



# 19 kWh electric vehicle charging

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Trading a gas pump for a plug is a wonderful thing. It's far more convenient, takes less of your time, and saves you from breathing toxic fumes and smelling like gas for hours after fueling. Charging is a different experience than pumping gas and understanding the subtleties takes time. I've been driving electric for over two years and I'm still learning. Potential EV owners might want to get a head start on the learning curve, and maybe save a bunch of money as a result.

Mostly, I'll relate how charging works for a Nissan Leaf, a four-door, five-passenger hatchback with a range of about 100 miles, but I'll also mention other plug-in vehicles. The Leaf is intended for typical daily driving, which for 78% of drivers in the US means 40 miles or less per day. Occasional longer trips are possible and understanding charging will help you evaluate whether an EV will suit your driving needs.

Level 1 charging is the technical jargon for plugging your car into an ordinary household outlet. For a Leaf, this means about 4.5 miles of range per hour of charging, or about 22 hours for a full charge. Wow, does that sound terrible! But there's a problem with thinking this way: you'll rarely need to do a full charge from flat empty to full. If you drive 40 miles per day and charge overnight, you'll be back to full in 9 hours. When you're sleeping, it doesn't matter if it takes one hour or 9 hours to charge.

But what if you have to drive a lot one day, say 80 miles? Sure, it would take 18 hours to get a full charge, but with a 9-hour overnight charge, you'll be ready for your normal commute the next day. If you drive less than 40 miles per day or charge for more than 9 hours, you'll work back up to a full charge over the next few days.

If you need to drive 80 miles on consecutive days, you'll need an alternative. Maybe you'll drive your other car, that gas-burner you keep around for long trips, or if there's public EV charging in your area, you can charge away from home while you're parked to do your shopping or other errands.

Level 1 charging at work could also be a supplement for people driving over 40 miles per day, or even a substitute for those who can't charge at home (because they don't have a garage or fixed parking place, for example).

Since it's easy to get 40 miles of range charging overnight from 120V, Level 1 is perfectly suited for overnight charging of the Chevy Volt, a plug-in hybrid with a 40-mile all-electric range.

Although Level 1 charging is generally too slow for a road trip, it can be helpful as destination charging. Cathy and I drove 90 miles to San Juan Island, charged for a few days in a friend's garage when not cruising around the island, and left with a full charge. That was great, but I wouldn't want to have to

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wait for Level 1 charging in the middle of a travel segment.

Beyond range issues, Level 1 may not be suitable for primary charging in all cases. In extreme climates, more power may be required to maintain proper battery temperatures. In these cases, Level 2 charging may be more appropriate (see below).

At the other end of the spectrum is DC Fast Charging, the fastest type of charging currently available. It provides up to 40 miles of range for every 10 minutes of charging. These stations are expensive (up to \$100,000) and require more power than your house, so you'll never have one of these in your garage.

They are going to start appearing as public charging stations in the next year, beginning in the Leaf target areas. If there's one conveniently located near where you drive, you can get back up to 80% of a full charge while getting lunch or drinking a latte. Charging this fast makes it far more practical to drive beyond an EV's single-charge range in one day. It's still not going to make a one-day 800-mile drive practical, but a 200-mile drive with a couple of charging breaks can be quite doable.

Between the cheap Level 1 and expensive DC Fast Charging stations sits Level 2 charging. Level 2 supplies 240V, like what an electric dryer or oven uses. It goes through a box and a cord that improves safety by waiting to send power to the plug until it's plugged into an EV. Level 2 allows for a wide range of charging speeds, all the way up to 19.2 kilowatts (kW), or about 70 miles of range per hour of charging.

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