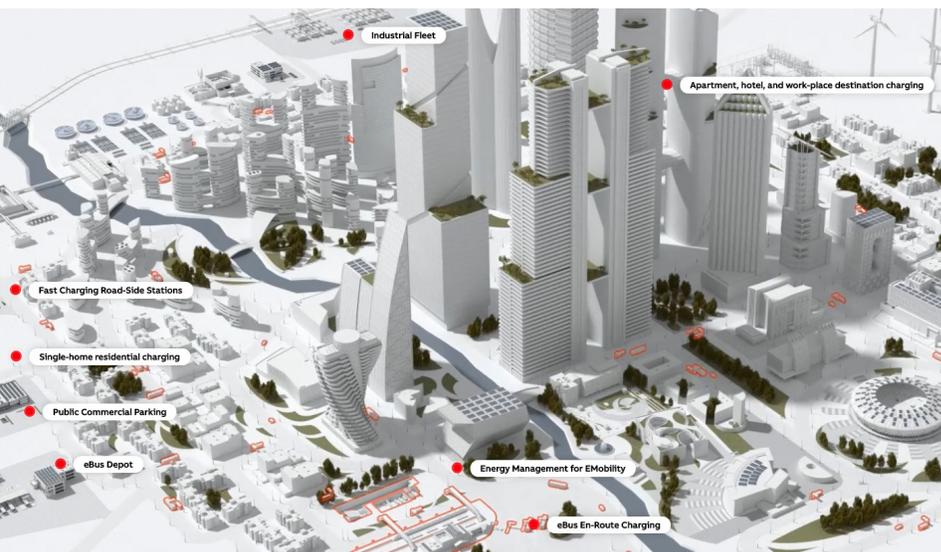


# EV Infrastructure Technology Guide

## Finding right-sized charging solutions



The highest quality EV charging sites will only be as successful as their planning, implementation and operation. Finding the charging technology that is best suited for each site is a key enabler to that success.

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Considerations for right sizing a charging site starts with meeting the needs of EV drivers and EV fleets.

### Growth means more choices

Electric vehicle drivers are increasingly relying on public charging infrastructure to enable their daily travel and extend driving range. Larger battery EV's are also prompting longer distance travel across highway corridors. As such, new technologies are being developed to meet those needs. Choosing the best site fit is critical to commercially successful charging infrastructure.

### Right sizing for time-based needs

Charging technology choices are expanding in power range and capability, but they also need to fit driver needs in order to be commercially successful. Next generation EVs will be able to charge at significantly higher powers than today, but they won't always need the same rates of charge. Right-sizing for sites to find the best technology for the parking use case is key.

Drivers of long-range EVs will appreciate a quick ten minute charge while stopped for a quick break along an interstate highway, or while on route to the next city. But they will also be satisfied by a one hour charge at a restaurant or shopping mall that they frequent in their community, or an eight hour charge while they are at work.

Electric fleets span more use cases and require charging equipment tailored to their needs. For some fleets, such as those with smaller vehicles, they may be fine with an overnight charge on a high power AC or low power DC charger. Conversely, fleets with extremely large batteries, such as buses or large trucks will require much faster charging for both depot and on-route needs. Additionally, a fleet may consist of vans, last mile delivery vehicles or school buses which require charging powers that may span technologies based on size of fleet and available power.

### Voltage output considerations

Today, most passenger vehicles use a 400 VDC battery architecture. Most DC fast chargers can accommodate this 400 VDC requirement. However, many new fleet vehicles, large trucks and buses - and a few premium EVs - may have a requirement for higher voltage. Where electric vehicles require a higher voltage unit to charge correctly, where many fleet vehicles may demand 550 to 800 VDC, the battery design must be considered when charging systems are chosen.

## Public and fleet EV charging

AC Level 2	Destination DC	DC Fast	DC High Power
3 to 19 kW	20 to 24kW	50 to 180 kW	150 to 600 kW+
4 to 24 hours	1 to 4 hours	15 to 60 min	5 to 20 min
<ul style="list-style-type: none"> <li>Office, workplace</li> <li>Multi family residential</li> <li>Hotel and hospitality</li> <li>Overnight fleet</li> <li>Supplement fast charging sites for PHEV use</li> </ul>	<ul style="list-style-type: none"> <li>Office, workplace</li> <li>Retail and public commercial parking</li> <li>Dealerships</li> <li>Urban or overnight fleets</li> <li>Sensitive power supply locations</li> </ul>	<ul style="list-style-type: none"> <li>Retail, grocery and dining</li> <li>Convenience fueling stations</li> <li>Highway truck stops and travel plazas</li> <li>Fleet depots</li> <li>OEM R&amp;D</li> </ul>	<ul style="list-style-type: none"> <li>Highway corridor travel</li> <li>Metro 'charge and go'</li> <li>Large commercial and private fleets</li> <li>Bus, medium and heavy duty vehicles</li> <li>OEM R&amp;D</li> </ul>

This chart shows common power ratings and average charge times for public EV infrastructure solutions. Variance among power and charge times relate to vehicle capabilities (charging protocol, BMS, environmental conditions),

battery capacity (state of charge, overall kWh capacity) and charging hardware power rating. Level 1 EVSE is not included in this chart as is extremely limited for most fleet, public and/or fee-based charging applications.

It's important to note that innovations in batteries and charging technologies are evolving rapidly. Many parameters and rules of thumb will change over time, making future-proofing an essential strategy when selecting charging infrastructure.

### Other siting considerations

In addition to matching the right technology to the site and use case, there are many more factors that should be considered when implementing charging infrastructure.

Of paramount importance is electrical and personal safety. Drivers should be assured that when they stop to recharge, they also have access to dusk-to-dawn area lighting, shelter for inclement weather and clean restrooms. Security cameras are a best practice not only to aid driver comfort but may also act as a vandalism deterrent. A similarly safe and well-lit environment is important to the fleet workforce who operates charging infrastructure around the clock in all conditions.

Siting must also consider the availability of safe and convenient ingress and egress, appropriate electric power delivery, and local grid capacity to meet

higher power charging needs. Placement of charging sites need not be next to building entrances, but sometimes it is a necessity due to location of power availability.

The most successful public locations will offer drivers options for meals and refreshment. Existing truck stops, travel plazas, convenience stores and near-highway commercial centers have been shown to be most successful in attracting consumers while also having also some civil and electrical infrastructure already in place.

For fleet operations, infrastructure needs to be compact and extremely reliable for high utilization scenarios - as well as scaled and future-proof to manage growth and prove out return on investment.

Underscoring the success of charging deployments is a commitment to supporting connectivity, uptime, and long-term asset management. This not only assures drivers that they can depend on public sites, but that operators of both public and fleet charging infrastructure can realize a successful business model.

### ABB Inc.

950 W Elliott Road, Suite 101  
Tempe, AZ, 85284  
United States  
Phone: 800-435-7365  
E-mail: US-evci@us.abb.com

### ABB Inc.

800 Hymus Boulevard  
Saint-Laurent, QC H4S 0B5  
Canada  
Phone: 800-435-7365  
E-mail: CA-evci@abb.com

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