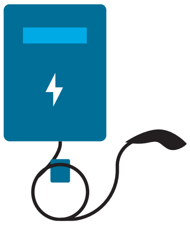
Workplace EV Charging Project Scenario Checklist

When selecting Electric Vehicle Supply Equipment (EVSE) and planning for workplace charging, there are several technical specifications to consider. This tool is designed to provide expanded information on key workplace charging project concepts summarized in the Workplace Charging Pocket Guide available on www.workplacecharging.com.

Identify Charging Needs

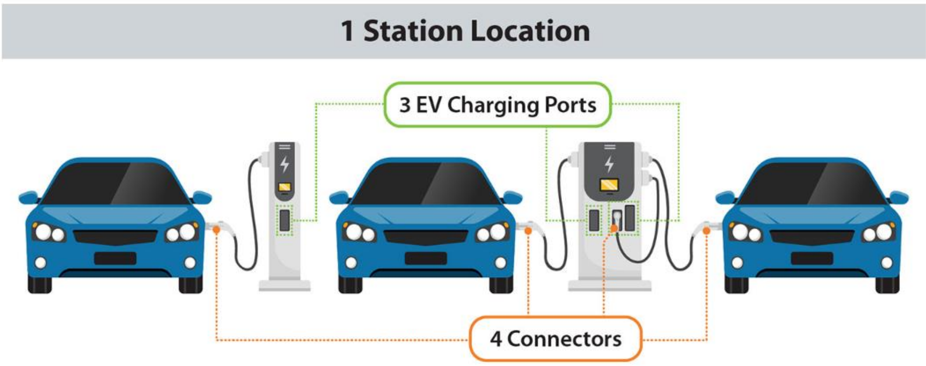
Employers or building managers can identify workplace charging needs by surveying employees to gauge interest from existing and potential EV owners. This can help estimate future expansion needs. See the EMPOWER Workplace Charging website for a Workplace Charging Survey Tool and more.

Select Charging Equipment



Depending on your employee charging needs, workplaces have a range of charging equipment to consider. A **station location** is a site with one or more EV charging ports at the same address. An **EV charging port** provides power to charge only one vehicle at a time even though it may have multiple connectors. A **connector**, or plug, is what is plugged into a vehicle to charge it. A **charging station** may have multiple ports with multiple connectors, as the image below shows.

Figure 1: Key EVSE Terms[1]

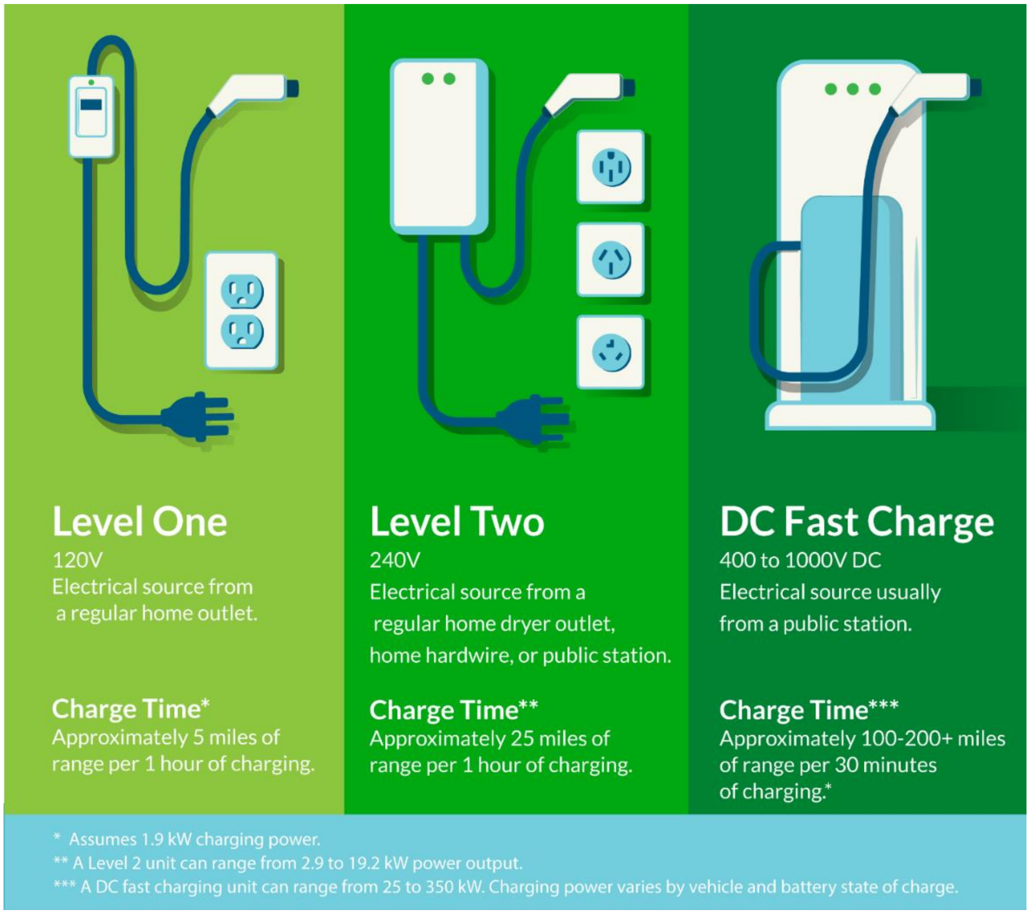


[1] Alternative Fuels Data Center. Electric Vehicle Charging Stations, https://afdc.energy.gov/fuels/electricity_stations.html

Levels of Charging Equipment

EV chargers provide power to charge electric vehicles and come in different levels, each with a different power output. EVSE fall under three power output categories: Level 1, Level 2, and Direct Current Fast Charging (DCFC), sometimes referred to as Level 3. The preferred type of charger will depend on how the charger will likely be used. Since employees typically park for longer periods of time, and therefore have relatively long time periods available to charge, Level 2 chargers can meet most workplace charging needs, while Level 1 chargers may not provide enough power to sufficiently charge vehicles by the end of a typical workday. However, should a workplace require EV chargers for fleets in addition to employee charging and where there is a need for higher powered charging, DCFC should be considered.

Figure 2: Levels of EV Charging Equipment[2,3]



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[2] Maryland Department of Transportation, et al. Maryland EV, https://marylandev.org/charging/
[3] According to the U.S. Department of Transportation (https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds), a typical EV charging from empty to 80% would take 40-50+ hours with a Level 1 charger, 4-10 hours with a Level 2 charger, and 20 minutes to an hour for a DC fast charger.

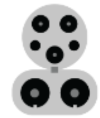
Charging hardware costs will vary depending on the level of charging equipment, with costs increasing as the equipment levels increase due to the equipment itself costing more and the potential upgrades to supporting electrical infrastructure needed to power the higher-level equipment. Estimated costs for Level 1 charging equipment would range from $300–$831 whereas a typical Level 2 would cost approximately $1,182. There is a more dramatic price jump between Level 2 and DCFC equipment with DCFC equipment ranging from $28,401–$140,000.

Connector Type

The charging connector is the charging component that directly connects to the vehicle. There are different connector types, as listed below. Note that standard Level 2 connectors in North America are typically either SAE J1772 or J3400 (NACS or the North American Charging Standard).

Table 1: List of EVSE Connector Types

Level of EV Charger	Connector Type	Connector Description	Connector Reference
Level 1	SAE J1772	Standard EV cord set features a standard NEMA connector on one end (like the common three-prong NEMA 5-15) and an SAE J1772 connector.	 J1772 connector
Level 2	SAE J1772	Level 2 charging equipment, like Level 1, uses the J1772 connector. All commercially available EVs in the United States can charge using both Level 1 and Level 2 equipment.	 J1772 connector
	J3400	Vehicles equipped with a J3400 (NACS or the North American Charging Standard) connector can utilize this for all charging levels, including Tesla's Level 2 Destination Chargers and home chargers all Tesla vehicles are provided with a J1772 adapter for compatibility with other Level 2 charging equipment. Historically NACS connectors have been exclusively used by Tesla. However, major vehicle and charging manufacturers have announced plans to adopt NACS connectors in the future.	 J3400 (NACS) connector

Level of EV Charger	Connector Type	Connector Description	Connector Reference
DCFC	CCS	CCS connectors (also known as SAE J1772 combo) let drivers use the same charge port with AC Level 1, Level 2, and DC fast charging equipment. The only difference is that the DC fast charging connector has two additional bottom pins. Most EV models on the market can charge using the CCS connector.	 CCS connector
	ChAdeMO	The CHAdeMO (CHArge de MOve) EV charging connector, developed by the CHAdeMO Association, is another common DC fast connector type among Japanese automakers.	 CHAdeMO connector
	J3400	SAE International is standardizing the J3400 connector based on Tesla's design for the NACS connector, which works for all charging levels, including Tesla's fast charging option, called a Supercharger. Although Tesla vehicles do not have a CCS or CHAdeMO charge port, they come with a limited CCS or CHAdeMO adapter that supports charging up to 19.2 kW. Tesla does sell full power adapters for both connector types. Several vehicle manufacturers have announced adopting the J3400 connector as early as 2025, which will allow non-Tesla EVs to charge at Tesla stations with the J3400 connector.	 J3400 (NACS) connector

Verify Warranty Cost and Terms

It is crucial to consider initial and extended warranty costs and terms for EV charging equipment. Warranties provide financial protection for unexpected repair costs, often covering key components such as high voltage equipment, cables, and connectors, which can be costly to replace. Warranty pricing can differ depending on the manufacturer, with options for fixed-term, renewable plans, or even warranties that are bundled with the cost of the equipment. Although the regular upkeep of charging infrastructure may be relatively low, the expense of fixing malfunctioning chargers can be substantial, particularly if the warranty period has expired. Annual Level 2 warranty and maintenance costs are estimated to be $400, whereas annual costs for DCFC may range from $300–$3,000 per year.

Confirm Safety and Compliance

When purchasing EVSE, it is important to ensure that chargers are safe to operate. First, look for EVSE that have been certified by the Occupational Safety & Health Administration's (OSHA) Nationally Recognized Testing Laboratory (NRTL) Program. This program acknowledges independent entities for their proficiency in electrical assessments and authorizes them to test and certify that products comply with relevant standards. There are a range of EVSE safety standards, some examples include UL 2594 and NFPA 70. For more information, see the ANSI website.

Determine Networking Needs

When selecting EV charging equipment, it is important to consider whether networked or non-networked chargers best meet workplace charging needs. Networked EV charging stations are remotely connected to a larger system of connected charging stations, adding features like remote management. Networked charging stations require additional technology and software compared to a non-networked charging station, adding to costs. Network providers also charge a fee for network management and administration. It is important to understand the frequency that networking subscription fees are charged and whether the fee is assessed per-port, per-station, or a combination.

The benefits of networked charging stations include:

- **Real-time monitoring:** Networked EVSEs can be managed remotely, with real-time data on charging status, usage, energy consumption, and more. The ability to troubleshoot potential issues remotely can reduce EVSE downtime.
- **Remote management:** Networked EVSEs can be remotely managed and configured, allowing for easy access control, billing, and reporting. In addition, remote management allows EVSE managers to control operating hours, charging time, and access. This feature can be important for non-employee use and restricting usage.
- **Load management:** Networked EVSEs can manage load sharing, which is useful in buildings where there is limited energy capacity and one circuit has to be used to charge multiple vehicles.
- **Potential revenue generation**: Owners of networked charging stations can charge a fee to users for the electricity consumed.

Some cons of networked charging stations include:

- **Higher cost**: Networked EVSEs are typically more expensive than non-networked EVSEs and may require a regular fee.

- **Proprietary networks**: Many networked charging solutions operate on proprietary networks and don't allow communication with other charging devices.

Conversely, non-networked chargers, also known as standalone units, may have lower upfront costs and simpler setup, but lack the remote management capabilities and usage fee collection of networked EVSE.

Sometimes a relatively inexpensive submeter can be installed to monitor energy usage across one or multiple devices (such as EV chargers) connected to a single electrical circuit, assuming there are minimal or no additional electrical loads, such as lighting, on the circuit. Some submeters may also provide access to usage data at minimal or no extra cost. The Open Charge Point Protocol (OCPP) is an application protocol for communication between Electric Vehicle (EV) charging stations and a charging station network similar to how cell phones communicate with cell phone networks. Selecting charging infrastructure with hardware that uses the OCPP version 1.6 or higher allows for a physical distinction between the appliance features of the infrastructure and the network backend. This enables the site host to transition between charging networks effortlessly, eliminating the need for costly hardware upgrades.

Workplaces may choose networked or non-networked chargers based on their unique charging needs. For example, a large company with many EV drivers and limited EV charging equipment may choose networked EV charging stations to manage charge times, charge fees, and optimize rates according to potential utility incentives. On the other hand, a small business with only a few EV drivers may prefer cheaper non-networked charging stations.

While networking capability is usually included in DCFC offerings, and therefore available to equipment managers at no additional cost, adding networking capability to Level 2 EV chargers is estimated to cost approximately $1,945.

Consider Energy Efficiency Benefits

The U.S. Environmental Protection Agency (EPA) manages the ENERGY STAR EVSE program which allows manufacturers to voluntarily certify their products to an energy efficient specification.

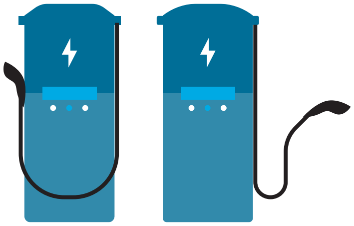
The benefits of an ENERGY STAR certified EVSE include:

- **Energy savings:** Certified EV chargers save energy when in standby mode (roughly 85% of the time that they are plugged in), reducing energy waste and charging costs.

- **Testing and verification**: Some EVSE manufacturers have made false safety and performance claims for their products. All ENERGY STAR certified products are fully tested for safety and energy use and are verified by nationally recognized independent certification bodies.
- **Communications network standards**: ENERGY STAR EV chargers use industry network communication standards. For the consumers, this means that the chargers are designed to work with a wide variety of other devices (wi-fi routers, electric utility energy management and price signals, etc.). While these communications protocols are still developing, choosing ENERGY STAR today means that you are aligning with emerging industry standards.

Lastly, there are often federal and local incentives available that can help offset the cost of ENERGY STAR-certified products. These incentives can further lower your monthly bills, making ENERGY STAR-certified EVSEs an economically and environmentally beneficial choice for consumers.

Install Charging Equipment



Planning and installation of EVSE requires the input and coordination of several stakeholders along with additional considerations. Estimated installation costs for Level 1 range from $200–$3000, Level 2 installation costs are estimated to be approximately $4,145, and DCFC installation is estimated to cost $45,506–$65,984.

Engage Your Utility

When planning for the installation of EVSE, it's critical to engage your utility early in the process to confirm the electrical capacity of your property and understand any potential upgrade needs. If upgrades are needed, utilities can provide guidance on the process and any associated costs. Some utilizes may also offer financial incentives or technical assistance to customers interested in installing EV charging equipment.

Site Charging Placement

The placement of the charger is another critical aspect to consider. Ideally, the charger should be close to the power source to minimize trenching and reduce installation costs. However, convenience and accessibility are equally important. The charger should be in a location that is easily accessible to the driver, possibly even a premium parking spot. This not only makes charging more convenient but also serves as an incentive for EV usage. Additionally, the U.S. Access Board has released Design Recommendations for Accessible EV Charging Stations to assist in the design and construction of accessible EV charging stations as EV adoption and EV charging deployment increase. Balancing these factors—proximity to power source, ease of access, and cost—will result in an optimal setup that encourages the use of electric vehicles and ensures a smooth charging experience. Always consult with a qualified electrician or EVSE supplier for proper installation and maintenance.

Comply with Relevant Codes and Permits

Policies and codes may influence the design of the physical parking space where an EV charging station is located. It is important to understand and comply with any requirements for installing EV charging equipment. Relevant policies often include building codes, parking ordinances, and zoning ordinances.

To ensure smooth project and installation timelines, it's crucial to understand permitting requirements and the time needed for reviews prior to approval. Permitting procedures can differ from one jurisdiction to another, supplying complete and correct information, building in review periods, and potential back-and-forth on project nuances can take a long time. While many local jurisdictions have created streamlined best practices for EVSE permitting processes, it is important to factor in appropriate permitting approval timelines to minimize potential delays. There may also be costs to acquire the necessary permits. Level 2 permits are estimated to cost around $283, and permits required for DCFC may cost $200-290.

Identify a Licensed Contractor

Additionally, identifying a licensed electrician is key to navigating the necessary permits and ensuring a safe and compliant installation. The electrician's expertise will be invaluable in adhering to local codes and standards, thereby avoiding potential fines or delays. To find licensed electrical contractors trained in EV charging station installation, refer to the Electric Vehicle Infrastructure Training Program (EVITP) list of contractors trained and certified in EV equipment installation.

Summary of Workplace Charging Costs

In order to provide workplace charging as an employee benefit or workplace amenity, upfront investments are needed. To support workplace financial planning, EVSE cost estimates for hardware, planning and more are provided below.

Table 2: EVSE Cost Estimates by Level[4][5]

Costs	Level 1	Level 2	DCFC
Equipment	$400–$2,000	$500-$9,000	$25,000–$167,400
Network	n/a	$1,945	included
Installation	$600	$400-$6,600	$10,797–$117,900
Labor	n/a	$2,471	$19,200–$27,840
Materials	n/a	$1,235	$26,000–$37,700
Permit	n/a	$283	$200–$290
Taxes	n/a	$156	$106–$154
Maintenance/Warranty	n/a	$400/year	$300–$3,000/year
TOTAL Cost (excl. annual costs)	**$1,000–$2,600**	**$6,990-$21,690**	**$81,303–$351,284**

Costs per charger should decrease should a property owner or manager decide to scale investments by purchasing and installing multiple chargers.

For information on available federal, state, and utility EVSE incentives, see the Alternative Fuel Data Center's Laws and Incentives Database.

Additional Resources

For more information on workplace charging initiatives, see the EMPOWER Workplace Charging website.

For more information on EV charging deployment in your area, we recommend reaching out to your local Clean Cities Coalition. Clean Cities coalitions are on the ground throughout the United States to assist with projects related to alternative fuel vehicles and infrastructure and can serve as a valuable source of information.

For more information on EV charging and planning for EV charging, please see the following resources:

- AFDC's Electric Vehicle Charging Stations webpage
- U.S. DOT's Urban E-Mobility Toolkit
- U.S. DOT's Rural EV Toolkit

[4] Columbia Willamette Clean Cities Coalition. Workplace Charging Barrier Study, https://www.cadeogroup.com/wp-content/uploads/2023/06/EMPOWER_Workplace-charging-barrier-study_FINAL_16JUN23_website-1.pdf

[5] Cost data is taken from a mix of single- and dual-port EV charging projects.