



# Employee Workplace Electric Vehicle Charging





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# Employee Workplace Electric Vehicle Charging

*Driving the San Diego Region Into the Future*

## About Plug-in San Diego (Plug-in SD)

Plug-in SD is a partnership between the San Diego Association of Governments and Center for Sustainable Energy with funding from the California Energy Commission. Its mission is to assist property owners in acquiring electric vehicle (EV) charging and better understanding the technologies, incentives and installation options available.

Among Plug-In SD's services, it provides no-cost consultations to property owners in San Diego County interested in installing EV charging infrastructure. While each installation is unique, many properties have similar questions and challenges when planning EV charging. This document summarizes common workplace EV charging solutions identified through consultations and serves as a starting point for EV charging installation projects.

This document provides information, guidance and resources that can help you get started on workplace EV charging, as well as tools to find incentives to help fund projects and identify vendors to design and implement EV charging solutions.

## Background

EV adoption is experiencing rapid growth, especially in California. In 2018, nearly 8% of new car sales in the state were battery electric (BEV) or plug-in hybrid electric (PHEV) vehicles.<sup>1</sup> As more drivers adopt EVs, charging at work will become increasingly important, especially for EV owners without reliable home charging options, such as those who live in apartments or park on the street.

Installing EV charging at your business or workplace has numerous benefits. Providing charging can improve morale and employee retention, while reducing your employees' transportation costs. In addition, providing workplace charging shows your support of EV adoption and can help boost your company's image, contribute to corporate sustainability goals and count toward Leadership in Energy and Environmental Design (LEED) certification.<sup>2</sup>

### *Considerations important to EV charging*

- **Estimate demand**  
What is your current EV charging need, and how will it grow into the future?
- **Choose design level**  
What charging speeds, controls and data-monitoring capabilities do you require? How will these considerations impact the cost of your EV charging project?
- **Choose ownership model**  
Do you want to own the EV charging equipment, or would you prefer to lease?
- **Choose cost model**  
Will employees pay for charging, or will you provide it as a free amenity?

<sup>1</sup>California New Car Dealers Association. California Auto Outlook. Vol. 15 No. 1. Available at: <https://www.cncda.org/wp-content/uploads/Cal-Covering-4Q-18.pdf>.

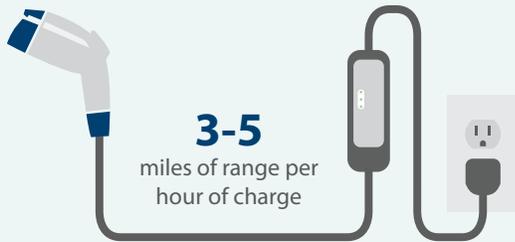
<sup>2</sup>USGBC Leadership in Energy and Environmental Design. <https://www.usgbc.org/credits/schools-new-construction/v4-draft/lc8>.

# Types of EV Charging

Electric vehicle charging is available at three levels, based on the rate at which a vehicle is able to recharge. Higher levels indicate faster charging rates but are typically costlier and are more likely to require upgrades to a site's electrical infrastructure.

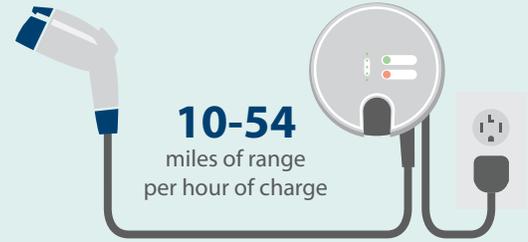
## Level 1 charging

Level 1 charging uses a standard 120-volt alternating current (VAC) outlet available in all residential and commercial locations. Almost all plug-in vehicles come with a Level 1 cord set charger as standard equipment. Level 1 charging is the lowest cost and slowest EV charging option, providing around 3-5 miles of electric range per hour. Level 1 charging is a good option for homes and workplaces, where a vehicle can charge for upwards of 8 hours at a time.



## Level 2 charging

Level 2 charging uses 240 VAC and provides between 10-54 miles of electric range per hour. Level 2 uses the same connector and charge port as Level 1. Level 2 charging units are more expensive than Level 1, typically with more advanced controls and monitoring capabilities, and are a good option for homes and workplaces, as well as commercial properties that want to provide EV charging to customers.



## DC fast charging (DCFC)

Direct current fast charging (DCFC) is the fastest and the most expensive EV charging option. DCFC uses commercial-grade 208, 440 or 480 VAC that is converted into direct current (DC) to add 75-300 miles of electric range per hour. Because of its high power demands, DCFC often requires upgrades to a site's electrical service. DCFC is ideal for sites where EVs need to gain a maximum amount of range in a short time, such as along highway corridors and some retail shops. DCFC is not appropriate for home charging and is typically not recommended for workplace charging, unless there is a specific need for rapid recharging of vehicles. Additionally, not all EVs are equipped with the hardware required for DCFC.



**Table 1** Electric Vehicle (EV) charging levels and common use cases

	Level 1	Level 2	DC fast charging
<b>Charging Speed</b>	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
<b>Typical Locations</b>	Single- and two-family homes Townhomes Multifamily dwellings Commercial office buildings	Single- and two-family homes Multi-unit dwelling Commercial office buildings Retail shops Fleets	Highway corridors Public charging depots Retail shops Hospitality & recreation facilities

## Typical Cost Drivers

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 electrical service panels.

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. Site hosts may wish to recover these costs from tenants, employees and visitors based on individual usage, incorporate these costs into rent or lease terms or elect to provide EV charging as a free amenity.

### Trenching

Installing EVSE in an existing paved parking lot may require digging trenches to bury electrical conduit. Trenching and patching an asphalt surface typically costs around \$100 per foot and can add significantly to installation costs. When possible, run electrical conduit above ground and install EV charging stations close to the electric service panel to reduce the length of electrical runs. If a project requires trenching, consider any plans to expand EV charging and include extra electrical runs to avoid additional future costs.

### Electrical service upgrades

The addition of EVSE can add significant electrical load to a site and may require upgrades to electrical service panels. Larger Level 2 and DCFC installations also may require upgrades to the local electrical distribution grid, such as transformer upgrades, which can cost between \$10,000-\$25,000.<sup>3</sup>

For smaller installations, the site's electrical service panel may have room to install several Level 2 chargers without requiring an upgrade. A professional electrician can examine a panel to determine if there's room for additional capacity. Each Level 2 EV charger will typically require its own 40-amp circuit. Should a panel not have room for the additional circuits, it may require a panel upgrade.

### Ongoing costs

The primary ongoing cost for EV charging is the cost of electricity and any other utility bill impacts, such as increased monthly service or demand charges.<sup>4</sup> These costs vary greatly, depending on the size of the installation and level of utilization.

An employee that charges on a Level 1 charger for eight hours per day, or a Level 2 charger for two hours per day, will consume about 11 kilowatt-hours (kWh) of electricity and gain between 30-40 miles of electric range. At an average cost of \$0.23/kWh, that is approximately \$2.50 per day, or \$55 per month, in electricity costs per vehicle. This assumes that employees do not charge during summer peak time-of-use (TOU) periods (4-9 p.m.; June 1–October 31) when electricity costs are significantly higher.

For a networked charging system, typical network fees cost between \$100-\$900 annually, depending on the installation.<sup>5</sup>

<sup>3</sup>[https://afdc.energy.gov/files/u/publication/evse\\_cost\\_report\\_2015.pdf](https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf).

<sup>4</sup>Demand charges apply to some, but not all, commercial electricity rates. Consult your latest utility bill or speak with a utility customer service representative to learn more about your current electric rates and potential impacts to your utility bill.

<sup>5</sup>[https://afdc.energy.gov/files/u/publication/evse\\_cost\\_report\\_2015.pdf](https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf).

## Estimating Your Demand

An important first step to installing workplace EV charging is to estimate current and future demand for EV charging. Conduct a simple **employee survey**, asking how many employees currently own or plan to purchase a BEV/PHEV and the distance of their typical commute. This will provide an estimate of daily miles traveled and can easily be translated into required charging capacity. A simple rule of thumb for a typical eight-hour workday is that a Level 1 charger can provide 24–40 miles of range and a Level 2 charger can provide at least 80 miles of range. This assumes that drivers rotate chargers once they have finished charging and that charging sessions are limited to only cover daily commuting distances.

Due to the rapid adoption of EVs, and the fact that EVSE has an expected useful life of at least 10 years, Plug-In SD recommends that you consider doubling the size of your installation to meet future demand.

## Basic Installation Design

### *Low-cost option – Level 1 charging*

The easiest and least expensive EV charging design is to install multiple 120-volt, weather-resistant wall outlets at the parking spots located nearest to your company's subpanel. The outlets can be served by wall-mounted conduit, avoiding the need for expensive trenching. EV charging spots should be located as close to the electric service panel as possible, to minimize the cost of running electrical conduit.

Employees would be required to bring their own Level 1 charging equipment, which they would plug into the outlets. Most EVs come with a 120-volt charger included. An employee charging for eight hours would gain between 30-40 miles of electric range – more than enough for a typical commute.



**Figure 1** Multiple 120-volt outlets mounted along an external wall provide easy access to Level 1 charging. EV owners use the Level 1 cord set that is typically provided with purchase or lease of the vehicle.

If your property is accessible after hours, Plug-in SD recommends the use of simple mechanical timers that can be programmed to cut electricity to the outlets after hours, thus preventing illicit charging. Additionally, to minimize utility bill impacts, you may wish to cut power to the outlets at 4 p.m. during summer months, when peak time-of-use (TOU) period rates begin.

This option uses simple 15/20-amp single-pole breakers on the electrical panel. Your subpanel may already have room for adding breakers. Work with a licensed electrical contractor to determine if your electrical service panel can accommodate additional load. If required, a service panel upgrade can add significant costs to a project.

Assuming no trenching or electrical service panel upgrades are needed, a low-cost Level 1 charging solution for six employees can be installed for around **\$2,000-\$3,000**, including the cost of an electrician's labor and permitting.

## Midlevel Installation Design

### Moderate-cost option – Level 2 charging

Level 2 charging requires installing a 240-volt, wall-mounted or bollard style charging unit next to parking spots located as close as possible to the subpanel or electrical room. Ideally, the units would be served by wall-mounted conduit, avoiding the need for expensive trenching. Bollard style units will likely require trenching, so that electrical conduit is protected and does not present a tripping hazard. This option accommodates customers who would like to charge while visiting your facility and can charge company EVs overnight.

Level 2 offers networked and nonnetworked charging. A nonnetworked Level 2 charger will have no internet connection and essentially provides a driver with an access point to simply plug in and charge. Billing employees for the use of a nonnetworked EVSE can become complicated, as the equipment does not have the ability to track individual users' energy usage or the duration of time they are connected and charging. A nonnetworked charger will be less expensive, with wall-mounted or bollard style Level 2 charging units costing between \$500-\$2,000. Level 2 EVSE installation costs can vary widely depending on the site, but average around \$3,000 per unit,<sup>6</sup> bringing the total cost for a nonnetworked solution to **\$3,500-\$5,000 per unit**.

**Table 2** Overview of charging station options

	Level 1	Level 2	DCFC
<b>Charging speed</b>	3-5 miles of range/hour	10-54 miles of range/hour	75-300 miles of range/hour
<b>Voltage</b>	120	240	480
<b>Installed cost estimate</b>	\$200-\$400 per outlet	\$3,500-\$5,000 per unit (nonnetworked) \$4,500-\$9,000 per unit (networked)	\$30,000-\$100,000 per unit

<sup>6</sup>[https://afdc.energy.gov/files/u/publication/evse\\_cost\\_report\\_2015.pdf](https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf).

A networked EVSE transmits data over the internet to a network host, allowing for more advanced controls, billing options and usage analytics. Additionally, the use of a networked EVSE may allow the business to participate in utility programs, like demand response, which can result in utility bill credits and reduce the overall cost of ownership. Level 2 EVSE with network capabilities typically cost between \$1,500-\$6,000, not including the cost of installation and ongoing network fees. While installation costs are similar for a nonnetworked solution, the increased cost of the networked EVSE brings the total cost to **\$4,500-\$9,000 per unit**.

**Table 3** Networked vs. nonnetworked Level 2 EVSE functionality

	Networked	Nonnetworked
<b>Internet connection</b>	Yes	No
<b>Usage tracking &amp; analytics</b>	Yes	No
<b>Timed charge</b>	Yes	No
<b>Individualized billing</b>	Yes	No
<b>Demand response participation</b>	Yes	No
<b>Access restrictions</b>	Electronic	Mechanical

For a nonnetworked charger, you will need to ensure that access to charging can be restricted during off hours to prevent illicit charging. If you are not able to restrict access to your parking lot after hours, you may consider installing mechanical timers that can cut electricity to the circuit at a predetermined time. Another option offered by some nonnetworked chargers is keypad access, requiring users to enter a code to unlock the charging connector.



**Figure 2** Wall-mounted Level 2 chargers can reduce installation cost and deliver up to 54 miles of electric range per hour. Note that charge rates depend both on the power of the Level 2 charger and the capacity of the EV's onboard charging system.

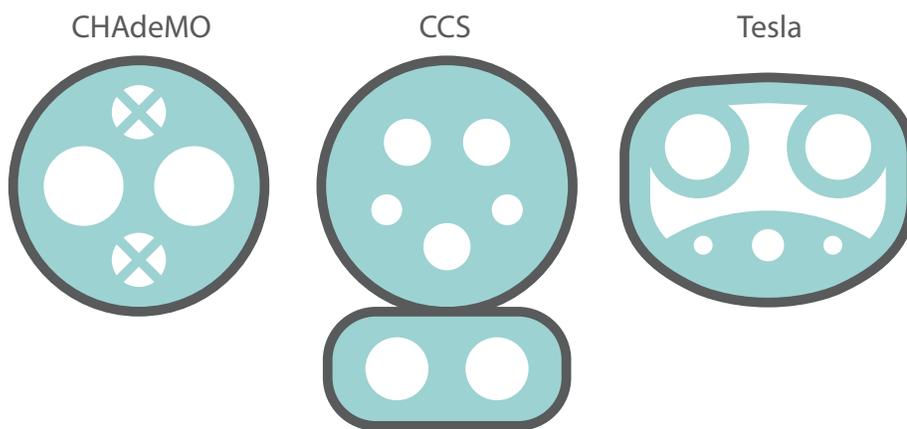
## Advanced Installation Design

### Higher-cost option – Level 1 or 2 + DC fast charging

The most advanced, and highest cost, option would include DCFC for rapid charging of longer-range EVs in tandem with either Level 1 or 2 charging. This would require up to 480 VAC three-phase power and a 40-80 amp dedicated circuit to provide a direct current (DC) output range between 31-62 kW. Due to the higher energy demands, this option would be much more likely to require expensive electrical upgrades to the site's electrical service and potentially to the electric distribution grid transformer that serves the site.

Plug-in SD recommends placing these charging stations away from the building, preferably in the center of a four-car parking area to maximize vehicle rotation. This option will require a dedicated meter and possibly a dedicated line from the utility transformer. Plug-in SD does not recommend using this option for workplace charging unless the intent is to charge high-mileage EVs purchased as a business asset. An example would be a delivery or taxi service, where you will need your vehicles to be able to “pit stop” charge throughout the day. Employees with DCFC-equipped vehicles, like Tesla, Nissan Leaf and Chevy Bolt, could also make use of fast-speed chargers. However, DCFC draws a tremendous amount of electricity in a short period of time, and fast charging will often be unnecessary for employee vehicles that will remain parked for hours.

DCFC units range in price from \$10,000-\$40,000, and transformer upgrades to accommodate the increased power demands can cost between \$10,000-\$25,000. While average DCFC installation costs are around \$21,000, they can range anywhere between \$8,500 - \$51,000.<sup>7</sup> Along with equipment costs, installing a DCFC can cost **between \$30,000 - \$100,000 per unit.**



**Figure 3** The three DCFC connectors used in North America: CHAdeMO, Combined Charging System (CCS) and Tesla.

## EVSE Rental Option

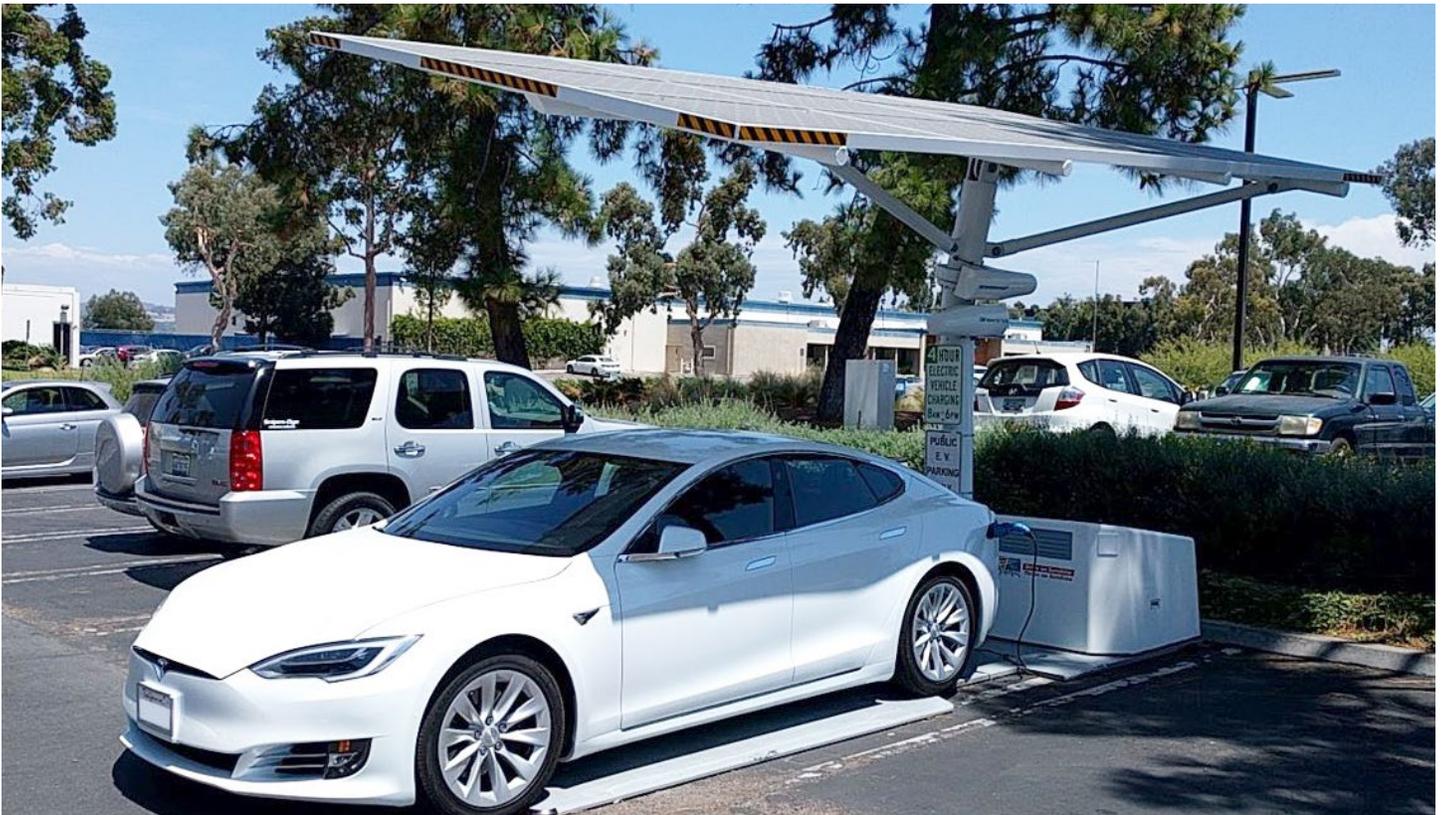
While most EVSE are purchased, some equipment manufacturers offer rent or lease options as an alternative. This may be a useful option if a workplace charger system requires expensive units that offer networked keycard access and billing management.

Most rental offerings require the building owner to provide the conduit and wiring to the area of installation. The charging equipment manufacturer will then install, maintain and update and/or upgrade the equipment throughout the rent/lease term. Renting may be a good option if your company has a shorter-term property lease or is planning to move locations soon and does not want to purchase EVSE. Most charger unit rent/lease terms are three, five or 10 years. When the agreement schedule is complete, the manufacturer will remove the chargers unless the rent/lease term is extended.

<sup>7</sup>[https://afdc.energy.gov/files/u/publication/evse\\_cost\\_report\\_2015.pdf](https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf).

## Stand-Alone Chargers

Portable combination “solar + battery storage + EV charging” units are a potential solution for workplace charging. Because these units generate their own electricity and do not interact with the building’s electrical system, they avoid the cost of permitting, trenching and running electrical conduit and will not impact utility bills. Should an office location change, the units can be moved easily. Stand-alone solar photovoltaic chargers also qualify for the federal 30 percent solar investment credit and accelerated depreciation, although only a tax professional can confirm both the availability of these tax benefits as well as your business’s ability to claim them.



**Figure 4** An EV charging under a stand-alone solar canopy. The solar photovoltaic panels charge a battery that then charges the vehicle. The solar canopy does not interconnect with the building’s electrical system.

## Cost Recovery

Incentive programs and tax credits can help property owners recover some of the upfront costs of installing EV charging. The **California Electric Vehicle Infrastructure Project** (CALeVIP) offers incentives for Level 2 and DCFC in specific areas throughout the state.

Incentive availability changes frequently. The **CALeVIP** website maintains a list of additional incentive projects and the California Air Resources Board offers an incentive search tool on the **DriveClean.ca.gov** website.

Businesses may choose to recover the ongoing costs of providing EV charging by having employees and/or visitors pay for their use. Alternatively, many businesses provide EV charging as a free amenity, with return on investment coming in the form of improved employee morale and retention.

**Company offers free employee charging as an amenity** – Some businesses offer free employee charging as a pre-payroll-tax benefit to employees. However, the Internal Revenue Service has not provided clear guidance on whether complementary workplace charging qualifies as a fringe benefit that must be reported as taxable income.<sup>8</sup> Plug-in SD recommends consulting with a tax professional before offering workplace charging as a free amenity.

If providing EV charging as a free amenity to employees, consider implementing a two-hour charging policy for employees to limit utility bill impacts. An employee that charges for two hours will be able to gain between 20-40 miles of electric range, which should be more than adequate to cover a typical commute. Additionally, by rotating the chargers every two hours throughout the day, four employees will be able to utilize one charging station in a typical workday, with charging ending at 4 p.m. when peak TOU periods begin.

**Company acts as a pass-through access point for employee charging** – Under this option, the business would contract with a network service provider to handle billing. Users could create an account, or use an existing account, and link their personal payment information. For the employee, this would be a similar experience to using a public EV charger. The business can work with the network service provider to establish different rates for employees and visitors. For example, employees may be charged slightly more than the cost of electricity to recover the cost of installation and ongoing network service fees. Visitors, on the other hand, may be offered a limited amount of complementary charging. This option would require a networked solution and would provide access either through a keypad, a radio-frequency identification (RFID) card or remote activation using a smartphone app.

### *Low Carbon Fuel Standard (LCFS) credits*

In 2009, the California Air Resources Board created the Low Carbon Fuel Standard (LCFS) to encourage the use of less carbon-intensive transportation fuels. Electricity is considered a lower-carbon fuel, and workplaces that install EV charging can generate credits that may be sold in California's LCFS market. The sale of LCFS credits can provide an additional revenue stream, offsetting the cost of installing and operating your EV charging stations. Businesses may choose to capture and sell these LCFS credits for themselves, or they may cede their credits to their EV service provider. Discuss with your service provider how ownership of LCFS credits will be treated, and how your business will be compensated if you choose to cede your right to your credits.

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<sup>8</sup>Georgetown Climate Center. Federal Income Tax Treatment of Workplace Electric Vehicle Charging as a Fringe Benefit. June 2016. Available at: [https://www.georgetownclimate.org/files/report/GCC\\_TaxConsiderationsforWorkplaceCharging\\_June2016\\_0.pdf](https://www.georgetownclimate.org/files/report/GCC_TaxConsiderationsforWorkplaceCharging_June2016_0.pdf).

## Getting Started – A Recap

Follow the four main steps to starting an EV charging project.

1. **Estimate demand** – Conduct an employee survey to estimate the current demand for EV charging and anticipated future demand. Keep in mind that EV adoption is expected to grow rapidly as more models become available and as EVs enter the used vehicle market.
2. **Choose design level** – Using the survey results, consider what level of charging is appropriate for your need and budget. Will simple, inexpensive Level 1 charging meet your need, or will you require faster charging speeds and advanced controls and monitoring of networked Level 2 charging?
3. **Choose ownership model** – Do you prefer to own the charging equipment, or are you planning on moving locations, in which case a lease option may be better suited to your needs?
4. **Evaluate cost recovery options** – Research available incentives and/or tax credits for installing EV charging infrastructure. Determine if you will charge employees and/or visitors to offset increased energy costs, or if you will provide charging as a free amenity.

Once you have worked through the four steps, you'll be well prepared to begin speaking with EV service providers and electrical contractors who will be able to recommend solutions suited to the needs and constraints of your workplace. The following Additional Resources section includes tools for finding incentives to defray costs and identify vendors to design and implement electric vehicle charging solutions.



## Additional Resources

**CALeVIP** – The California Electric Vehicle Infrastructure Project (CALeVIP) is a California Energy Commission-funded project that provides incentives for Level 2 and DC fast charging in select locations throughout the state.

**CALeVIP Connects** – CALeVIP Connects is a free online directory that allows you to connect directly with EV service providers and request information for potential EV charging projects.

**Employee Workplace Charging Survey** – A sample employee survey from the AFDC that can be used to estimate the demand for EV charging at your workplace.

**Incentive Search Tool** – DriveClean.ca.gov provides a search tool to help you find incentives for EVs and charging infrastructure.

**Plug-In SD FAQ** – A list of frequently asked questions from Plug-In SD covering the basics of charging, costs, incentives and more.

**The Alternative Fuels Data Center (AFDC)** – An information clearinghouse maintained by the U.S. Department of Energy (DOE) that is home to useful resources, as well as a list of relevant laws and incentives.

**Veloz/PEVC Case Studies** – Veloz provides several useful case studies and fact sheets on their website.

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