Washington
Green Transportation Program
Moving forward with Washington's public fleets

Estimate Power & Charging Station Needs

By estimating the power demands for your new EVs, 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.

Estimate Power Demand

Consider the following factors:

- 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.
- If you will use managed/networked charging, which could save time and money depending on your organization's fueling, electrical and mileage data, and reporting needs.
- Level of charging that best fits your EV fleet to control charging costs. 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?

Calculate energy 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 to:

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

If you are adding a small number of EVs to your fleet, you can estimate power demand by taking the average and/or peak miles traveled per day and dividing by the average miles per kWh for the target vehicle, as shown here:

Power demand for an EV (kW) =

[EV energy consumption (kWh/mile) x maximum daily mileage (miles)]

÷ 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.

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

The amount of electricity and variables that impact how fast EVs will charge are:

- Battery size measured in kWh
- Vehicle acceptance rate: the amount of power the on-board charger provides the battery when charging, in kW (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: electrical capacity (energy needed to charge vehicles at the highest capacity).

The combined result for all EVs is 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.

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.

- **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.
- **Drive cycle** includes the maximum and average speeds, number of stops, and idle time.
- **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.

Calculate the Charging Load Profile

EVs typically don't use a full battery charge each day so many fleet EVs will not need to be charged at the same time or up to 100%.

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.

When calculating the charging load profile, consider:

- **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 and kWh to charge the vehicle**. The Nissan Leaf may be 24 kWh at 3.3 kW, 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 charging**. For L2 at 240 V, vehicles may charge for 4 to 8 hours. For DCFC, charging may add 26 miles per hour in 30 minutes at 480 V (3 phase).

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