



Electric Vehicle Charging Stations/Supply Equipment (EVSE)

Electric Vehicle Supply Equipment (EVSE) consists of all the equipment needed to deliver electrical energy from an electrical energy source to an electric vehicle’s (EV) battery. This is done by securely connecting the EVSE plug to the EV to supply a flow of electricity. There are three primary types of EVSE as shown below. Level 1 and Level 2 charging provide alternating current (AC) to the vehicle which converts to direct current (DC) needed to charge the battery. The third type, DC fast charging, provides electricity directly to the vehicle’s battery. The charge times will vary depending on the type of EVSE charging equipment, on-board vehicle charging equipment, the vehicle’s battery capacity and type of battery, and how depleted the battery is.

EV Charging Stations (EVSE) Details

Level 1 (AC) Charging	Level 2 (AC) Charging	DC Fast Charging
<ul style="list-style-type: none"> • Lower Power AC • 120-volt (V) AC circuit or 20 amperes (A) • 4-6 miles of range per hour of charge • EVSE unit cost (single port) range: \$300-\$1,500 • Installation cost: \$0-3,000 • Most often used in homes, sometimes used at workplaces 	<ul style="list-style-type: none"> • Mid-High Power AC • 208/240-volt (V) AC circuit or 20-100 amperes (A) • 10-20 miles of range per hour of charge • EVSE unit cost range: \$400-\$6,500 • Installation cost: \$600-12,700 (~\$3,000 average) • Used in homes, workplaces, and for public charging 	<ul style="list-style-type: none"> • DC Fast Charging • 208/480-volt (V) AC 3-phase or 20-400 amperes (A) • 60-80 miles of range per 20 minutes of charge • EVSE unit cost range: \$10,000-\$40,000 • Installation cost: \$4,000-51,000 (~\$21,000 average) • Most often used for public charging, along heavy traffic corridors

EV Charging Station (EVSE) Charging Analysis

Level 2 Charging									
Battery at 0%		% Charged Per Hour							
Charging Hours		1	2	3	4	5	6	7	8
Battery Size	100 kWh	7%	13%	20%	26%	33%	39%	46%	52%
	50 kWh	13%	26%	39%	52%	65%	78%	91%	104%
	25 kWh	26%	52%	78%	104%	-	-	-	-



Level 2 Charging								
Battery at 50%		% Charged Per Hour						
Charging Hours		1	2	3	4	5	6	7
Battery Size	100 kWh	57%	63%	70%	76%	83%	89%	96%
	50 kWh	63%	76%	89%	102%	-	-	-
	25 kWh	76%	102%	-	-	-	-	-

DC Fast Charging					
Battery at 0%		% Charged Per Hour			
Charging Hours		0.5	1	1.5	2
Battery Size	100 kWh	13%	25%	38%	50%
	50 kWh	25%	50%	75%	100%
	25 kWh	50%	100%	-	-



EV Charging Station (EVSE) Options

EVSE units are available from different vendors with a variety of designs and features. The type and quantity of EVSE chosen for a site will depend on the intended users, site specific conditions, and business case for the station.

Option 1: ChargePoint (both EVSE hardware provider and network service provider)

ChargePoint Charging Station Installation Cost Scenarios	
Model CPF25 32A Single-Port Level 2 EVSE – Wall Mount	\$1,500.00
Model CPF25 32A Dual-Port Level 2 EVSE – Pedestal Mount	\$3,675.00
Model CT4023 32A Dual-Port Level 2 EVSE – Wall Mount	\$6,190.00
Average Fleet Plan cloud service cost	\$1,000.00
Average installation cost	\$6,000.00
Average total EVSE costs:	\$8,500 - \$13,190.00

For exact info on pricing for ChargePoint products, contact Jimmy Smith at jimmy.smith@chargepoint.com.

Option 2: Greenlots (network service provider)

This option includes choosing one of Greenlots' EVSE software solutions and EV chargers from one of Greenlots' partner EVSE hardware providers (e.g., BTC Power, Efacec, EVSE LLC) best suited for the site and charging needs.

Greenlots SKY™ EV Charging Network Software Estimate	
SKY Back Office License (per EVSE port per year)	\$240.00
Data Plan (per pmt/gateway module per year, 1-4 ports)	\$202.50
Total costs (including transaction fees)	\$897.50

For exact info on pricing for Greenlots products, contact Michael Smucker at msmucker@greenlots.com.

Option 3: BTC Power (hardware provider)

BTC Power Charging Station Installation Cost Scenarios	
30A Dual-Port Level 2 EVSE – Wall Mount	\$3,600.00
40A Dual-Port Level 2 EVSE – Wall Mount	\$3,900.00
70A Single-Port Level 2 EVSE – Wall Mount	\$4,350.00
Average installation cost	\$6,000.00
Average total EVSE installation costs	\$9,600 - \$10,350.00

For exact info on pricing for BTC Power products, contact Don Jarecki at djarecki@btcpower.com.

Option 4: EVSE LLC (hardware provider)

EVSE LLC Charging Station Installation Cost Scenarios	
Model 3703 30A Level 2 EVSE – Wall Mount	\$2,605.50
Model 3704 30A Level 2 EVSE – Wall Mount	\$3,343.50
Model 3722 30A Level 2 EVSE – Ceiling Mount	\$3,390.00
Operating Software cost (Greenlots network)	\$897.50
Average installation cost	\$6,000.00
Average total EVSE installation costs	\$9,503 - \$10,287.50

For exact info on pricing for EVSE LLC products, contact Dean Spacht at dspacht@controlmod.com.



Appendix A

Charging Basics

If your organization is interested in providing employees with workplace charging, it will help to become familiar with electric vehicle supply equipment (EVSE). There are multiple types of EVSE, which differ based on their communication capabilities and how quickly they can charge a vehicle

Types of Charging Equipment (EVSE)

EVSE is the equipment used to deliver electrical energy from an electricity source to a PEV. EVSE communicates with the PEV to ensure that an appropriate and safe flow of electricity is supplied. EVSE for PEVs is classified according to the rate at which the batteries are charged. Two types—Level 1 and Level 2—provide alternating-current (AC) to the vehicle, with the vehicle's onboard equipment (charger) converting AC to the direct current (DC) needed to charge the batteries. The other type—DC fast charging—provides DC electricity directly to the vehicle.

Charging times range from less than 30 minutes to 20 hours or more, based on the type or level of EVSE; the type of battery, its capacity, and how depleted it is; and the size of the vehicle's internal charger. EVs generally have more battery capacity than PHEVs, so charging a fully depleted EV takes longer than charging a fully depleted PHEV.

- Level 1
 - Level 1 EVSE provides charging through a 120-volt (V) AC circuit and requires electrical installation per the National Electrical Code. Most, if not all, PEVs come with a Level 1 EVSE cord set. On one end of the cord is a standard, three-prong household plug (NEMA 5-15 connector). On the other end is a J17725 standard connector, which plugs into the vehicle.
 - Level 1 typically is used for charging when only a 120-V outlet is available, such as at some residential and workplace locations. Based on the battery type and vehicle, Level 1 charging adds about 2 to 5 miles of range to a PEV per hour of charging time.
- Level 2
 - Level 2 EVSE can easily charge a typical EV battery overnight, and it is a common installation for residential, workplace, fleet, and public facilities. Level 2 EVSE offers charging through a 240-V (typical in residential applications) or 208-V (typical in commercial applications) electrical service. These installations are generally hard-wired for safe operation (although a wall plug connection is possible). Level 2 EVSE requires installation of charging equipment and a dedicated circuit of 20 to 80 amp (A) depending on the EVSE requirements (Figure 1). Most Level 2 EVSE uses a dedicated 40 A circuit. As with Level 1 equipment, Level 2 equipment uses the J1772 connector. Based on the battery type, charger configuration, and circuit capacity, Level 2 charging adds about 10 to 20 miles of range to a PEV per hour of charging time, depending on the power level of the onboard charger.
- DC Fast Charging
 - DC fast-charging EVSE (sometimes referred to as DC Level 2 EVSE) enables rapid charging and is generally located at sites along heavy traffic corridors and at public fueling stations. Some DC fast-charging units are designed to use 480-V AC input, while



others use 208-V AC input. A DC fast charger can add 60 to 80 miles of range to a light-duty PEV in 20 minutes. DC fast-charging is not commonly used as a workplace charging option. Workers' vehicles are typically parked for several hours at a time, so they don't require rapid charging at work.

Connectors and Plugs

Today's EVSE and PEVs have standard connectors and receptacles based on the J1772 standard developed by SAE International. Vehicles with this receptacle can use any Level 1 or Level 2 EVSE. Most major vehicle and charging system manufacturers in the United States support this standard, which should eliminate concerns about vehicles' compatibility with charging infrastructure. Most currently available PEVs that are equipped to accept DC fast charging are using the CHAdeMO connector (see image above). SAE International recently developed a "hybrid connector" standard for fast charging that adds high-voltage DC power contact pins to the J1772 connector, enabling use of the same receptacle for all levels of charging.

EVSE Ownership and Payment Models

A growing number of vendors not only sell Level 2 equipment but also offer installation and ongoing service and maintenance. Some vendors of EVSE units require drivers to subscribe to a charging service that uses credit card, cash, or radio-frequency identification (RFID) devices to control access to the EVSE and to enable the owner of the EVSE to collect usage data and payments for charging. Owners can also set up charging to be free for all or some users. Some EVSE vendors share in the revenue generated by the EVSE and charge service fees for managing payment transactions, maintenance, and troubleshooting services.

Some workplace charging hosts may decide to purchase, install, and operate stations themselves. This model gives the host or owner control of the station and its revenues. For example, a parking lot owner might buy and operate a pay-for-use charging station as part of its business strategy.

Installation

Installation costs for fleet sites are generally lower than workplace and public sites. This is partly due to installation without public access, lower permitting related costs, and because fleets typically are better able to minimize cost through optimal siting choices. The EPRI study determined that Level 2 EVSE at fleet sites cost, on average, \$2,018 per port and \$2,109 per EVSE (refer to Figure 11).

Tips for Minimizing EVSE Costs

EVSE Unit Selection

- Choose the EVSE unit with the minimum level of features that you will need.
- Choose a wall mounted EVSE unit, if possible, so that trenching or boring is not needed.
- Choose a dual port EVSE unit to minimize installation costs per charge port.
- Determine the electrical load available at your site and choose the quantity and level of EVSE units to fit within that available electrical capacity.

Electric Vehicle Service Equipment – Detailed Overview



Location

- Place the EVSE unit close to the electrical service to minimize the need for trenching/boring and the costs of potential electrical upgrades.
- Instead of locating the EVSE at a highly visible parking spot a great distance from the electrical panel, use signage to direct PEV drivers to the EVSE unit.
- If trenching is needed, minimize the trenching distance.
- Choose a location that already has space on the electrical panel with a dedicated circuit.

Long Term Planning

- Contact your utility early in the planning stages to discuss electricity consumption and demand charges as well as electrical service needs. Avoid utility demand charges by balancing charging time windows with other electricity usage and working closely with your utility.
- Consider the quantity and location of EVSE that you plan to install over the next 10-20 years when installing your first unit. Upgrade your electrical service for your anticipated long term EVSE load and run conduit to your anticipated future EVSE locations. This will minimize the cost of installing future units.
- Consider the electricity infrastructure for EVSE when building a new facility. It is less expensive to install extra panels and conduit capacity during initial construction than to modify the site later.

2019 Model Year Smart City EV Pricing

Lease Purchase Comparison					
2019 Vehicle Models	Mike Albert	Ricart Ford	Byers	Savings	Plan
Nissan Leaf	\$22,304.12	\$23,310.00	-	\$1,005.88	Lease
Chevy Bolt	\$30,749.40	-	\$33,878.00	\$3,128.60	Lease
Ford Fusion Energi	\$31,455.43	\$28,552.78	-	\$2,902	Purchase