



Electricity

WHAT IS CHARGING?

What is a PEV?

A plug-in electric vehicle (PEV) is a vehicle in which there is an onboard battery that is powered by energy delivered from the electricity grid. There are two types of electric vehicles: a battery electric vehicle (BEV) and a plug-in hybrid electric vehicle (PHEV). BEVs run exclusively on the power from their onboard battery. PHEVs have both an onboard battery and an internal combustion engine that is used when the car's battery is depleted.

There are upwards of 12,000 PEVs in the San Diego region (as of Summer 2015).

How many stations are in the San Diego region?

Currently there are over 550 public charging stations in the San Diego region.

How much does it cost to fuel my vehicle?

It generally costs less than half as much to drive an electric vehicle as an internal combustion engine

| 24-month average* | |
|-------------------|--------|
| Gasoline | \$3.35 |
| Electricity** | \$1.22 |
| Savings | \$2.13 |

*June 2013-June 2015

**Gasoline gallon equivalent



Level 1 Charging

Level 1 charging uses 120 volts AC. An PEV can be charged with just a standard wall outlet.

Level 2 Charging

Level 2 charging uses 240 volts AC. This is the same type of voltage as an outlet used for a dryer or washing machine.

DC Fast Charging

DC fast charging is a very quick level of charging. An PEV can be charged up to 80% within 30 minutes of charging.

What types of vehicles can use electricity?

Electric vehicles come in all shapes and sizes. These days, they are not merely limited to light-duty passenger vehicle (of which there are over 25 models!)s.

- Vanpool shuttles
- Pickup trucks
- Medium-duty vehicles
- Transit buses
- School buses
- Forklifts
- Low-speed vehicles (like a golf cart)



TYPES OF PLUG-IN ELECTRIC VEHICLES

Battery Electric Vehicle (BEV): Battery electric vehicles run entirely on the energy stored on an onboard battery. The vehicle is charged by electricity from the grid. On average, the vehicle's range is upwards of 80 miles on a single charge.

Plug-in Hybrid Electric Vehicle (PHEV): A plug-in hybrid electric vehicle runs on electricity and a gasoline as well. The onboard battery is charged by electricity from the grid, and when the battery is depleted, the gasoline engine is used.

Where can I learn more about electric vehicles?

You can learn more about EVs on the following websites:

- Alternative Fuel Data Center – www.afdc.energy.gov
- Plug-in Electric Vehicle Collaborative – www.pevcollaborative.org
- Plug-in America – www.pluginamerica.org
- Plug-in Cars – www.plugincars.com
- Go Electric Drive – www.goelectricdrive.org



Are Electric Vehicles Right for your Fleet?

You may not be sure whether or not an electric vehicle is the right decision for you. The following tools and resources are available to help guide you through your decision-making process.

Learn from examples of fleets that are using PEVs in their daily operations

Case Studies

Sacramento Powers up with Electric Vehicles: From the Alternative Fuel Data Center, this case study shows how the City of Sacramento included PEVs into their fleet and installed charging stations powered by the sun. Watch the video here: <http://www.afdc.energy.gov/case/2143>.

Gilroy School District ZEV Bus: The City of Gilroy in California created a first-of-its-kind ZEV bus fleet. Watch the video here: <http://www.afdc.energy.gov/case/2023>.

Sonoma County: This PowerPoint presentation provides an overview of how Sonoma County successfully installed PEV charging for its fleet. http://www.acgov.org/sustain/documents/EV_Case_Study_Sonoma.pdf

SDG&E Workplace Charging: The Plug-in Electric Vehicle Collaborative has developed a case study about the charging stations at San Diego Gas & Electric. The workplace is host to over 100 PEV charging stations and serves not just employees, but an electric fleet of more than 25 PEVs. Read more: <http://www.pevcollaborative.org/sites/all/themes/pev/files/docs/case-studies/SDGE.pdf>.



Several fleets in the San Diego region also use electric vehicles:



Financing your Electric Vehicle and Infrastructure

You've decided that it makes sense to consider adopting PEVs into your fleet. These tools are intended to help you better understand the financial benefits of adopting PEVs and the costs associated with their procurement.

Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool

The AFLEET tool is developed by the Department of Energy's Clean Cities Program. It estimates the environmental and economic costs of adopting alternative fuel vehicles into your fleet. It takes into consideration fuel costs, fuel types, and vehicle purchase price. Before getting started with this tool, having the following data available will strengthen the estimates returned:

- Vehicle class your fleet would likely adopt
- Annual vehicle miles of a single vehicle
- Vehicle purchase price
- Useful life of fleet vehicle(s).
- Will there be a loan to help procure the vehicles? If so, what are the terms of the loan?

Take advantage of this tool here: <https://greet.es.anl.gov/afleet>.

Workplace Charging Calculator

The Workplace Charging Calculator is developed by CALSTART. It estimates the initial cost of installing charging infrastructure, operating costs, and how to recover all operating costs. This takes into consideration employee driving patterns, charging levels that wish to be installed, and energy costs. Use the tool here: <http://evworkplace.org/calculator/>.

Savings in Fuel Costs

The [Alternative Fuel Data Center's Vehicle Cost Calculator](http://www.afdc.energy.gov/calculator/) shows the total cost of ownership and emissions for a large variety of makes and models of most vehicles, including alternative fuel vehicles. You can also create your own custom vehicle if you cannot find the model you want. The tool is: <http://www.afdc.energy.gov/calculator/>.

The Bren School of Environmental Science and Management at UC Santa Barbara offers a high-efficiency vehicle comparison. Based on certain details, this tool will inform the user which vehicle can save them the most money. The tool is: <http://iee.ucsb.edu/CleanCarCalculator>.

Incentives

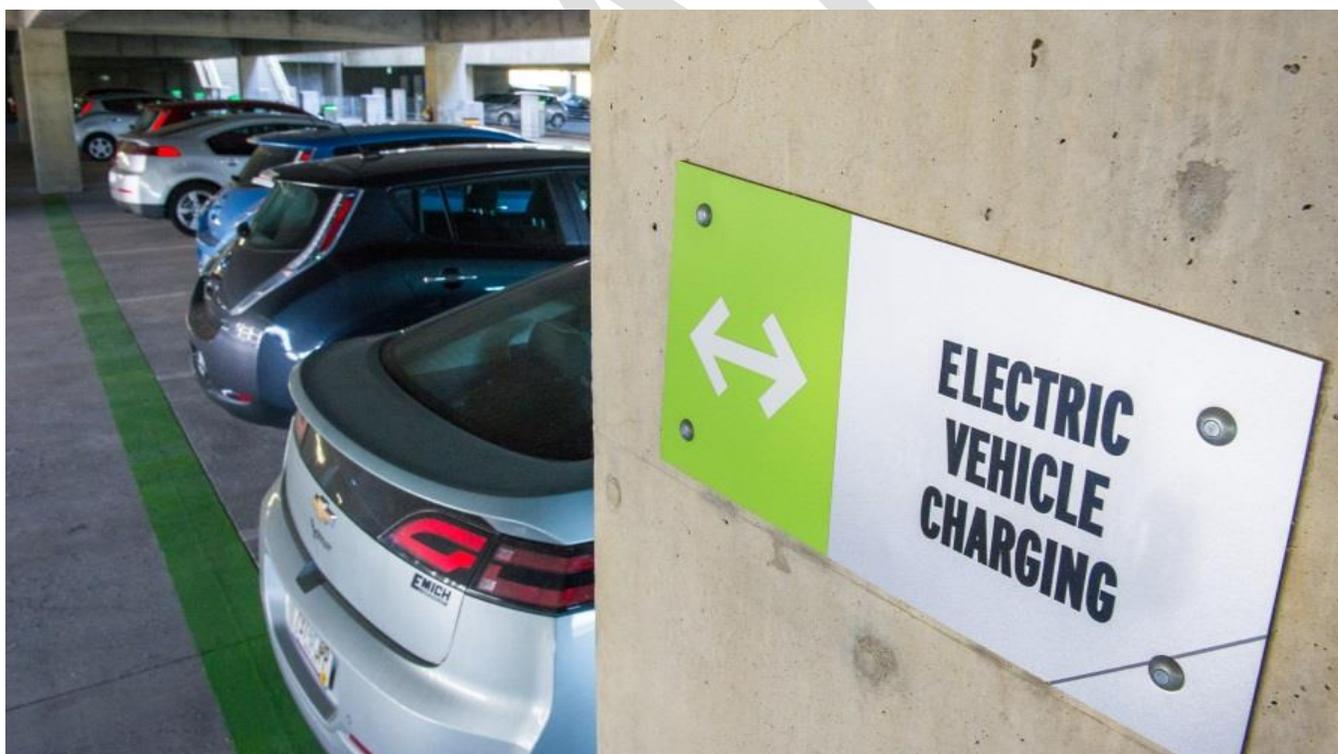
| Incentive Name | Incentive Website |
|---|---|
| Clean Vehicle Rebate Project | http://www.energycenter.org/cvrp |
| Public Fleet Pilot Project | https://energycenter.org/public-fleet-project |
| Alternative & Renewable Fuel and Vehicle Technology Program | http://www.energy.ca.gov/altfuels/ |
| Low Emissions School Bus Grants | http://www.arb.ca.gov/msprog/schoolbus/schoolbus.htm |
| EVSE Loan and Rebate Program | http://www.treasurer.ca.gov/cpcf/calcap/evcs/index.asp |

Charging Stations

Steps to Installing PEV Charging Stations

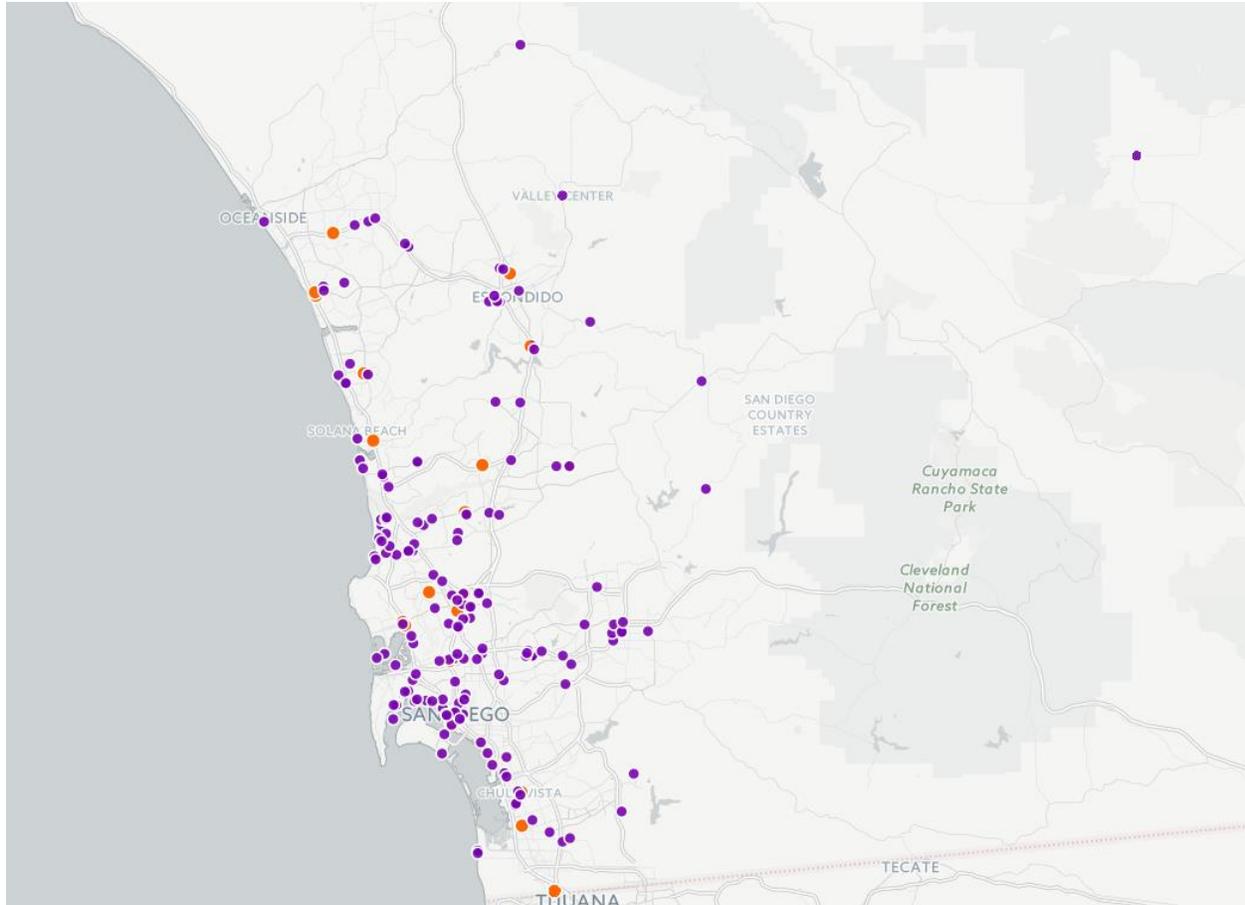
- Consider your fleet's needs over the next several years – due to the cost of charging station installations, include the fleet's projected PEV acquisitions when deciding the number of charging stations to install. If you are anticipating an increase in PEVs, consider adding extra circuits and conduit to future charging station locations.
- Evaluate on-road mileage and charging times of PEVs – this will help inform the type of EVCS to install. If your fleet consists of PEVs that do not travel great distances during the day, 120v outlets (i.e., Level 1) may be sufficient.
- Locate EVCS and parking close to electric service – this will lower the overall installation cost.
- Signage – designate PEV-only parking spaces, or fleet-only parking/charging spaces.

The Clean Cities guide *Plug-In Electric Vehicle Handbook for Fleet Managers* discusses other PEV such as vehicle operating cost comparisons, conversions, maintenance, and detailed guide to planning and installing EVCS. ¹



¹ http://www.afdc.energy.gov/pdfs/pev_handbook.pdf

Map of Public PEV Charging Stations in San Diego Region



*purple indicates Level 2 site; orange indicates DCFC site

http://www.afdc.energy.gov/fuels/electricity_locations.html

What are the costs of installing a charging station?

The cost of installing a charging station varies based on the type of charging station and the environment in which it will be installed. Though the cost of basic charging equipment is relatively low, the high costs come from potential electrical panel upgrades, wiring, and trenching.

While it may seem necessary to install Level 2 equipment for your fleet, it may make more sense to accommodate your fleet with Level 1 (i.e., a 120-volt plug with sufficient electrical capacity) options. This is especially true for fleet vehicles that tend to be dormant overnight in one central location.

| | Estimated Cost of Installing EV Charging Station ² | |
|-----------------------|---|-------------------|
| | Level 2 | DC Fast Charging |
| Hardware | \$450-\$3,000 | \$12,000-\$35,000 |
| Electrician Labor | \$100-\$1,500 | \$1,600-\$3,000 |
| Electrician Materials | \$50-\$300 | \$300-\$600 |
| Other materials | \$50-\$150 | \$100-\$400 |

| Specific Cost Considerations ³ | |
|---|------------------|
| Conduit | \$1.50-\$2.50/ft |
| Trenching | \$25-\$100/ft |
| Concrete Patch | \$14-\$15/sq. ft |
| Asphalt Patch | \$10-\$11/sq. ft |

Codes and Standards

When installing a fueling station, it is important to adhere to the necessary codes and standards. This guidance document provides a thorough list of codes and standards for electric vehicles and infrastructure:

<http://www.afdc.energy.gov/pdfs/48605.pdf>.

Electric vehicle charging stations are governed by codes similar to other electrical devices, notably, the National Electrical Code (NEC) 625.

| Fueling Station Aspect | Pertinent Codes and Standards |
|-------------------------------|--|
| Vehicle and Charger Interface | Society of Automotive Engineers (SAE) J-1772, J-2841, J-2293, J-2847, J-2836 |
| Vehicle Charging Stations | NFPA 70 NEC article 625 |
| Charging Station Components | UL FFTG, UL FFWA |

² Information gathered from CALSTART “Best Practices for Workplace Charging” and Rocky Mountain Institutes “Pulling Back the Veil on EV Charging”.

³ Ibid.