# Estimate Power & Charging Station Needs

It is important to estimate the power demands for your new EVs so you can identify the number and types of charging stations you will need for each location. The power demand is based on each vehicle's duty- and drive-cycles and the levels of charging required.

Provided below are details about:

- Things to consider
- Calculating how much electricity is needed to charge EVs
- Calculating the charging load profile

## Things to consider

- Consider what ratio of charging stations and nodes are needed for your EVs. Do you require one L2 charging station for each EV, or will one L2 station for multiple EVs with load management fit the fleet? Or are your needs so big that your fleet requires a DCFC drive-through location?
- How long will it take to charge each of the EVs you are considering? A good resource for this information for light-duty vehicles is the Enphase charging schedule.
- Depending on your organization's fueling, electrical and mileage data, and reporting needs, discuss managed/networked charging, which could save time and money
- To control charging costs, determine the level of charging that best fits your EV fleet. Discuss:
    - Typical parking and travel patterns.
    - Where charging will occur for specific EVs: on site at a fleet depot, distributed throughout the property, or at the employee's residence?
    - When will charging occur: overnight or during the day?

## Calculating how much electricity is needed to charge EVs

EV power consumption varies by time of day, mileage, battery temperature, weather (heater or air conditioning use), driving route, topography, and time the vehicle sits idle (dwell time). Knowing your EV fleet's power demand is important for:

- Evaluating the capacity of your facility's electrical system to meet these needs
- Limiting utility demand charges while meeting the charging needs of multiple vehicles

If you are adding a small number of EVs to your fleet, a simple method for estimating power demand looks at average and/or peak miles traveled per day divided by average miles per kWh for the target vehicle, as follows:

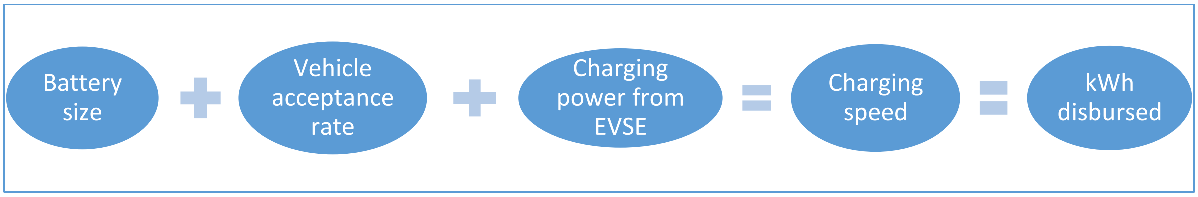
$$Power\ demand\ for\ an\ electric\ vehicle\ (kW) =$$

$$\frac{vehicle\ energy\ consumption\ \left(\frac{kWh}{mi}\right) \times\ max\ daily\ mileage\ (mi)}{Vehicle\ dwell\ time\ (hours)}$$

For many plug-in hybrid EVs or EVs with low demand (e.g., small utility vehicles, forklifts, landscaping equipment, or ATVs), a standard wall outlet on a dedicated circuit may meet the charging need.

For EVs that travel 50 or more miles daily, L2 charging will likely be required to provide enough power. Facilities with a 600 A panel can often handle the addition of several L2 charging ports, but higher power is often needed to charge medium- or heavy-duty vehicles.

The graphic below illustrates factors used to more closely estimate the amount of electricity and time required to charge each EV in a fleet. The combined result for all EVs is referred to as the fleet's maximum power demand or load profile, useful when thinking about installing L2 or DCFC charging stations, and for scheduling how and when to charge different vehicles. Many of a fleet’s EVs will not need to be charged at the same time or up to 100%.




*Amount of electricity and variables to charge EVs in a fleet*

Where:

- Battery size is measured in kWh.
- Vehicle acceptance rate is the amount of power the on-board charger provides the battery when charging, in kW. Get this information for specific models from the vehicle specs.
- Charging power from EVSE, from 3.8 kW to 7.6 kW (on a 30 A to 40 A circuit).
- Charging speed, such as L2 or DCFC.
- kWh disbursed is the electrical capacity (the energy needed to charge vehicles at the highest capacity).

Also consider duty cycles, drive cycles, and dwell cycles for the EVs you plan to charge. This value is calculated by type of EVSE and time of day when charging will occur.

- The **duty-cycle** is the time of day the fleet (or vehicle) may be in use. Additional duty-cycle information could include the hours or shifts per day, days per week, total miles per cycle, and average or peak load profiles.
- The **drive-cycle** includes the maximum and average speeds, number of stops, and idle time.
- The **dwell time or charging window** is the period of time in the vehicle’s duty cycle when it is idle or parked and can be charged.

## Calculating the charging load profile

EVs typically don’t use a full battery charge each day. When calculating the power demand or load profile for your EVs at the highest capacity, investigate the time of day (or night) available to charge using data about usage and mileage. This may require knowing if employees take their work vehicles home and charge them there, or if the vehicles are left at a fleet site or other agency site to charge overnight.

| Calculating the charging load profile | |
|---|---|
| Mileage expected for typical duty cycle | Duty cycle includes mileage, where it is parked, and how long it is parked each day or night |
| Battery size | Battery size and kWh to charge the vehicle. The Nissan Leaf may be 24 kWh at 3.3, or 60 kWh at 6.6 kW; the Chevrolet Bolt at 7.6 kW; or Tesla at 9.6 kW or 11.1 kW. |
| Location of charging depot or distributed | For L2 at 240 V, vehicles may charge for 4 to 8 hours.<br>DCFC charging may add 26 miles per hour in 30 min at 480 V (3 phase). |