

Multi-unit Dwellings (MuD) Challenges and Successes



Joel R. Pointon
Principal
JRP Charge Consulting

Multi-unit Dwelling Vehicle Charging Support



Co-chair Multi-unit/Workplace Working Group- California Plug-In Electric Vehicle Collaborative



- Public/private organization - accelerating the adoption of plug-in electric vehicles to meet California's economic, energy and environmental goals
- More than 40 PEV stakeholders - automakers, utilities, charging equipment/network providers, government, research & education

Charging at Multi-unit Dwellings

- Many cities have increasing populations living in Multi-units
- Tenants requests will only increase for charging access
- Multi-units have unique challenges that require creative spectrum of solutions



PEV Types

WHAT IS A PEV?

A PEV is a Plug-in Electric Vehicle that runs at least partially on battery power and is recharged from the electricity grid.



Pure Battery Electric Vehicles (BEVs) run on electricity stored in batteries and have an electric motor rather than a gasoline engine.



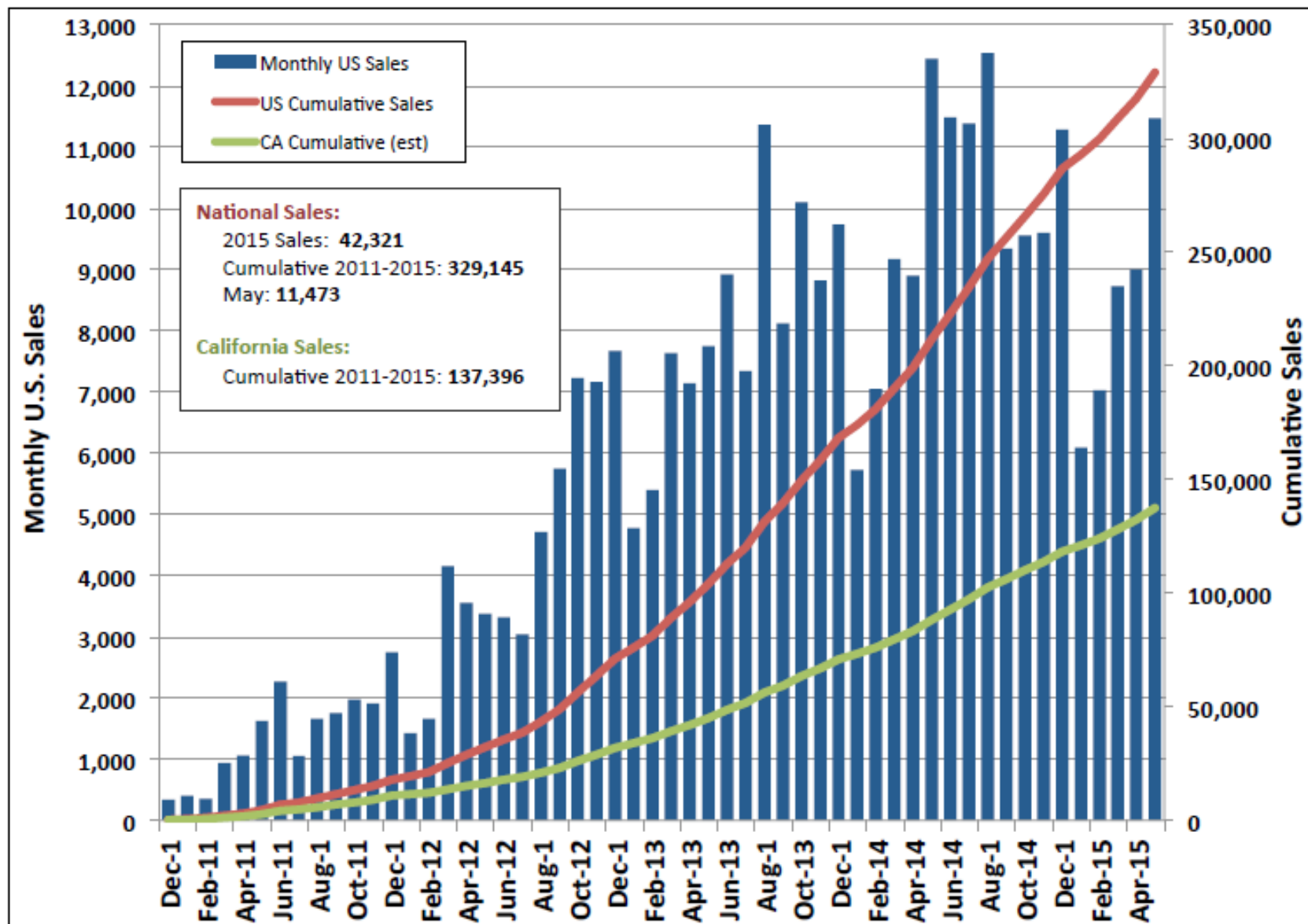
Plug-in Hybrid Electric Vehicles (PHEVs) combine two propulsion modes in one vehicle – an electric motor (that is battery-powered and can be plugged in and recharged) and a gasoline engine (that can be refueled with gasoline).

BEVs and PHEVs – What's the difference?

| | BEV | PHEV |
|------------|---|---|
| Emissions | Zero emissions from vehicle; only emissions are from utility electricity generation mix | Zero emissions when driving on electricity. Emissions when driving on gasoline depend on engine emissions certification |
| Range | Generally 70 to 100 miles (proportional to battery size) ; some models are higher | All electric range varies from 15 to 35 miles (proportional to battery size); gasoline range is about 300+ miles |
| Propulsion | Electric motor / battery only | Electric motor / battery <i>plus</i> gasoline engine |
| Re-fueling | Recharge with electricity | Recharge with electricity <i>and/or</i> refuel with gasoline |

Source: California PEV Collaborative (CG2-2).

BEV and PHEV Graphics courtesy of the Electric Power Research Institute, *Plugging In: A Consumer's Guide to the Electric Vehicle*, 2011.

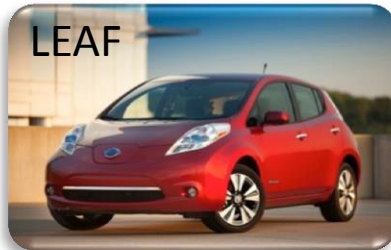


Note: Approximation assumes CA sales are 45% of national sales.

Reference: www.hybridcars.com

BEV Models Available.... More Coming

NISSAN



Focus Electric



TESLA



Spark



Rav 4



iMiEV



BEV Models Available.... More Coming

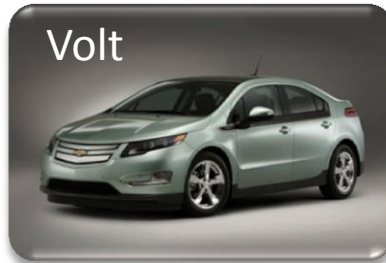
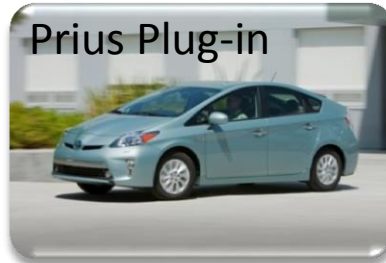
BMW Group



BMW Group



PHEV Models Available... More Coming



Why Install Charging at Your Multi-unit?

- Amenity that attracts tenants
- “Greener” image for marketing
- Property a leader in sustainable practices (LEED points)
- PEV sales are growing – more tenants will be asking for it



Residential Charging Equipment

- Uses a standard 110/120-volt alternating current (VAC) three-pronged wall plug.
- Uses 208/240 VAC and can be hardwired or connected with a plug*, but typically requires a contractor.



Images: www.pluginamerica.org & leviton.com

* 12 inch cord requirement for wall hung units

How Quickly Will it Charge?

Residential Charging

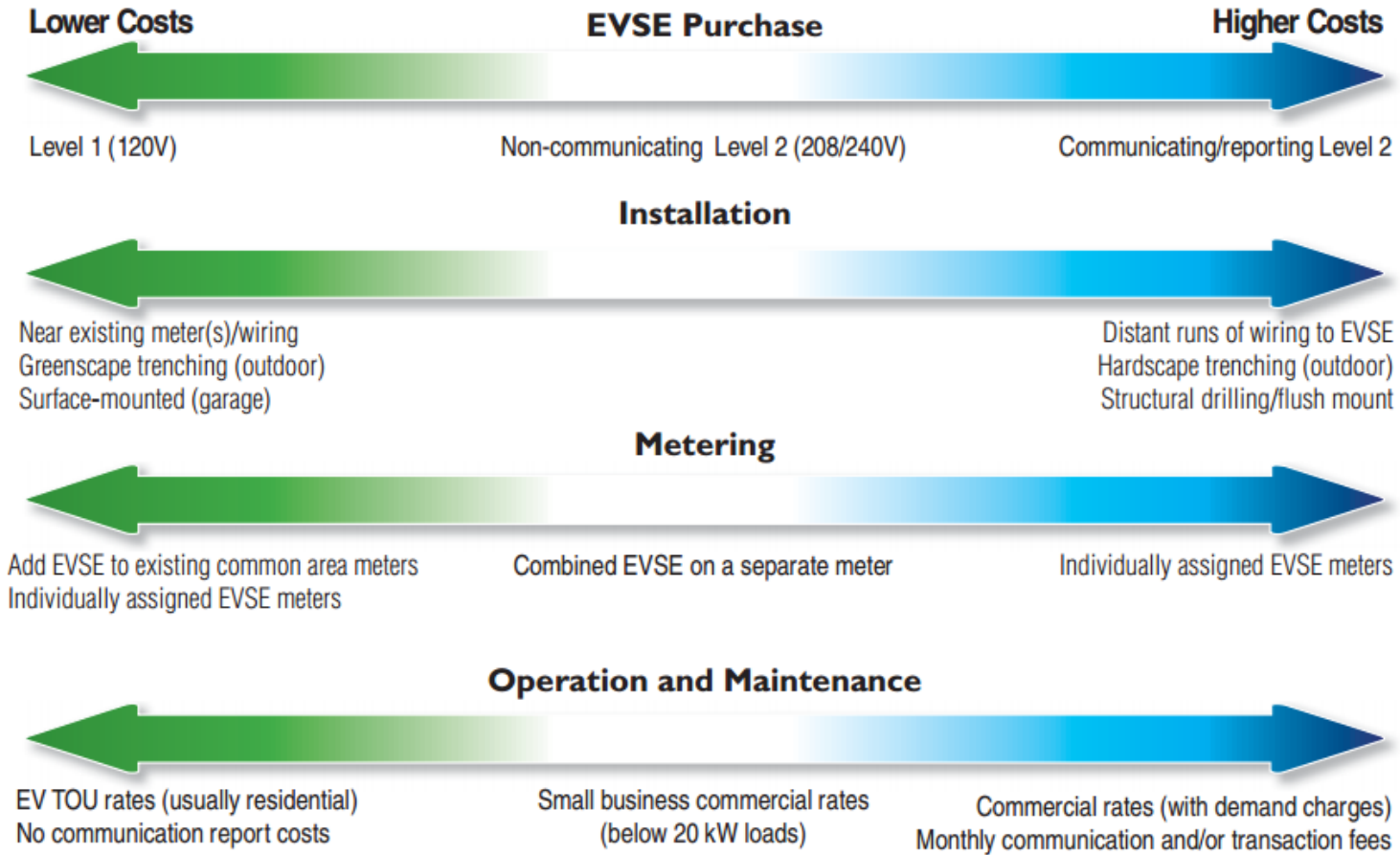
| Type of Charging | Power Levels (installed circuit rating) | Miles of Range per Hour of Charging* |
|-------------------|--|---|
| AC Level 1 | 110/120VAC at 15 or 20 Amps | ~4-6 miles/hr. |
| AC Level 2 | | |
| 3.3 kW (low) | 208/240VAC at 30 Amps | 8-12 miles/hr. |
| 6.6 kW (medium) | 208/240VAC at 40 Amps | 16-24 miles/hr. |
| 9.6 kW (high) | 208/240VAC at 50 Amps | 32-48 miles/hr. |
| 19.2 kW (highest) | 208/240VAC at 100 Amps | > 60 miles/hr. |

* Refer to vehicle specifications for exact ratings.

Charging Equipment Installation Process

- Conduct a survey of residents
- Consider different approaches/options for installing chargers
- Contact electrical contractor
- Contact local utility to discuss rate options
- Contractor will coordinate planning with local utility and municipal government for permitting and inspections

Costs





Considerations for Multi-unit PEV Charging

Key Considerations

- Building architecture and physical electrical design
 - Proximity of electrical service room to desired charging location
 - Wiring needed to accommodate charging stations
- Commercial electricity rates for common-area meters
- Cost of installation
- Parking ownership models

Different Approaches

- Hire turnkey operator to handle all charging services and payments
- Install individually assigned charging units
 - Residents can individually select and own their charging units
 - Residents can pay directly for their energy use
- Install chargers as shared community resource (often valet services)
- Arrange for use of nearby business chargers during “off” evening hours

Example of Challenge



California PEVC Case Studies

- Case studies provide examples of the spectrum of MuD charging installations
- Case studies are available online and will be added to as developed (evolving solutions)

26 PLUG-IN ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

CALIFORNIA PLUG-IN ELECTRIC VEHICLE COLLABORATIVE 27

MILLENNIUM TOWER SAN FRANCISCO

Built in 2007, Millennium Tower is a 419-unit high-rise condominium tower in San Francisco. Its numerous amenities include a private resident dining room, lap pool, sports club/A Fitness Center, wine tasting room with cellar, private theater, valet parking and a private concierge. The garage provides 340 parking spaces for residents and their guests.

CHARGING SNAPSHOT

- No. of units: 419
- No. of parking spaces: 340
- No. of residents currently driving PEVs: 6
- Number of charging stations and types: 8 Level 1 and Level 2

CHARGING STORY

Workplace Charging Setting

Millennium Tower installed its charging stations as part of the San Francisco multi-unit dwelling demonstration program, in conjunction with ChargePoint, the City of San Francisco and REJ Electric. The demonstration program, funded by the U.S. Department of Energy and the California Energy Commission, paid a significant portion of equipment and installation costs.

Decision-making process

Building management agreed to be part of the demonstration program with the cooperation of the building engineering group and the valet parking provider, City Park. The homeowners association (HOA) set the ground rules that the program must be revenue-neutral. Costs and revenue are monitored to ensure full cost recovery. Rates are currently set at \$.76 per kWh during on-peak times and \$.64 per kWh during off-peak times. This fee includes all costs for electricity, software services and maintenance. The charging stations' electricity usage is captured by the commercial common area meter, which measures electricity usage for all shared areas. Drivers pay for their individual usage via an account with ChargePoint, the charging station manufacturer.

Charging implementation and management

Currently, six PEV drivers share three charging stations located in the guest parking area. The building has valet parking so it is easy and efficient for residents to share the units. To the extent possible, parking management also tries to take advantage of lower off-peak charging rates.

Multi-unit dwelling charging challenges

Before the installation of the charging stations, residents were plugging Level 1 cords into wall sockets and the management company could not recover the electricity cost. The current system allows the costs to be paid by the PEV drivers.

A change in cellular coverage for the area occurred after the units had been installed. Previously, there had been cellular coverage even though the charging stations were located in an underground parking garage. Recently, wireless communication has been poor during the day but available at night. The stations still function normally, but now they communicate data back to ChargePoint only at night.

Charging costs

The entire project cost was covered by grants.

Contact information

Spencer Sechler
City Park
Spencer.Sechler@SFParking.com

“As the parking provider for Millennium Tower, City Park worked with the engineering group and the HOA to ensure that all ongoing costs for the chargers would be covered by the PEV drivers. As a result, the program has received only positive reviews from the residents.”

www.PEVCollaborative.org/MuD

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Case Study

CityFront Terrace

San Diego

- 320 residents/417 parking spaces
- 20 AC Level 2 metered make ready (wired to spot)
- Drivers pay directly for their electricity use and choose their own charger
- Cost \$80,000 total or \$4,000 per space

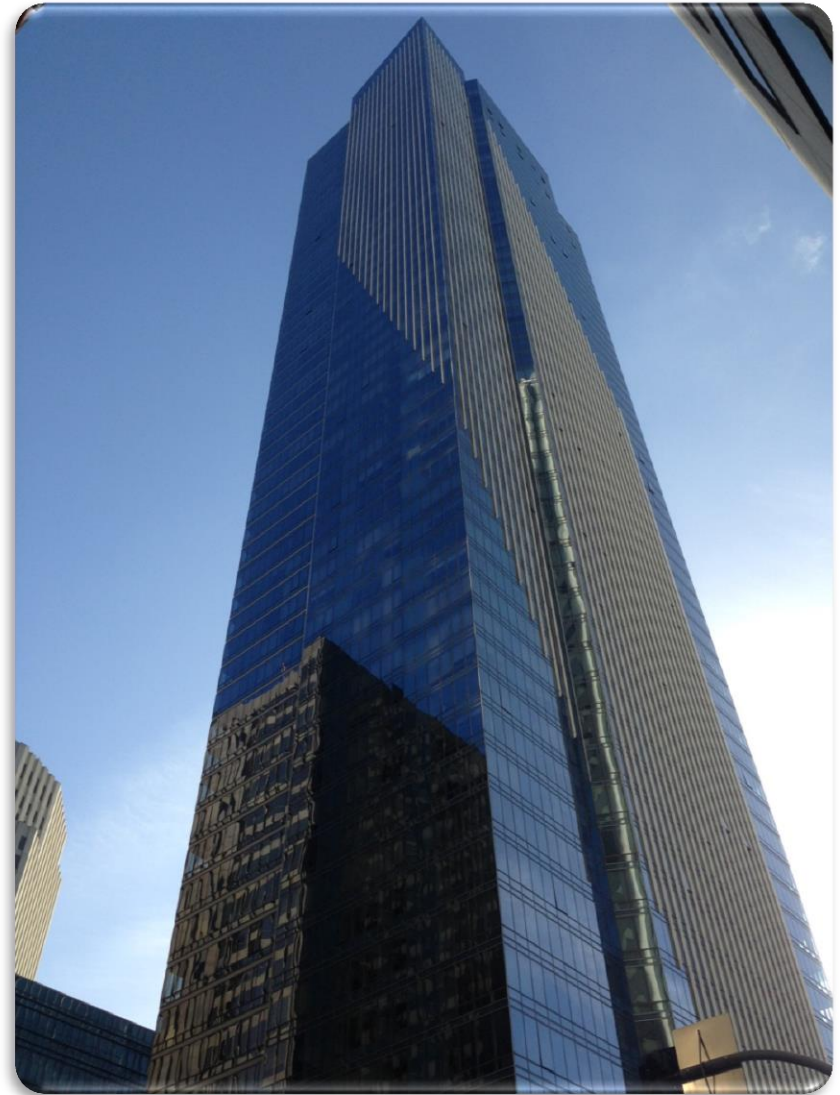


Case Study

Millenium Tower

San Francisco

- 419 residents/340 parking spaces
- AC Level 1 (3), AC Level 2 (3)
- Program is revenue neutral
- Drivers pay ChargePoint for electricity (membership)
- \$0.76 per kWh on-peak*
- \$0.54 per kWh off-peak*
- Drivers share (3) Level 2 chargers using valet to manage use
- Some costs covered by CEC grants



* Cost determined by HOA

Case Study

Towers at Costa Verde

San Diego

- Over 590 residents
- Level 2 (10) with pre-wiring for 10 more
- Billing managed by NRG eVgo
- Install costs approx. \$21,000 under NRG eVgo settlement



Case Study

The Elysian

Los Angeles

- 96 units
- Motivated to be sustainable company
- AC Level 2 (10) with dual ports – 20 connections
- 5 in garage, 5 in outside parking lot
- Purchased ChargePoint chargers
- Installed by on-site electrician
- Residents free, guests pay by kWh based on time-of-day

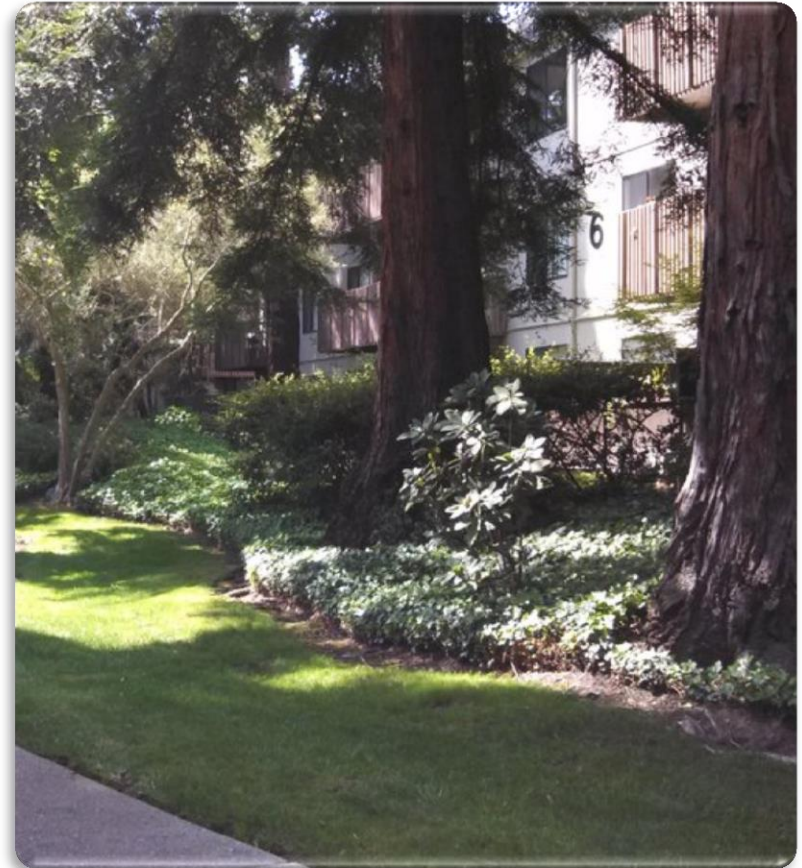


Case Study

Shelter Creek Condos

San Bruno, CA

- 1,296 units
- Level 2 (4) with dual ports
= 8
- Drivers pay ChargePoint for electricity at a price determined by HOA and property manager
 - \$1.25/kWh
 - High to cover service fees
 - Hope to reduce fee once there are more users
- Installation cost ~\$20,000 covered by CEC grants



Case Study

Sofia Lofts

San Diego

- No. of Units - 17
- Level 1 (1)
Level 2 (2)
- Prewired garage for more chargers
- On-site Car2Go PEV car sharing program
- AeroVironment chargers for Car2Go cars linked to PEV system
- Installation costs - ~\$10,000 covered by CEC grant

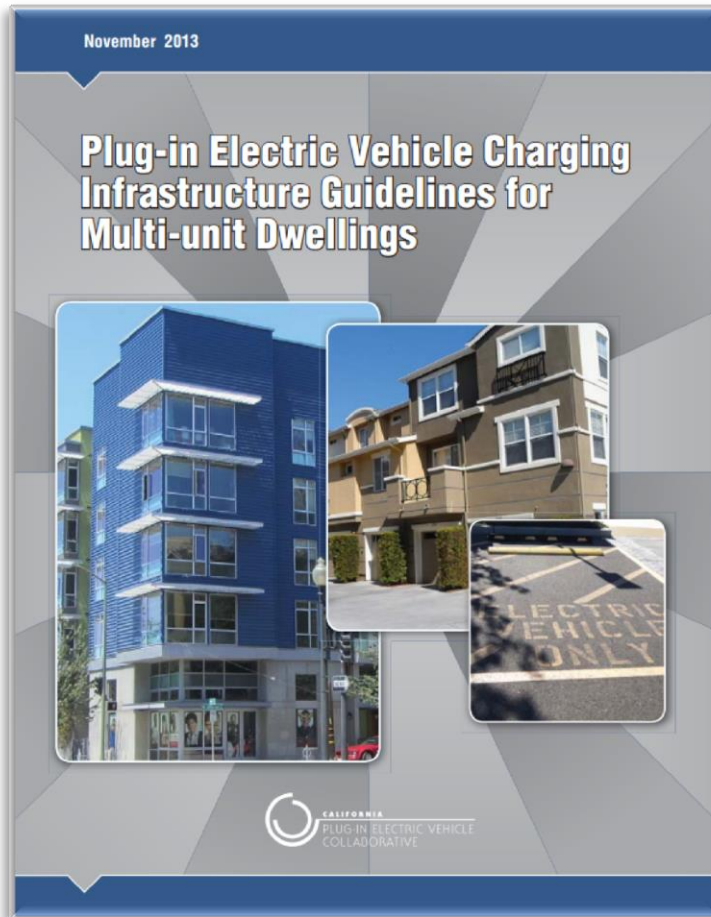


Infrastructure Proposals

| | SDG&E | SCE | PG&E |
|----------------------|-----------------------------------|--|--|
| # of sites | 550 | 3,000 | 25,000 ¹ |
| Cost | \$103M | \$346.1M | \$653.8M |
| Market Segments | Apartments and Workplaces | Apartment, Workplaces, and public interest sites | Apartment, Workplaces, and public interest sites |
| Who Owns Make-Ready? | Utility | Utility | Utility |
| Who Owns Charger? | Utility | Host site | Utility |
| User Pricing | Utility Tariff Direct to the User | Determined by Host/EVSP | Utility Tariff Direct to the User |

¹PG&E's proposal also includes funding for 100 DC Fast Charging stations, not included in site total
Slide courtesy of CPUC

Resources – Multi-unit Guideline



Includes information on:

- Charging a PEV
- Charging equipment installation flow
- Community considerations for charging station installation
- Operating/Maint. costs
- Financial recovery models and technology solutions
- Case Studies

Resources – Decision Guides

HOW DO MULTI-UNIT DWELLINGS BECOME PEV READY?

Over one-third of Californians live in rentals or multi-unit complexes. In San Francisco and Los Angeles over half the residents live in Multi-unit Dwellings (MuDs). Charging for multi-unit complexes is necessary for the success of PEVs.

KEY MESSAGES

- California is at the beginning of a major transition to fueling cars with electricity. Multi-unit Dwellings (apartments, condominiums, cooperatives, mobile home parks, or townhomes) need creative and innovative charging solutions.
- Leadership is important in solving the challenges of PEV charging. Home Owner Associations (HOAs), building owners and property managers will want to start getting PEV ready now.

INNOVATIVE CHARGING SOLUTIONS

Multi-unit Dwellings come in a variety of configurations. Parking arrangements for these residential buildings are equally diverse, ranging from deeded or assigned parking to no parking at all. If charging at the PEV driver's assigned parking space is not possible, other possible charging solutions to explore 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.

LOCATION

- Trade parking places so PEV drivers can park where it's cheapest to install charging.
- Use guest parking.
- Charge overnight in nearby municipal lots, business buildings or shopping malls.
- Park at on-street charging locations close by.
- Use alternative charging options (workplaces, 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.

Communication Guide #1
May 2013
www.PEVcollaborative.org

Guide 1: Great primer on electric vehicle charging for multi-unit dwellings

Plug-in Electric Vehicle Charging Guide for Property Owners, Managers and Homeowner Associations of Multi-unit Dwellings

Plug-in electric vehicles powered by electricity have arrived! More than 15 models are currently in showrooms and more are on the way. As a multi-unit dwelling owner, manager or member of a homeowners association board, you may have received resident requests for charging stations or seen a charging cord plugged into an outlet in your garage.

Property Benefits

- Charging stations will give the property a positive "green" image, which can be used for marketing.
- Charging stations can help make the property a leader in sustainable practices.
- As the plug-in electric vehicle (PEV) market grows, the number of requests for charging will undoubtedly grow.
- Charging stations can provide Leadership in Energy & Environmental Design (LEED) points for the property.

Getting Started

Start by learning about the many considerations and charging options for MuDs:

- Demand.** A resident survey is a good way to find out how many residents already have PEVs or plan to buy them. Find a link to a sample survey in the Additional Resources section.
- Logistics.** Whether parking is assigned, deeded or first-come, first-served, each option has its own set of considerations.
- Electrical capacity.** Do resident units have their own electric meters, are they accessible from the parking area and is there spare electrical capacity? Do common area meters, such as those for security lighting or laundry rooms, have spare electrical capacity? Are new service meters needed for the chargers?
- Charging choices.** There are several different levels of charging and dozens of brands of equipment, ranging from simple wall boxes to communicating units with networking capability. The units and features you choose will depend on your specific property's requirements and will determine associated costs.
- Cost recovery.** Properties seeking to recover costs for residential charging installation and operation can either assign chargers to individual drivers or use charging equipment with a payment system.
- Incentives.** Local and regional incentives for charging station installations may be available. See the Additional Resources section to search for incentives.

November 2013
www.pevcollaborative.org

Guide 2: Information for property owners, managers, and homeowner associations

Plug-in Electric Vehicle Charging Guide for Residents of Multi-unit Dwellings

So you've been eyeing the new models of plug-in electric vehicles and thinking about buying or leasing one. You like the idea of saving money on gasoline and doing your part for clean air. But, as a renter or condo owner, you wonder if you'll be able to charge your new car at home and what you'll need to do to convince your property manager to install a charging station.

Property Benefits

Here are some points you might use to persuade managers to install charging.

- Charging stations will give the property a positive "green" image, which can be used for marketing.
- Charging stations can help make the property a leader in sustainable practices.
- As the PEV market grows, the number of requests for charging will undoubtedly grow.
- Charging stations can provide Leadership in Energy & Environmental Design (LEED) points for the property.

Do Your Homework

Start by educating yourself and helping your property manager understand the options.

- Demand.** A resident survey is a good way to find out how many residents already have PEVs or plan to buy them. Find a link to a sample survey in the Additional Resources section.
- Decision-making process.** How do you obtain permission to install a charger? By law, condo property managers cannot prohibit the installation of charging, but they can set requirements and conditions.
- Logistics.** Whether parking is assigned, deeded or first-come, first-served, each option has its own set of considerations.
- Electrical capacity.** Do resident units have their own electric meters, are they accessible from the parking area and is there spare electrical capacity? Do common area meters, such as those for security lighting or laundry rooms, have spare electrical capacity? Are new service meters needed for the chargers?

November 2013
www.pevcollaborative.org

Guide 3: Information for residents of MUDs

Resources - Resident Survey

- Find out tenants' and homeowners' current and future interest in PEVs
- Available in hardcopy or electronic formats

Residential Electric Vehicle Charging Survey

Definitions:
PEV: A Plug-in Electric Vehicle (PEV) is a general term for any car that runs at least partially on battery power and is recharged by plugging in to the electricity grid. There are two different types of PEVs to choose from - pure battery electric and plug-in hybrid electric vehicles.

BEV: Battery Electric Vehicles (BEVs) operate exclusively on electricity stored in batteries and has an electric motor rather than a gasoline engine. (e.g., Nissan Leaf, Ford Focus EV, Tesla Model S).

PHEV: Plug-in Hybrid Electric Vehicles (PHEVs) combines two propulsion systems in one vehicle; an electric motor that is battery-powered and can be plugged-in and recharged and a gasoline engine that can be refueled with gasoline. (e.g., Chevy Volt, Toyota Prius Plug-in)

1. Do you currently own or lease a plug-in electric vehicle (PEV)? (Select One Only)

YES, I own or lease at least one PEV. *[Skip to Question 5.]*
If "YES", please specify vehicle year, make, and model:

NO, I do not own any PEVs.

2. On a scale of 1 to 5 with 1 being "Not Likely," and 5 being "Very Likely", how likely are you to purchase or lease a PEV by the end of 2015? (Select One Only)

| | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Not Likely | | | | | Very Likely | |
| 1 | 2 | 3 | 4 | 5 | | Don't Know |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

[If you selected 1, 2, 3, or Don't Know, skip to Question 9.]

3. In which year do you think you would buy or lease a PEV? (Select One Only)

in 2013
 in 2014
 in 2015 or beyond

4. What type of PEV would you most likely lease or purchase? (Select One Only)

Battery Electric Vehicle (BEV: ~100 miles electric range; e.g., Nissan Leaf, Ford Focus EV)
 Plug-in Hybrid Electric Vehicle (PHEV: ~15-40 miles all electric range & up to 300 miles gas range; e.g., Chevy Volt)
 Don't know

Page 2 of 3

Workplace Charging Resources

This block contains several overlapping resource documents:

- How Can I Get Plug-in Electric Vehicle Charging at My Workplace?**: A guide explaining that workplace charging offers added travel flexibility and boosts all-electric driving range. It also increases zero-emission miles driven.
- Convincing your Boss**: A document listing motivations for some companies, such as green branding, attracting talent, and helping the CEO or other stakeholders.
- Why Employers Should Install Workplace Charging for Plug-in Electric Vehicles**: A document highlighting benefits to employees, companies, and communities. It notes that the market for plug-in electric vehicles is growing and that being able to charge at work is an important consideration for many drivers.
- WORKPLACE CHARGING: WHY AND HOW?**: A document stating that 74 percent of Plug-in Electric Vehicle (PEV) owners express strong interest in workplace charging.
- Employer Benefits**: A document listing benefits such as enhancing green branding, reducing costs, and improving employee productivity.
- Employers' Guide to Installing Workplace Charging for Plug-in Electric Vehicles**: A comprehensive guide with a flowchart showing steps: Research Options and Develop a Plan, Choose a System, Create and Follow an Installation Checklist, Establish and Follow SOP Policies and Procedures, and Evaluate and Monitor Progress. It includes a list of key resources and a checklist of actions for employers.

For More Information

Home | Contact Us

CALIFORNIA PLUG-IN ELECTRIC VEHICLE COLLABORATIVE

WHO WE ARE OUR FOCUS MEMBERSHIP NEWS & EVENTS RESOURCES

From Awareness to Paradigms:
GM's Thoughts on PEVs at Three Years Old
[Read More](#)

PEV Sales Dashboard

March 5, 2014

NATIONAL SALES:

| |
|---------------------------|
| PEVs sold in 2014: 7,045 |
| Cum. 2011 - 2014: 181,087 |

*Numbers are approximate

CALIFORNIA SALES:

| |
|--------------------------|
| Cum. 2011 - 2014: 64,549 |
|--------------------------|

Latest News & Events

PEVC Member Meeting
San Diego
Tuesday, March 11, 2014
Hosted by: San Diego Gas & Electric

RFP for Distribution of PEVC 2013 Working Group Documents
The Collaborative is accepting proposals for a contractor to help with the widest possible distribution in California of their 2013 documents. Proposals are due by 5:00 p.m. on Thursday, March 13, 2014.
[Download RFP](#)

Agenda
February 26, 2014
February 20, 2014

www.PEVCollaborative.org

DriveClean.ca.gov Plug-in Electric Vehicle Resource Center

PEVs & The Environment How PEVs Benefit You Learn More

Like 10 Share 3 Print

Search & Explore

- Plug-in Vehicles
- Charging
- Incentives
- Costs
- Safety

View Resources For:

- Dealers
- Fleets
- Businesses
- Electricians
- First Responders
- Cities
- Policy Makers
- Media

PEV Buying Guide

Welcome to California's buying guide and resource center for plug-in electric vehicles (PEVs). We'll help you compare your options and take the next steps into PEV ownership.
[Get Started >>](#)

Find a PEV

Technology:

Year:

Make:

Model:

[SEARCH](#)

Checklist

PEV Buyers
How to prepare for your PEV purchase.

PEV Owners
Steps to getting your decals, rebates, and other PEV perks.

Stories on the Street

Kia's new Soul EV is coming this fall. Check out their new ad:
[\[2015 Soul EV\] "Recharge"](#)

Answers to Your Questions

True or Not?

Q. Why should I drive electric?
A. Plug-in electric cars deliver all...

MYTH: Plug-in vehicles don't have enough range.

www.DriveClean.ca.gov/pev

Resources



- CA Energy Commission – Small Bus. Financing Program
<http://www.treasurer.ca.gov/cpcf/calcap/evcs/index.asp>

Loans enrolled in the Electric Vehicle Charging Station Financing Program can be used for the design, development, purchase, and installation of electric vehicle charging stations at small business locations in California. CalCAP may provide up to 100% coverage to lenders on certain loan defaults. Borrowers may be eligible to receive a rebate of 10-15% of the enrolled loan amount.

- CA Air Res. Board (ARB) -
<http://www.arb.ca.gov/newsrel/newsrelease.php?id=730>

Possible for a family that meets income guidelines to receive as much as \$12,000 toward the purchase of an electric car.

- Up to \$2,000 for a charging unit at your single residence or multi-unit dwelling for the purchase of battery electric cars; and
- An additional \$1,500 and \$2,500, respectively, for the purchase or lease of a new plug-in hybrid or electric car from a separate program known as the Clean Vehicle Rebate Project.



www.DriveClean.ca.gov/pev

Questions?



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