

EV Charging Infrastructure Toolkit – Fleets



Why Install Electric Vehicle Charging?

EVs are an increasingly popular choice for public and private fleets, due in large part to their lower maintenance and fuel costs. Battery electric vehicles (BEVs) without an internal combustion engine do not require oil, filter or spark plug changes, and even plug-in hybrid electric vehicles (PHEVs) require them much less frequently if they are utilized primarily in electric mode. Additionally, the fuel cost per mile for an EV is approximately one-third that of a gasoline vehicle with 25 miles per gallon fuel efficiency.¹

Alameda County in California recently purchased 64 plug-in hybrid electric vehicles (PHEVs) and 23 battery electric vehicles (BEVs) for use across ten county and municipal fleets, with an estimated fuel savings of \$500,000 and a 1.5 million pound GHG reduction over five years.² Additionally, New York City recently released data indicating that annual maintenance costs for BEVs are between \$1,200 - \$1,600 less than for gas vehicles.³ Despite the higher up-front cost, New York City still estimates the total nine-year cost of ownership, including the cost of installing EV charging infrastructure, is about \$9,000 less than for a comparable gasoline vehicle.

Additionally, electrifying public fleets can greatly reduce a business or jurisdiction's greenhouse gas (GHG) emissions and contribute to sustainability goals. This is especially true in California, where grid electricity is especially clean, and many jurisdictions and business alike have adopted aggressive GHG reduction targets.

Installing adequate EV charging infrastructure is a key component to effectively electrifying a public or private fleet. While fleet vehicles may utilize public EV charging infrastructure, the higher cost of charging is likely to negate fuel savings, and access to public charging is often unreliable.

¹ This assumes an electricity cost of \$0.23 per kilowatt-hour and a gasoline cost of \$4 per gallon.

² <https://www.georgetownclimate.org/files/report/Capturing-the-Federal-EV-Tax-Credit-for-Public-Fleets%20-%20Case%20Study.pdf>

³ Coren, Michael J. "New York City says electric cars are now the cheapest option for its fleet." Quartz, 18 Mar. 2019, <https://qz.com/1571956/new-york-city-says-electric-cars-cheapest-option-for-its-fleet/>. Accessed 22 April 2019.

Considerations for Charging Fleet Vehicles

For organizations operating a vehicle fleet, part of estimating demand will involve deciding whether to acquire EVs as fleet vehicles. Determining what type and model of EV may be appropriate for your needs can be a daunting process, but many resources are available to help. Many organizations find the sustainability benefits and reduced fuel and maintenance costs are worth the higher purchase price of EVs, especially factoring in the available incentives and rebates. When thinking about setting up charging stations for fleet purposes, you'll want to evaluate battery-electric vehicles (operate on electricity only) versus plug-in hybrid vehicles (gasoline and electricity), based on driving radius and charging needs. Fleet vehicles may not need to have usage tracked and can stay parked overnight; non-networked Level 2 or even simple Level 1 solutions can be an appropriate, low-cost strategy. You'll need to decide if your site layout and operational needs call for separate fleet-only charging stations or whether they can share use with the public or employee vehicles. Consider upsizing your installation to prepare for future EV purchases. As prices and technology continue to improve, more fleet applications will be appropriate for EVs.

Fleet EV Charging Checklist

While each installation is unique, many locations have similar questions and challenges when planning for charging stations. This document summarizes common steps to help you consider options and understand how and when to engage the experts – your local utility, licensed contractors and charging stations vendors. This toolkit provides general information and resources for each step of the following checklist.

This checklist is presented in a linear format, but the process of installing charging stations will be dynamic, with various interrelated considerations. Steps 1-4 will be preliminary explorations of issues that can be revisited with expert help once you've decided to move forward and contacted your utility and/or charging stations vendors. Actions listed are from the perspective of the project lead for your site. Your utility, vendors, and contractors will guide you through actual installation steps and more detailed considerations.

STEP 1: Estimate Demand

- 1.** Examine existing fleet inventory to determine vehicles well-suited for near-term replacement (older models, high-mileage, ready replacements on the market).
- 2.** Examine existing fleet inventory to determine which vehicles are well-suited for long-term replacement (heaviest fuel users, high mileage but short individual trips, best at showcasing the organization's commitment to sustainability, etc.).
- 3.** Check availability of existing charging stations nearby using PlugShare or other maps.
- 4.** Contact site employees/visitors to gauge interest; survey to quantify charging needs and driving habits.
- 5.** Estimate average employee/visitor dwell time – what speed of EV charging is appropriate?

STEP 2: Consider Charging Station Options

- 4.** Consider appropriate charging equipment types based on estimated demand, visitor dwell time (Level I typically suit low mileage & long dwell, Level II mid/long mileage & mid/long dwell, and DC Fast Charging for short dwell).

- 5.** Examine physical siting constraints (e.g., access to electrical infrastructure, ADA, visibility etc.). For leased facilities, the building owner will likely need to provide conduit and wiring to the installation site. Depending on location, this may be a major consideration.
- 6.** Weigh charging stations ownership models – organizationally owned or third-party vendor.
- 7.** Determine if you want to measure charging station use and require payment from users. This will lead to other considerations (e.g., software reqs., networked vs. non-networked capability, in-house vs. third-party payment options, and using pricing to drive parking space turnover).
- 8.** Consider increasing the installation of make-ready spaces to account for growing demand, reducing future capital costs related to site development (e.g. trenching, wiring).

STEP 3: Estimate Capital Costs

- 9.** Determine the number and type of charging stations you want to install onsite.
- 10.** Measure distance to charging stations location from power point of connection to estimate make-ready costs, which cover laying the infrastructure needed for the immediate installation of a charging station in the future (e.g., trenching and conduit installation).
- 11.** Determine if your electrical service/panel requires an upgrade (engage utility or technology provider).
- 12.** Have technology provider estimate operations & maintenance costs (e.g., electricity use, demand charges, networking fees).

STEP 4: Evaluate Cost Recovery Options

- 13.** Research available incentive and funding programs. Examples include the Carl Moyer Memorial Air Quality Standards Attainment Program, as well as State Programs such as Alternative and Renewable Fuels and Vehicle Technology Program (ARFVTP) and Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP). Some programs (ex. HVIP) require approval prior to equipment purchase to guarantee coverage.
- 14.** Consider contracting with charging stations network provider to recover ongoing charging costs.

STEP 5: Contact Utility to Conduct Site Evaluation

STEP 6: Contract with Vendors - Choose from offered equipment and service contracts

STEP 7: Hire Installers - Work with utility, vendors to plan, permit, and install EV charging

STEP 8: Implement Management Policies

- 15.** Ensure compliance with ADA regulations, consider general parking and traffic flow issues.
- 16.** Contact insurer regarding potential liability issues.
- 17.** Consider installing signage guiding visitors to EV charging.
- 18.** Communicate with site staff/stakeholders regarding installation and use of charging stations.
- 19.** Set schedule to review charging stations usage and contracts with third parties to consider adjustments.

EV Charging Installation Timeline



EV Charging Resources

STEP 1. Estimate Demand

What is your current EV charging need, and how will it grow into the future? Weighing the need for charging stations at your location will require reaching out to stakeholders at your site and researching existing EV charging locations nearby. A simple first step is to contact each stakeholder at the site to inquire about EV charging interest for their staff and visitors. A key question will be evaluating the typical vehicle dwell times at your site to consider the appropriate charging speed.

Tool 1: EV Charging Demand Sample Survey



The U.S. Department of Energy has prepared a sample survey for workplaces to gather information on employee charging stations demand. This may not be appropriate for evaluating public demand but will give a good idea what types of questions to consider:

https://afdc.energy.gov/files/u/publication/WPCC_sample_employee_survey_0816.pdf

Tool 2: EV Charging Location Maps



Use these maps to see where nearby chargers are located, how many chargers are available, and their rates and access rules. Keep in mind that demand will continue to grow. PlugShare:

<https://www.plugshare.com/>. U.S. DOE: <https://afdc.energy.gov/stations/#/find/nearest>.

Tool 3: Ready Set Charge Fleets Report



The Bay Area Climate Collaborative has prepared a detailed guide for implementing EVs as fleet vehicles, including charging stations considerations. <http://baclimate.org/wp-content/uploads/2015/10/Ready-Set-Charge-Fleets-EV-Fleet-Guide.pdf>



Tool 4: Vehicle Incentive Projects

California’s Clean Vehicle Rebate Project provides funding for eligible EV purchases, including rebates up to \$7,000 for public agency fleets in designated areas:

<https://cleanvehiclerebate.org/eng/fleet>. Additionally, the Carl Moyer Memorial Air Quality Standards Attainment Program offers incentives for several vehicle categories and is open to public agencies <https://www.arb.ca.gov/msprog/moyer/moyer.htm>.

STEP 2. Consider Charging Station Options

What charging speeds, controls and billing capabilities do you require? You will want to consider the demand and dwell times of your fleet to select appropriate charging equipment. The table below provides a summary of charging stations types. Levels 1-3 offer increasing charging speed but with added cost and complexity. Level 1 may be adequate to serve employee vehicles parked for many hours at a time, while Level 2 and Level 3 (DC Fast Charging) are typically appropriate for daily high-mileage fleet vehicles.



Tool 5: EV Charging Information

The U.S. Department of Energy maintains a clearinghouse of information and resources for alternative fuels, including EV charging: <https://afdc.energy.gov/fuels/electricity.html>

Charging Station Types Summary

	Level 1	Level 2	Level 3 (DC Fast Charging)
Charging Speed	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
Typical Locations	Single-family homes Townhomes Multi-family dwellings Office buildings	One and two-family homes Townhomes Multi-family dwellings Office buildings	Public access Retail shops Highway corridors Hospitality & recreation facilities
Equipment Description	Standard 120 VAC outlet and cord set charger that typically comes with EV Metering and billing not available	240 VAC outlet and wall-mounted or bollard style charging port Networked units available, allowing for advanced controls, billing options	Commercial-grade 208, 440 or 480 VAC converted into direct current (DC) through large standing unit Often requires upgrades to a site’s electrical service Not all EVs can utilize

An important consideration is the number of charging stations that you will install at your location. If you plan on installing public chargers at your locations as well, charging stations intended to serve fleet vehicles may need to be separated from public access unless they only need an occasional charge. If visitors only occasionally utilize charging stations, 1-3 public access charging ports may be enough, but the number will also depend on the level of equipment selected. Faster charging speeds means more vehicles can be served by the same charging stations, and strategically locating units between parking spaces can help facilitate switching cords between vehicles. In general, you want to provide enough charging stations that users are frequently able to charge, but not so many that the charging stations are underutilized. Due to the rapid adoption of EVs, and the fact that charging stations have an expected useful life of at least 10 years, you may want to consider increasing the size of your planned installation to meet future demand. One way to go about this is to install more in-ground infrastructure (often called stub-ups) than chargers. Another strategy is to install a mix of DC Fast Charging and Level 2 or Level 1 charging, depending on fleet needs and available funds.

Ownership Models

Public Agency/Organization/Property Manager owns equipment

Benefits	Considerations
<ul style="list-style-type: none">• Host dictates whether charging is free or fee-based• Host determines the fee for charging (if applicable)• Host keeps all revenue, perhaps recovering cost of electricity (if charging for a fee)• Host can determine station users	<ul style="list-style-type: none">• Host must buy equipment• Host must pay construction costs• Host must manage payments• Host must properly maintain equipment

Electric Vehicle Service Provider (EVSP) owns equipment

Benefits	Considerations
<ul style="list-style-type: none">• No or limited equipment or installation cost to host• EVSP manages and maintains the station• EVSP shares revenue from the station with host	<ul style="list-style-type: none">• Host usually remains customer of record on utility bill and must pay electricity costs upfront before EVSP reimburses host• PEV drivers need to have membership fees to use stations

STEP 3: Estimate Cost

The cost of installing EV charging varies considerably based on specific site requirements. Aside from the actual cost of the EV charging equipment, often referred to as electric vehicle supply equipment (EVSE), typical installation costs include trenching for electrical conduit and upgrades to the site's electrical service.



Tool 6: EV Charging Cost Report

The U.S. Department of Energy has prepared a report on average equipment and installation costs for non-residential EV charging projects:

https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf

The table below provides a simplified estimation tool based primarily on costs provided in the Department of Energy report. It includes average potential costs that may or may not apply to every project. Early consultations with your utility and charging stations providers will help refine these estimates.

Charging Station Installation Cost Estimator

Cost Driver	Average Costs	Example
Installation Costs		2x Dual Port (4 Ports)
Equipment – Level 2 (Non- Networked)	\$500 - \$2,000 x Ports	=
Equipment – Level 2 (Networked)	\$1,500-\$6,000 x Ports	= \$3,000 x 4 Ports
Equipment – DC Fast Charging Equipment	10,000-\$40,000 x Units	=
Installation – Level 2 Equipment	\$3,000 - \$6,000 x Ports	= \$3,800 x 4 Ports
Installation – DC Fast Charging Equipment	\$8,500 - \$51,000 x Units	=
Trenching for Electrical Conduit	\$100 x Feet	= \$100 x 45 feet
Transformer Upgrade	\$10,000-\$25,000	=
Total Estimated Cost:		= \$31,700

Additionally, site hosts must consider the ongoing costs of EV charging. These consist primarily of the cost of electricity and any other impacts to utility bills, such as increased service or demand charges, but may also include monthly or annual payments to network service providers.

STEP 4. Evaluate Cost Recovery

Installing EV charging will often require a considerable up-front capital expenditure. Site hosts may wish to recover the costs of installation and ongoing use from employees and visitors based on individual usage or elect to absorb the cost themselves and provide EV charging as a free amenity. California law ([AB 2414](#)) specifies that providing free EV charging is not a gift of public funds. No matter what cost recovery strategy you choose, there are additional resources that can provide funding for eligible EV charging installation projects, as listed below.



Tool 7: AFDC Incentive Listing Tool

The U.S. Department of Energy's Alternative Fuel Data Center (AFDC) hosts a comprehensive listing of currently available EV incentives within the state of California. Please note that certain programs (ex. CALeVIP) are time-limited: <https://afdc.energy.gov/fuels/laws/ELEC?state=ca>



Tool 8: Add Solar photovoltaics to EV infrastructure

The National Renewable Energy Laboratory created a summary of considerations for adding distributed solar PV with EV charging: <https://www.nrel.gov/docs/fy14osti/62366.pdf>. Solar Sage provides an easy [online calculator](#) for estimating solar panel costs based on electricity demand.

STEP 5. Contact Utility

Once you taken time to consider the items listed in Steps 1-4 of the checklist, you'll be well prepared to begin speaking with your utility, EV service providers and electrical contractors who will be able to recommend solutions suited to the needs and constraints of your location. These experts can also help refine cost estimates and potential recovery strategies. The utility specifically can help walk you through any necessary electrical service upgrades, potential electricity bill impacts, and other technical aspects of the project.

STEPS 6 & 7: Contract with Vendors & Hire Installers

Charging stations equipment and network providers offer a variety of products, services, and unit ownership arrangements. Speaking with several vendors and reviewing case studies is important before finalizing a contract.



Tool 9: CALeVIP Connects

CALeVIP Connects is provided as part of the CALeVIP incentive program. It is a free online directory that allows you to connect directly with EV service providers and request information for potential EV charging projects. <https://calevip.org/find-an-evsp>

STEP 8: Implement Management Policies

Once your charging stations is operational, you will want to take steps to ensure it is well utilized and enhances your site. Communication with site stakeholders, staff and visitors will be key to success. Distributing a written use and management policy and installing signage to direct potential users to charging units are two important steps. You may also want to set a schedule to review utilization and ongoing costs to decide whether your current charging stations and services are still serving your needs.



Tool 10: Veloz Accessibility and Signage Guide

Veloz provides several charging stations-related resources on its website, including a report with recommendations on parking management, accessibility and signage.

<https://www.veloz.org/resource/accessibility-signage-for-pev-charging-infrastructure/>

Additional Resources

Alternative Fuels Data Center (AFDC) – The U.S. Department of Energy’s AFDC is an information clearinghouse with useful resources like case studies, an EV charging locator and a list of relevant laws and incentives. <https://afdc.energy.gov/fuels/electricity.html>

Veloz/PEV Collaborative – Veloz provides many useful resources including case studies, templates and fact sheets on their website. <https://www.veloz.org/veloz-resources/>

Fleets for the Future – Fleets for the Future is a coalition of regional councils and industry experts that maintains a website with useful resources on alternative fuel fleets.

California GoBiz – The Governor’s Office of Business provides several EV-related resources, including an extensive Community Readiness Guidebook to help local governments facilitate charging stations installation with templates, tools and resources. <http://businessportal.ca.gov/zero-emission-vehicle-program/zev-resources/>





Kern Council of Governments

Contact:
Linda Urata, Regional Planner
Kern Council of Governments
lurata@kerncog.org

FUNDING PROVIDED BY THE
**CALIFORNIA
ENERGY
COMMISSION**

