Technical Article

Misconceptions About EV Charging

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The electric vehicle (EV) charging industry is growing fast, given commitments from car manufacturers worldwide to sell only EVs in the future, and assistance from governments to build fast, reliable charging networks. These EVs will need EV charging stations that are fast, efficient and powerful.

In this article, I'll go over some misconceptions about EV charging.

Misconception No. 1: You Can Charge an EV Directly with AC Power.

Yes, there are EV chargers that will charge an EV directly with AC power, relying on the onboard charger to convert AC into DC and then ultimately charging the EV battery with DC. But there are also EV chargers that first convert AC power into DC and charge the EV battery directly by bypassing any onboard AC to DC conversion. Generally, DC chargers operate at higher power levels, which reduces charging times.

Misconception No. 2: All EV Charging Stations Use the Same Charging Technology.

EV charging stations use various technologies. There are chargers that directly charge the EV with AC power by leveraging the onboard charger to convert AC into DC.

There are also EV chargers called DC chargers that convert AC into DC and directly charge the EV battery by bypassing the onboard AC to DC conversion. It is possible to adopt different power topologies for AC conversion to DC.

Misconception No. 3: EV Chargers Have the Same Power Levels.

EV chargers (or charging piles) are divided into multiple power levels, as shown in Figure 1. Levels 1 and 2 are AC chargers up to 20 KW. Level 3 comprises fast DC chargers that are typically 50 KW and above and can go as high as 350 KW.

EVSE Type	Power Supply	Charger Power	Charging time Battery EV (BEV)
Level 1 (AC Charging)	120VAC 12 A to 16 A (Single Phase)	~1.44 kW to ~1.92 kW	~17 Hours
Level 2 (AXC Charging)	208 ~ 240 VAC 15 A ~ 80 A (Single/Split Phase)	~3.1 kW to ~19.2 kW	~7 Hours (3.3 kW on-board charger) ~3.5 Hours (6.6 kW on-board charger)
Level 3 (Combo Charging System or DC Charging	200 to 920 VDC (Max 500 A) (Poly Phase)	From 120 kW up to 350 kW	~10 to 30 Minutes

Figure 1. Table of EV Charger Classifications

Misconception No. 4: EV Charging Stations Are Operated by Grid or Electrical Utility Companies.

This is not true. While it is possible for grid and utility companies to operate charging stations, some automakers operate their own network of charging stations, which other EVs can use. There are also third-party charging station network operators that are neither electric utility companies nor EV original equipment manufacturers.

Misconception No. 5: High-level Chargers Are More Power-efficient.

Power topology, control method, and design and component selection can greatly affect the overall power efficiency of a charger. As an example, zero-voltage switching and zero-current switching power topologies can greatly reduce switching losses and therefore boost power efficiency.

On the other hand, low-level chargers are not more efficient than high-level chargers. Low-level chargers rely on an onboard charger to convert AC to DC and then charge the EV battery. Ultimately, because a variety of components determine charger power efficiency, it is not possible to explicitly state that a particular charger level is more efficient than another. Typical efficiencies are between 95% and 99%, depending on the implementation.

Misconception No. 6: High-voltage EV Chargers Are Known for Being Less Reliable.

With new battery technologies emerging, car batteries are moving to voltages 800 V and higher. With this trend likely to continue, a common question that EV charger designers will have is how to maintain your isolation rating and system reliability.

Technologies for solar energy (solar inverters), where DC bus voltages are in the range of 1,000 V to 1,200 V, are widely popular in EV charging designs. Those isolation technologies have been proven over more than a decade and are well-known for being reliable.

Misconception No. 7: EVs Still Require That Drivers Go to a Charging Station to “Fill up” – Just like Gas Stations.

Many different options for charging at home are available, and consumers can automatically charge their EVs automatically when electricity rates are lower – at night, for example. Most modern homes, or those with an attached garage, will have 240-V plugs available that enable charging rates between 100 to 200 miles worth of range.

Even the lowest-power chargers installed in a home garage and connected to a standard 120-V plug can charge 40-60 miles worth of range per night. For most drivers, charging daily at home is the easiest and most convenient option.

Misconception No. 8: EVs Take Too Long to Charge, and DC Charging Stations Don’t Charge That Much Faster.

A DC charging station is a Level 3 charger that can accommodate power levels in the range of 120 to 240 kW. This type of charging station uses an external charger to supply high-voltage (300 V to 750 V) DC at up to 400 A directly to the vehicle’s battery. Level 3 chargers typically charge batteries to an 80% state of charge in under 30 minutes.

It is possible to stack modular converters to achieve even higher power levels. Various standards worldwide (such as the ChaoJi standard) allow power levels as high as 900 kW for Level 3 chargers, which will drive charge times as low as 10 minutes, depending on battery capacity.

Misconception No. 9: There Is No Need for a Wireless Network Between EV Chargers and the Cloud.

Given the limited power supply that buildings have, it is necessary to have a wireless network between EV chargers and the cloud. A wireless network enables users to manage the overall EV charging load in real time.

Additionally, a wireless network aids in controlling power distribution at each EV charging point. A wireless network also makes room for the possibility of saving electricity costs by charging EVs during off-peak hours.

Misconception No. 10: Existing Building Infrastructures and Parking Spaces Are Already Pre-wired for EV Charging.

When installing new EV charging stations, wireless connectivity is the most convenient solution. The wireless connectivity standard needs to manage difficult radio-frequency environments and data throughput and latency requirements – typically, a 1/s update rate for charging data. The inclusion of wireless connectivity (meshed networks) helps make a system scalable for hundreds and thousands of EV chargers.

Misconception No. 11: Connectivity Does Not Play a Role in EV Charging.

Connectivity assists EV charging efforts by helping satisfy user interface and access control requirements. It enables the management of access control from the cloud, often through user smartphone apps. Additionally, connectivity permits the transmission of billing information and occupancy data to the cloud.

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