spaces at on-site electric vehicle charging stations shall comply with EVG-812.3. Access aisles shall adjoin an accessible route. Two electric vehicles charging stations or one electric vehicle charging station and one accessible parking space shall be permitted to share a common access aisle.

Comment 3:

- Does a shared access aisle between an accessible parking space and an EV charging station make the EV charger accessible? Since a disabled person could utilize the EV charger while parked in the accessible parking space, does this create an accessible EV charger? City of San Diego Technical Policy 11B-1 allows for this.

ZEV Permitting - OVERVIEW

Snapshot: When individuals or businesses purchase ZEVs and seek to install approved charging or fueling equipment to support their cars, they rely on their local government to serve them. If the ZEV permitting process is smoothly integrated into current permitting programs, this will ensure a positive experience for all. A streamlined permitting process is efficient, rapid, and consistent while ensuring safe installations and the lowest possible cost for owners. Furthermore, improved permitting processes reduce complexity for all participants. City officials have well-defined and repeatable actions, these procedures and requirements are obvious understood by contractors, and the installers can in turn clearly communicate expectations to ZEV owners.

Background: Permits are required for EVSE and hydrogen fueling installations primarily in order to ensure that these installations are planned and executed *safely*. The more complicated the installation, the more detailed the permitting process typically is. However, a permit process that is longer and more arduous than necessary adds cost, time, and uncertainty to an EVSE installation, and can deter infrastructure development.

Depending on the complexity and type of installation, considerations during permit review may include fire safety and physical wiring concerns, aggregated electrical load capacity for PEVs and hydrogen safety for FCEVs, lighting, aesthetics and compliance with other zoning requirements, changes to existing use permits, effects of installations on parking requirements, and ADA and accessibility requirements. Permitting officials may be unfamiliar with ZEV equipment and infrastructure, contributing to unnecessary reviews and delays, so ensuring local officials are well trained is an important contributor to improving the permitting process.

The method by which ZEV permits are accepted and reviewed directly impacts cost, schedule, and customer experience. Current permitting practices for PEV installations include:

- **No Permit Necessary**: For PEV permitting, a few jurisdictions have characterized a branch circuit installation for a single electric vehicle charging station as a minor improvement, and either do not require a permit for the installation or allow for post-installation permitting.
- **Permit Required, Online System**: Some jurisdictions have invested in online permitting and inspection portals. The jurisdiction defines what is

Case Study:
The New Jersey Department of Community Affairs Division of Codes and Standards has an innovative permitting program that some California jurisdictions may be interested in adopting. Specifically, the NJDCA has designated installation of residential charging equipment as "minor work" and thereby allows the homeowner or electric contractor to provide verbal notification to the local code enforcement agency prior to starting the installation, rather than obtaining permit prior to commencing work, with the requirement that the permit application be subsequently filed within five days of the notification. Click here for more information.

acceptable to be permitted through the online system. As a result, the upfront paperwork and time to complete the necessary permit application is reduced.

- **Permit Required, Over-the-Counter (OTC) with Scope-of-Work Only**: This process is similar to the online system except that the contractor deals directly with a city official noting the type of job being completed. There is no detailed overview of the installation and the permit is obtained immediately.
- **Permit Required, OTC with Plan Check**: Plan check is defined as a technical review of the installation and will typically require additional documentation from the electrician. While adding time and cost to the upfront permit application process, plan checks are intended to speed up the actual onsite inspection time since an inspector has documents that can be compared to the actual installation
- **Permit Required, Plan Check**: The same technical review occurs, but not immediately. Instead, an official or third-party contractor reviews the documents according to the jurisdiction's process timeline; it is not uncommon for the timeframe to be a few days to a few weeks.

Many local governments have already taken action to improve the ZEV permitting process. According to a mid-2012 survey of Bay Area local governments to assess PEV readiness, more than half of local governments in the Region currently issue same-day permits for EVSE in single family residences, and 80% charge applicants under $250 for these permits. The survey also indicated that 22% of jurisdictions have either adopted or are in the process of adopting additional practices to support expedited and low-cost permits for installations at all property types.

The past efforts and experiences of these jurisdictions represent opportunities for agencies that have not yet taken initial steps to improve their permitting processes. For example, San Francisco offers same-day on-line or over-the-counter permits for single family EV chargers, because the city treats these chargers just like a standard electrical permit. By integrating ZEV permitting into standardized permitting practices and drawing on others' experiences, local governments can avoid having to reinvent the wheel in order to achieve ZEV readiness.

The permit and inspection process also presents a key opportunity for consumer outreach and education, as it is often the last chance to influence a new ZEV owner or site manager before they invest in equipment installation. Providing materials to educate permit applicants about information such as ZEV incentives can be a part of the permitting process. For more information, please see the "Public and Business Engagement" section of this guidebook.

It is important to note that the ZEV permitting process does not occur independently from other key actions of overall ZEV readiness. The permit review process is inherently related to the zoning and code requirements it enforces, as well as to the types of land uses and infrastructure that are prevalent in a jurisdiction. When contemplating efforts to improve the permitting process, considering this process in the context of a jurisdiction's broader ZEV readiness goals can help to maximize the benefits of efficient permitting.

The sections in this chapter of the Guidebook discuss permitting recommendations for ZEVs, and are divided into categories according to the various charging and fueling options that exist:

- Single-Family Residential Charging
- Multi-Unit Dwellings Charging
- Workplace Charging
- Retail and Public Sector Charging
- Fast Charging
- Hydrogen Fueling

Single-Family Residential Charging

Introduction: Single-family homeowners have represented the largest source of demand for PEVs to date. This is partially because charging in single-family homes presents the fewest physical and institutional barriers relative to other charging environments. Attached garages often have household outlets that can be used for overnight charging instead of buying special equipment. The cars may be parked a relatively short distance to an electrical panel, eliminating the need for trenching or lengthy conduit. Many cities have taken measures to require PEV-ready wiring in new residential construction and to improve the permitting and inspection process. Reducing the upfront costs of charging in single-family homes is the "low-hanging fruit" of PEV planning. It is also the most effective way to increase the overall value of driving electric miles, regardless of the battery capacity of the PEVs being driven.

Background: The permitting process for single-family residential charging is one of the most straightforward areas for PEV permitting. The installation for single-family charging equipment can typically be as simple as adding a 120V or 240V branch circuit, the same permitting process for installing a standard electrical appliance, such as a washing machine.

Any electrical work, including the addition of a 120V or 240V outlet, typically requires an electrical permit from the local building department and a subsequent inspection to verify that work has been completed in compliance with the approved permit. Obtaining a permit generally requires the completion of an application describing the work to be completed and payment of a permit fee. Some jurisdictions allow permits to be requested online, while others require a personal visit to City Hall.

Case Studies:

- The City of Los Angeles has committed to a 7-day approval process for installation of EVSE, providing the customer's electrical system can support the charging requirement.
- The County of Los Angeles' Public Works Department has drafted a simple checklist for permitting and inspection to provide consistency throughout the greater Los Angeles area.
- The Tri-Chapter Uniform Code Council representing building departments in the greater Bay Area has adopted uniform guidelines for both residential and commercial EVSE permits that provide guidance for the 55 jurisdictions in the South Bay region
- The City of Riverside has prepared a guide to EVSE permitting for local residents. The document is available on the city's website.

Variables in the permitting process can significantly affect residential EVSE installation cost, timing, and complexity. These variables can include local requirements specific to EVSE installations, the electrician's familiarity with these local requirements, the type of EVSE installation, and an individual permitting official's experience with EVSE installations. While electricians typically make it a habit to call city officials ahead of time in order to understand these requirements, confusion often remains because some permitting officials may have limited (or no) experience with EVSE installations.

Some common issues that may arise during the permitting process for single-family residences may include:

- **Required Permitting Documentation**: To obtain a permit, documentation requirements have ranged from none, such as in online systems, to a full set including a site plan, line drawings, load calculations, and installation guide. In most cases, a simple, hand-drawn diagram has been sufficient. Other cases, however, have required professional drawings.
- **Plan Check:** While processes for permitting the installation of a basic 120V/240V circuit are established and generally do not require a formal review, some jurisdictions have added a plan check requirement for a 240V circuit when associated with L2 EVSE. This step, which typically requires a formal review by an official, can take a few hours to a few weeks. If the installation is delayed, an electrician may need to complete additional office visits to provide documentation and answer questions, increasing the cost of the installation. One reason given for a plan check is to ensure a successful inspection during the first visit by the inspector. In this case, the inspection official needs only to review the installation against the submitted plans which theoretically makes the inspection simpler, straightforward, and timely. Online permitting systems largely eliminate plan check requirements.
- **Dedicated TOU Meters for PEV Charging:** Installing a separate TOU meter dedicated to EV charging in order to obtain EV-specific electricity rates adds a layer of complexity to the EVSE installation. It requires the electric utility to be involved in the installation process, adding time and cost to the overall effort. Early in the PEV experience, some permitting officials expressed concern that a meter dedicated for EV charging in a garage might enable un-permitted garage apartments. This concern should have dissipated now that all of California's largest utilities –LADWP, PG&E, SCE, SDG&E, and SMUD – currently offer and endorse dedicated EV TOU programs.

Recommended Actions:

- **Implement Online Permitting for Residential Charging:** Cities and counties are encouraged to enable homeowners and licensed contractors to submit PEV charger permit applications online for installations at a pre-determined complexity level to reduce the number of time-consuming visits to government offices.
    - At minimum, EVSE permit applications should require:
        - EVSE manufacturer's name and the level of EVSE
        - Existing electrical service and a load calculation of demand
        - Will EVSE require upgrades to the building's electrical system?
        - Will EVSE include installation of a 2nd meter?
        - A certification from a nationally approved testing laboratory for the EVSE
- **Provide Outreach and Resources**: Local governments are encouraged to provide information on their web sites as resources for defining residential EVSE requirements. Outreach material may also include PEV benefits and types, available EVSE options and other PEV resources to prepare homeowners and licensed contractors. For more information, see the "Public and Business Engagement" section of this guidebook.

- **Ensure Permitting Officials are Trained in EVSE Requirements:** A number of organizations exist that can provide training on EVSE to local governments. See the "Incentives and Outreach" section for more information.
- **Encourage Use of an Existing Unused Electrical Circuit Where Feasible in Residential Use**: Some customers may have an unused dryer circuit in the garage that can be used for EVSE. Others may be willing to switch to a gas dryer to free up the dryer circuit for installation of EVSE and avoid a panel upgrade.
- **Integrate Residential Charging Permit into Standard Electrical Permitting**: For level 1 and 2 EVSE, there is little difference between an EVSE installation and a standard appliance installation. Local governments should work to include permits for single-family residential charging in their standard electrical permitting process.
- **Establish Reasonable Permitting Fees:** There are two primary cost components of permitting a residential EVSE installation: 1) the permit fee, itself, and 2) the electrician's indirect costs to complete the paperwork, including time and material necessary. For a jurisdiction issuing a permit, the cost of the permit should cover the time necessary to issue the permit (including necessary plan checks), as well as the time to inspect the installation. However, the manner in which a permit fee is calculated varies; a flat fee can be based on a published fee schedule, the total project cost, or the scale of the project. The permit cost should be kept at a reasonable price.

Range of Current Permitting Fees	
Jurisdiction	**Permit Fee**
Mountain View	$56.51
Yorba Linda	$62.25
City of Los Angeles	$97.20
Irvine	$98.00
Alameda County	$161.40
San Francisco	$164.20
Menlo Park	$207.00
Palo Alto	$250.00
Riverside County	$260.71
Anaheim	$261.00
Malibu	$624.00

- **Provide Sub-Metering Options for Interested Residents**: Direct residents who are interested in sub-metering to contact the local utility. More information on this process can be found in the "Working with Utilities" Section of the Guidebook.
- **Ensure an Efficient Inspection Process:** There are several different strategies available to local governments ensure an efficient inspection process. Options may include giving a specific window of time for a visit, doing spot checks, establishing trusted relationships with specific installers, or online inspection using digital photographs. Measures taken should be consistent with safety requirements.

Case Study: The City of Riverside allows water heater replacements to have a "virtual" inspection in which the contractor emails photos to the city inspector. Cities may wish to consider photo inspection for simple EV installations.

Featured Resource: The National Renewable Energy Laboratory, in conjunction with the U.S. Car GITT Permit Working Group, has developed a universal permit application recommended for adoption by local jurisdictions.

Charging and Permitting in Multi-Unit Dwellings

Introduction: Multi-unit dwellings (MUDs), which include apartment and condominium buildings, make up a significant percentage of the housing stock in many California jurisdictions. As such, they represent a large potential source of PEV adoption in the future since most charging occurs at home. Identifying clusters of MUDs and understanding their proportion of the land use mix within a local jurisdiction will help planners target PEV readiness priorities to this housing type.

Background: Some multi-unit EVSE installations are straightforward, but many are complicated by physical space or electric distribution limitations, or by ownership and management issues. The physical challenges faced by MUD residents, owners and management groups include:

- **Limited parking**: In most multi-family complexes, especially older ones, parking spaces are at a premium and there may not be room to install charging stations.
- **Long distance between utility meters, parking spaces and unit electrical panels**: A new 208/240V PEV charging circuit requires connection between the charger location and the tenant's or owner's electrical panel. In MUDs, the electrical panel may be in the residential unit and located hundreds or even thousands of feet from the parking area.
- **Inability to take advantage of off-peak charging rates**: A new meter and utility service may be required to take advantage of off-peak PEV charging rates. Since most multi-family units have meters that are clustered together in a central location, there may not be space to add another meter.
- **Limited electrical capacity**: Older buildings typically have limited electrical capacity. Level 2 chargers typically require a minimum of a 40 amp circuit. Older apartments or condominium units may have only a 60 amp service or less. Upgrading electrical capacity may be very costly and may also trigger requirements to bring the property up to today's building codes.
- **Variable costs associated with installation**: Costs for MUD installations are largely determined by existing electrical capacity and distance from the electrical panel to the parking space. Cost mitigation strategies can include placement of charging equipment in guest parking spaces or other common areas. While these high costs can be significantly reduced if EVSE capacity is included in the construction phase, other approaches must be considered for existing buildings.

The National Electrical Code requires electrical capacity for charging equipment to reflect the full load charging capability of the equipment, plus an additional 25% capacity buffer, in order to prevent circuit overload. If multiple charging stations are installed, planners and utilities have historically had to assume that all might be in use simultaneously when determining electrical needs. However, the need to upgrade electrical panels in existing buildings may be reduced by the use of energy management software, which can monitor and regulate the additional load brought by PEV charging. A tentative interim amendment to the National Electrical Code has been issued, and adopted by California, that allows the maximum electric vehicle supply

equipment load on a service panel or feeder to reflect the maximum load permitted by an automatic load management system. To view this amendment, please visit the NFPA website.

Other difficult issues surrounding installing EVSE in multi-unit dwellings relate to the governance structure of these properties. Rental units are controlled by property managers or property owners. Condominiums and townhomes have Homeowners' Associations (HOAs) with elected Boards of Directors and contracts that govern the use of both private and common area space. Installing charging units at the deeded or assigned parking spaces may be physically impossible or impractical, requiring alternative options such as use of visitor parking, common space or other options. Any of these options will require approval by property managers and homeowners' associations.

The rights and responsibilities of HOAs and PEV owners for EV charging in common-interest developments (condominiums, co-ops and other ownership MUDs) are outlined under California law by Senate Bill 880, which was signed February 29, 2012. The law provides a basic framework for resolving challenges to PEV charging posed by HOAs.

The basic purpose of this law is to ensure that PEV drivers are not unreasonably prohibited from installing a charging station, either in their deeded or designated parking spaces or in common areas. HOAs must allow charging in common areas only if installation in the PEV owner's deeded or designated space is impossible or unreasonably expensive. If a driver has exclusive use of a charging station in a common area, HOAs must then enter a license agreement with the PEV driver, who must meet the following conditions:

- The charging station meets all applicable health and safety standards as well as all other applicable zoning, land use or other ordinances, or land use permits
- Complies with the association's architectural standards for the installation of the charging station
- A licensed contractor is engaged to install the charging station.
- Within 14 days of approval, provide a certificate of insurance that names the association as an additional insured party under the owner's homeowner liability coverage policy in the amount of $1,000,000 (except when existing wall outlets are used).
- Pays for the electricity usage associated with the charging station.

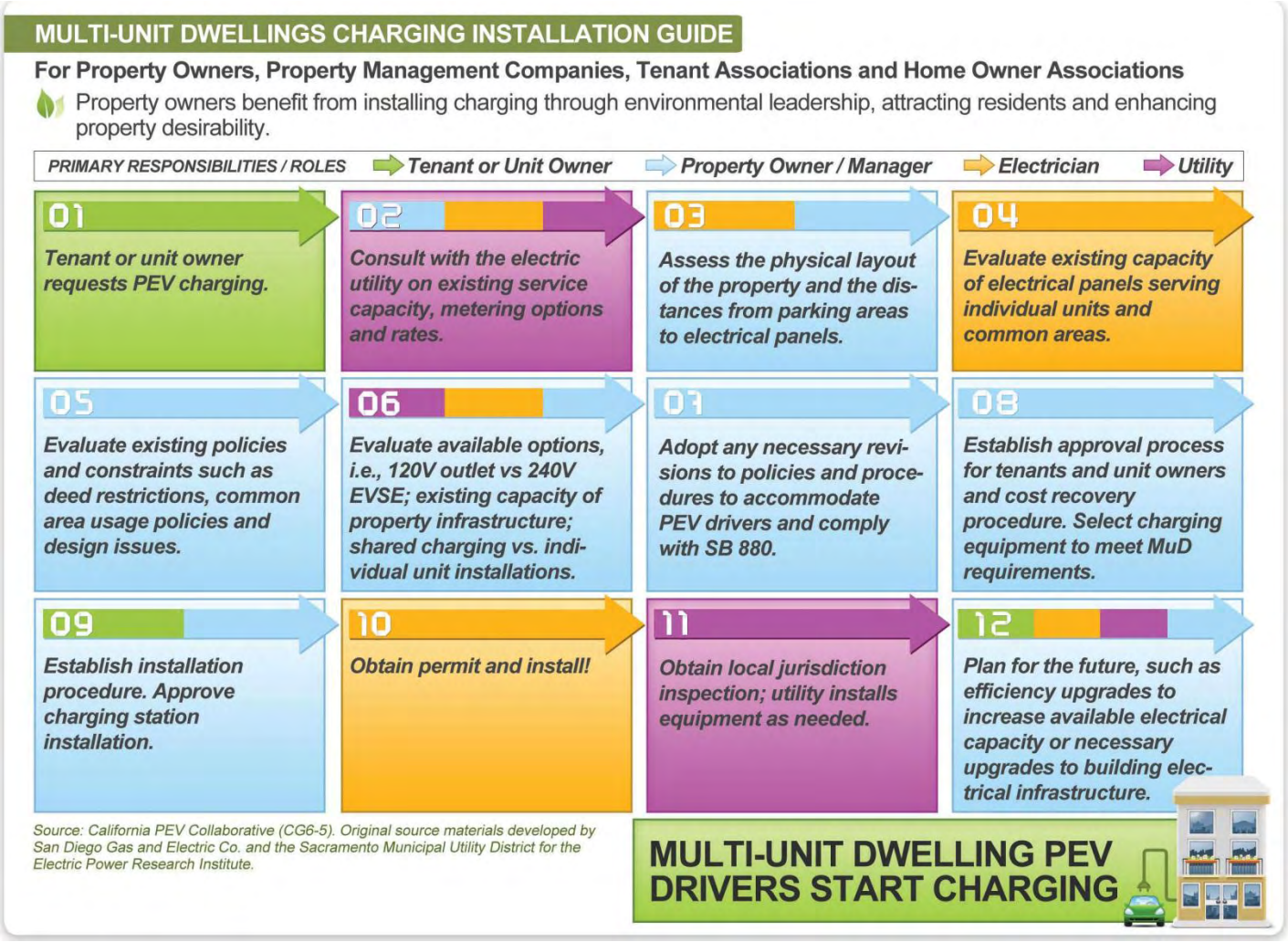
The HOA can also compel current and future owners of the charging station to pay for maintenance, repair or removal of the charging station and for any resulting damage to the station, common area, or exclusive use common area. Importantly, the law allows, without a full HOA member vote, a portion of the common area to be used for utility lines or meters to support charging in a deeded or designated parking space. The provisions of this bill can be found in sections 1353.9 and 1363.07 of the Civil Code.

While many challenges exist to installing MUD charging, it is clear is that local governments can play a key role in solving these challenges. In some cases, the solutions may involve adjusting local regulations such as new construction codes to require pre-wiring of EVSE. However, in

many situations, the most effective role of local government may be outreach to residents and property managers alike, about MUD permitting challenges and solutions.

Recommended Actions:

- **For MUD Landlords or Owners:**
    - **Determine Parking Configuration for PEVs in MUD on case-by-case basis.** Multi-unit Dwellings come in a variety of configurations. Parking arrangements for these residential buildings are equally diverse, ranging from deeded to assigned parking to no parking at all. If Level 2 charging at a tenant's assigned parking space is not feasible, other possible PEV charging options include:
        - Equipment
            - Set up Level 1 charging (120 volt).
            - Install charging equipment that can serve more than one PEV.
            - Use charging stations with advanced technology to address issues such as electricity metering, billing and payment for electricity, and access by multiple users.
            - If electrical capacity is an issue, consider using an energy management system to control or limit simultaneous charging.
        - Location
            - Reassign parking places so PEV drivers can park where it's cheapest to install charging.
            - Install EVSE in guest parking spaces.
            - Examine nearby municipal lots, business buildings or shopping malls for available overnight charging, and consider partnerships or agreements.
            - Suggest parking at on-street charging locations close by.
            - Provide or refer to alternative charging options such as workplace, public charging, DC fast charging or car sharing services.
        - Cost
            - Bundle the cost of electricity with the cost of parking.
            - Adopt energy efficiency measures to free up electrical capacity in the building.



- **For Local Governments:**
  - **Develop and deploy an EVSE permit checklist:** Develop and utilize an EVSE Permit Checklist that references all required elements for approval of a permit. This allows a permitting agency to determine if certain criteria are being met, such as proof of electrical capacity. It also highlights that MUD charging installation will vary depending on the specific case. For your assistance, a checklist template has been provided in the Template Section of the Guidebook.
  - **Fast-track approval of MUD EVSE projects:** Local authorities may give priority to MUD permit applications since these EVSE installations are necessary for home charging. In addition, MUD inspection approvals may be fast-tracked.
  - **Develop written procedures to ensure early contacts with local utilities for MUDs**. Working cooperatively, local agencies and utilities are encouraged to develop procedures acceptable design and metering options.
  - **Publish submittal and plan check requirements for EVSE projects**: Local agencies are encouraged to make informational materials available (for over-the-

counter and online distribution) containing the requirements for EVSE permitting and installation.

Featured Resource: The California Plug-In Electric Vehicle Collaborative is currently working on a Multi-Unit Dwelling Guidelines publication, expected to be available for use in summer 2013. The Guidelines will also include information about MUD permitting and case studies. Once completed, this resource will be posted to the DriveClean website.

Workplace Charging

Introduction: Workplaces present a significant, and largely untapped, opportunity for PEV charging. After residences, they are the single most important environment for electric refueling. Vehicles are generally parked at workplaces for several hours every weekday, making it possible for them to completely recharge before the commute home and dramatically increasing electric miles traveled for PHEVs. The ability to charge at work may also encourage PEV adoption by those for whom residential charging is cost-prohibitive or logistically difficult, particularly residents of multi-unit dwellings.

Background: Implementing EV workplace charging is easiest where a business/organization is in complete control of their entire campus. With singular control of the key pieces of real estate parking area, building, and electrical service it is a straightforward process to establish an EV charging opportunity for employees. The situation can easily become much more complicated, especially in dense urban situations. For employers or employees at companies with a more complex building ownership/parking arrangement at their site, a modified approach will be needed.

The vehicles' lengthy stays in parking lots allow them to recharge using slower, lower-voltage, less expensive Level 1 charging from common, often available outlets. But the ability to charge several cars at once using multiple cords on Level 2 equipment would also make faster charging a potentially feasible option.

Case Study: At Google's Mountain View, CA, headquarters you'll find perhaps the world's largest workplace charging program. Google's parking lot features Level 2 charging stations managed by the ChargePoint Network as well as Level 1 charging spots. The charging stations are used by employees and by the company's growing car sharing program for their employees called GFleet. Google has a goal to make 5 percent of its campus parking EV-ready. Google does not charge its employees or guests to use these charging stations. Learn more.

The permitting process for workplace charging is one of many variables that employers may have to consider when installing workplace charging. Some of the other considerations include:

- Cost (installation, maintenance, operation, etc.)
- Developing an internal policy regarding charging vehicles (i.e., determining protocol for plug-sharing among employees)
- Liability issues
- Choosing the appropriate EVSE, vendor, and electrical contractor
- Buy-in from senior management
- Compliance with the Americans with Disabilities Act
- Obtaining approval from property or parking garage owners
- Getting employees interested in using the system
- Understanding IRS rules regarding employee benefits as it relates to workplace charging
- Evaluating future infrastructure needs during the initial installation
- Pricing of electricity provided at the worksite to employees

- Understanding the federal grant process for the purchase and installation of EV charging stations – how to apply, what terminology to use?
- Apportioning charging spaces between employees and the public, and understanding the conditions when public access is required.

Recommended Actions: Successful efforts to establish a workplace charging opportunity for PEV owners depend on the employee, employer, and/or building owner being fully informed about the challenges and benefits. Local governments can play a key role in helping share information about workplace charging with interested employers and helping guide them through the permitting process.

- **Share Information with Interested Employers about Installation Guidelines**. The following information can be shared with employers in your community:
    - Determine recharging site(s) at your business
        - Closer to existing electric utility equipment is cheaper, adding new circuits and conduit can increase capital costs significantly
            - 40A branch circuit: $10-$11/linear ft
            - 200A feeder circuit: $17 – $28/linear ft
            - Concrete patch: $14 - $15/square ft
            - Asphalt patch: $10-$11/square ft
        - Review traffic, pedestrian flow, parking requirements, and applicable ADA compliance issues
        - Determine additional retrofit needs, including landscaping
        - It is strongly advised to install extra conduit to allow for future expansion during your initial installation – this will save future trenching costs
    - Estimate the electrical load at site(s)
        - Determine whether to use Level 1 or 2 charging
        - Obtain charger requirements from vehicle and charger suppliers
        - Determine the appropriate number of EVSE units
            - Consider purchasing a Load Management System that automatically sequences multiple EVSE or chargers without human intervention (It is estimated that costs for a complete

More Info: If you are a business that wants to offer your customers or your employees the benefit of charging, please check out the Plug-In Vehicle Collaborative resources for businesses.

system could range from $5,000 to $13,000 depending on the number and charge.)
- Estimates should include the number of employee vehicles to be added over the next three to five years, with special attention to the availability of federal and state incentives and changing technologies.

- Contact EVSE suppliers
  - Confirm charging needs, types, and costs
    - Level 2 EVSE is most common – average install cost $2,000 to $3,000 without trenching or service upgrades
  - Identify any other special considerations for the specific equipment

- Contact Utility
  - Assess existing electricity supply - is it adequate?
  - If no, determine necessary electrical service upgrades
    - Consider installing extra circuits and additional electrical capacity during initial upgrade to minimize future costs
    - Sub-panel upgrade (200A, 120/240 VAC single phase): ~$1,900.00
  - Review metering requirements and elective options
    - Time-of-Use meter, demand response meter (can add costs)
    - Determine the impacts of rates on choosing charging times and frequencies
- Contact pertinent permitting agencies and obtain all pertinent building and use permits.
  - Identify special local fire, construction, environmental, or building requirements
  - Obtain all applications
  - Determine additional permitting costs
  - Determine site plan requirements
  - Hire the prime contractor and verify contractor subcontractor credentials.

- Local governments should help employers to easily identify any special local fire, construction, environmental, or building requirements that may be needed.
- Local governments should provide an easy-to-fill out application for workplace permitting.

Featured Resource: The California Plug-In Electric Vehicle Collaborative is currently working on a Workplace Charging Guidelines publication which will be available for use in summer 2013. The Guidelines will also include workplace charging decision-making guides. Once completed, this resource will be posted to the DriveClean website.

Retail and Public Sector Charging

Introduction: Most PEV charging occurs at home, followed by charging at the workplace. However, the proliferation of plug-in hybrid electric vehicles (PHEVs) has increased the demand for more sporadic charging outside of home or work. To maximize their electric miles driven, many PHEV drivers find it valuable to charge when visiting retail and government-owned destinations. Public charging is available in several locations, including: public parking lots, retail chains such as Kohl's and Walgreens, tourist destinations, entertainment venues, and airports.

Background: The cost to install EV charging infrastructure for retail or public sector charging varies widely, depending on a multitude of factors. These factors include: charging level, type of charger, facility characteristics, desired location of charging stalls at the property, and installation cost. Charger hardware cost will largely be dictated by choices of features and preference for design or brand, similar to the range of pricing for automobiles and other consumer technology.

A much wider range of cost will be attributable to the cost of installing the hardware. Charging stations that can be installed near to an electrical panel with existing space and capacity will cost the least. Those that require long conduit runs, trenching, and panel upgrades will cost much more.

All commercial electric vehicle charging station installations will require a permit. In general, only a building or electrical permit will be required. However, if extensive landscape, parking lot, electrical or structural alterations are involved, the services of an engineer and/or architect, as well as electrical design consultant, may be necessary. In these cases, additional permits may be required covering the appropriate project elements.

Recommended Actions:

- **Permitting agencies should be available to answer questions about retail and public sector charging early in the planning process** to help ensure the timely installation of chargers.
- **Permitting agencies should create a similar or duplicate permitting applicant for workplace and retail charging installations** since both types of charging impacts have overlapping similarities.
- **Local Governments can provide information about payment and financing options for retail charging.** Some of these options include:
    - **Free, or Free with Restrictions:** This system may be beneficial for short-term stays, such as two hours or less. Appropriate signage posted at the charger indicates hours and days of operation. Many site hosts choose to provide free charging, viewing it as an amenity to their patrons, as well as a lower-cost alternative to expensive networked installations. Research shows that EV drivers quickly learn the whereabouts of free stations and seek them out. They also frequently reward site hosts by shopping at their businesses and suggested that fellow drivers do the same.

- **Advertising Supported:** A charging station owner or operator may provide charging for free, or for a nominal fee, offsetting the cost of the station installation and its operation through advertising revenue. Advertising may be displayed at the charging station electronically or through display graphics conforming to sign codes or site host standards and policies.
- **Adopt a Charger:** Businesses or philanthropic organizations may choose to fund some or all of the expenses associated with the installation and operation of a charger. EV drivers would then enjoy free or subsidized charging. Chargers are being installed in national and local parks under this scheme by the non-profit Adopt a Charger organization.
- **Point of Sale Billing**: Stations support credit card payment, radio frequency identification (RFID) card access, or both. Some stations additionally provide a toll-free number that users can call to arrange payment and initiate charging. In the case of networked charging stations, charger availability and (possibly) reservation status may be determined remotely using mobile devices or the internet. Site hosts receive monetary proceeds directly or indirectly through a service provider.
- **Membership or Subscription Plan**: The EV owner participates in a monthly or annual plan with the charger manufacturer or a third-party service provider. Station owners can log into the networked system, configure access preferences and rates, post advertisements (if supported) and track usage history and electrical consumption. Plans vary widely among providers, as payment schemes and business models are still evolving.
- **Fee Bundling**: EV drivers are provided unique access codes to use the charger. Codes are entered via a keypad or card reader. The fee for charging is added to the customer's account with the site owner or operator.
- **Valet Charging**: This system may work well for businesses like restaurants or hotels where valet parking services already exist. Valet staff, park, charge, and return EVs as requested by the owner. If a fee is collected, it may be added to the parking fee, room fee, and other transactions on the customer's account. The valet EV charging model is in operation at a number of hotels in Hawaii and on the mainland.
- **EV Car Sharing**: A car sharing company pays the property owner for the right to park and charge EVs in the business owner's or manager's parking lot. The car sharing company handles all financial transactions and reimburses the property owner or operator based upon an agreed set of terms.

Featured Resource: TBD.

Fast Charging

Introduction: DC fast charging entails a much higher cost for equipment and installation than Level 1 or Level 2 charging (currently $20,000-$50,000). The electrical supply to the site must be commercial-grade, typically 208 or 480-volt 3-phase AC. Some commercial enterprises are viewing DC fast charging as a business opportunity, similar to operating a gas station. Unlike gas station customers, however, EV drivers may visit DC Fast Chargers only infrequently, based on a need to travel a greater distance on a given day. Or they may have no other access to convenient overnight charging where they live, in which case they may rely heavily on DC fast charge stations. Fleets may need DC fast charging to meet their higher daily mileage requirements. Sites where DC fast charging might be appropriate include tourist or rest stops, major roadway intersections, convenience stores, or even gasoline stations.

Background: DC fast charging installations offer a number of benefits and opportunities, including:

- Rapid charging for EV drivers who need to travel longer distances and don't want to wait for the time it would take using Level 1 or 2 charging.
- The ability for someone to own or operate an EV when they do not have access to Level 1 or 2 charging at their home or workplace.

DC fast charging installations also raise a number of challenges for property owners and utilities, specifically:

- The higher power requirements of a DC fast charge installation may require costly additional electrical service upgrades to the site.
- The demand placed on the grid by transient high power loads created by DC Fast Chargers may require utility upgrades to existing local infrastructure supplying the site.
- Demand-based electricity rates can result in higher electricity costs to the site host.
- There may be local zoning restrictions on the siting of retail DC fast charging locations (similar to restrictions on the siting of gas stations).

Case Study: Governor Brown and the California Public Utilities Commission recently reached a $120 million dollar settlement with NRG Energy Inc. that will fund the construction of a statewide network of charging stations for ZEVs, including at least 200 public fast-charging stations and another 10,000 plug-in units at 1,000 locations across the state. The settlement stems from California's energy crisis. One hundred million dollars from the settlement will fund the fast-charging stations and the installation of the plug-in units and electrical upgrades, at no cost to taxpayers. The remaining twenty million dollars will be directed to ratepayer relief. The network of charging stations funded by the settlement will be installed in the San Francisco Bay Area, the San Joaquin Valley, the Los Angeles Basin and San Diego County. For more information on the settlement, please contact the CPUC.

Recommended Actions: TBD.

Featured Resource: TBD.

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.

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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 lever 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
Level 2	240 VAC Single Phase Up to 19.2 kW (up to 80 amps)	3.3 kW (on-board) 6.6 kW (on-board)	8-10 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.

Hey REVI - SHOULD WE ADD THE FOLLOWING?

- Include specs for the 9.6 Kw vehicles.
- "Electrical design standards" that program managers could simply include in RFPs and such.
- Other items?

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