# All you need to know about charging your electric or hybrid car

When it comes to buying a battery electric vehicle (BEV) or plugin-hybrid (PHEV) for the first time there's an important thing to know - where and how to charge your vehicle. It isn't as scary as you think!

For the most part you will charge your car at your home car port or in the garage. There is a fast-growing network of public and private charging points that you'll have access to too. In this guide we will cover all the issues you need to understand from the get-go and demystify this strange new world from plugging in at home to the accepted etiquette of using a public fast charger.

## Home charging

Home charging using a Level 1, standard grounded 120 volt alternating current (AC) plug should be all you need for a commute to work and back. Most US commutes are less than a 40 mile round trip and a 120V socket will give you around 50 miles per overnight charge.

You will pay standard electricity use fees for doing this - just a few cents per mile at most. All BEV and PHEV cars have a socket and cable for this, and the onboard charging unit will assess the suitability of the charger before allowing the charge to continue.

For added expense you can install a 240V AC, Level 2 charger in your car port or garage. With a bigger current you should be able to at least double your range per hour of charging over the 120V standard. Be prepared to pay $2000 including installation as against around $500 for the 120V system.

Even with the added expense involved in installing the Level 2 charger you will soon find the costs per mile plummet by comparison to gasoline. The fast charger will pay for itself very quickly thanks to the minute cost of electricity over gas.

Another advantage of home charging is that you can get a 100% charge - as we will discuss later in this guide, you will find that a direct current (DC) fast charger will only fast-charge the battery to 80% before slowing down to a trickle to protect the battery.

As a general rule, EV batteries last longer if you slow-charge them than if you fast-charge them regularly. Charging at home could add tens of thousands of miles to your EV battery life if you only rarely fast-charged it.

If you are driving a plug-in hybrid (PHEV) you may find that you cannot charge your vehicle any more quickly than than a Level 2 charge, and Level 1 on older models.

## Charging at the workplace and malls

More and more stores, companies and government offices are offering private access car charging stations. This could mean you can charge at work, at both government and private organisations, or plug in while you shop.

You will generally find that employee and customer charging points are Levels 1 or 2 compatible and

only rarely fast charging as there are considerable cost implications in installing a DC fast charger.

There are benefits for the organisations in question. Setting up a charging point can be used to help with their corporate social responsibility obligations and offset other greenhouse gas emissions.

As an employee perk these charging stations can be invaluable, potentially allowing you to avoid installing a home charger. As a customer at a shopping mall you can charge your car over 3-4 hours while inside, an added benefit of visiting the stores.

Some of these charging points are free to use, though some charge a fee. Even so these fees are well below what your colleagues at work are paying at the gas pump and anyway, how many businesses have ever installed a gas pump in their car park for employees to use?!

## Fast charging

One of the complaints levelled at electric vehicles is that you cannot charge them as quickly as you can a gas powered (internal combustion engine or ICE for short) car by putting fuel in them. Though this forgets the fact that you don't have to leave your home to charge your car unlike an ICE car the mud has stuck in the public imagination.

You can fast-charge your car in an hour or less using a CHAdeMO, CCS or Tesla Supercharger. Broadly speaking, Japanese BEV models like the Nissan Leaf take CHAdeMO, and European and US models like the Chevy Volt take CCS. Teslas only take Tesla! CCS can offer faster charging times (up to 300kW) than CHAdeMO though a new CHAdeMO 2.0 system that provides competitive speeds to CCS could be on the US road network soon.

Despite more and more cars hitting the road that take CCS, there are far more CHAdeMO fast chargers on the US road network than CCS at present. The market will lead this change with supply being adjusted to meet demand. It won't happen overnight though.

For a longer road trip using a fast charging network you would drive 2-3 hours and have a break to stretch your legs and eat as you recharge the car. Many electric car navigation systems will advise shorter and longer charges for a more efficient route so you aren't doing very long legs with long stops - more a series of shorter stops and legs with one or two longer runs and longer charges to minimise your overall journey time.

The main drawback of fast charging is that it impacts long-term battery life. Essentially the more you slow-charge the battery the less it degrades. The heat and energy exchange of a fast-charge will lead to irreversible chemical changes within the cells that will kill them off more quickly than slow-charging.

Another point to remember is that the fast charger will only charge your battery to 80% at top speed before slowing to a trickle. This again is to protect the battery - an overcharged cell will explode.

Your car's computer will limit the charging station's power into your battery to the optimum for the vehicle. That is to say a battery capable of taking 40 kilowatts (kW) of power hooked up to a 300kW CCS charger will only take 40kW. As battery technology improves and more cars get faster charging-capable batteries so the new owners will be able to spend less time charging and more time driving.

A final point? High powered DC charging points cost a lot of money to install and those companies putting them in have to recover their costs. This is why you will pay a lot more per kilowatt-hour of electricity on a fast charger than you will on a Level 1 or 2 charger. On every level it pays just to trickle charge your vehicle at home, the mall or at work!

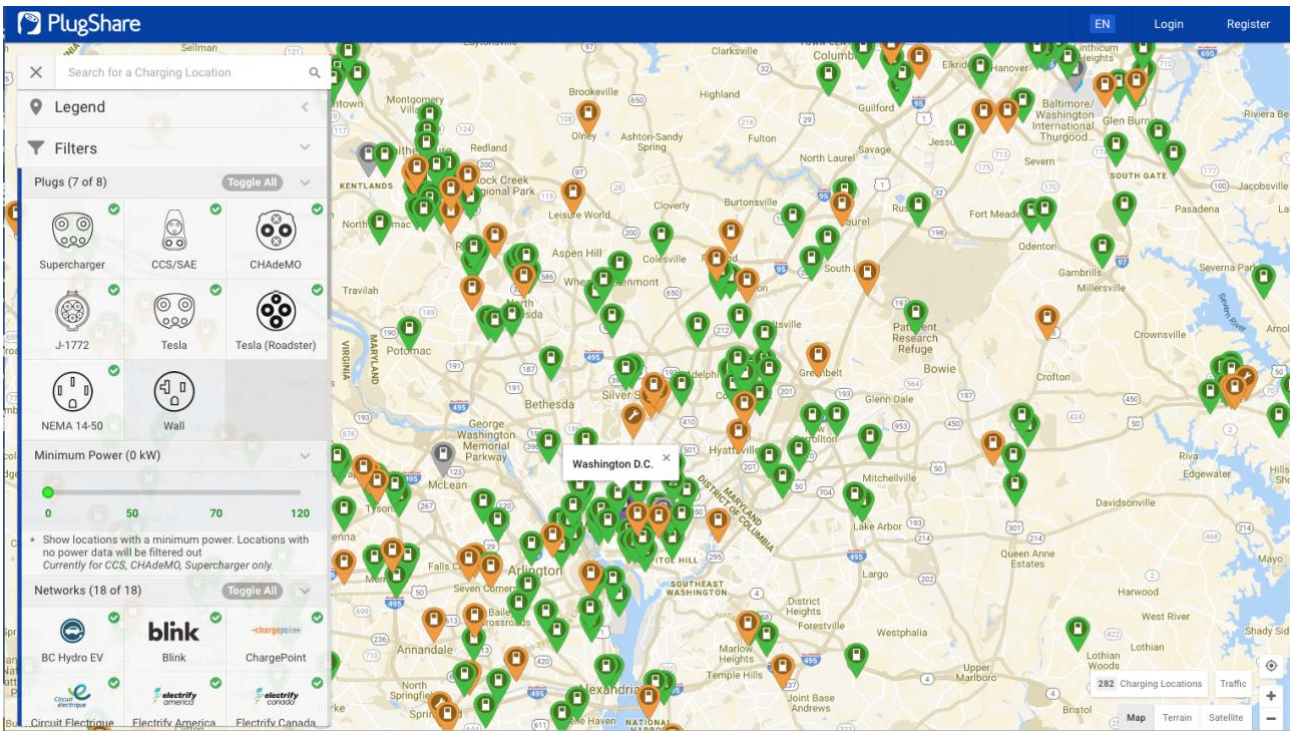
## Charging networks

A number of businesses have got into charging in much the same way as different oil companies sell gas at the forecourt. Unlike forecourts you will not find someone in a booth nearby to pay, but instead you will pay using a variety of means.

A common charging network system is via paid membership to access the charging points. Many (but not all) of these will offer pay-as-you-go charging but at a higher rate than charged to members. Others are purely pay-as-you-go but you will need a phone app to organise the charging. Tesla offer up to 10,000 miles of free charging annually depending on how you buy your car.

To add to this, some charging companies have denser networks in some states and cities in the US than others so on an interstate journey you may need to join up with a number of them to have a trouble-free journey.

The array of membership and payment schemes can be confusing and irritating until you get your head around it. It is a case of knowing your territory and once you do, so you will be able to go about your business.




## Charging apps

There are a number of smartphone charging map apps that show you your nearest charging point in a given area. Tesla and other BEV in-car navigation systems also have databases of charging points that you can use to get about a city, and in Tesla's case, much of the Western world!

Here at Steer we have looked at a number of charging point mapping apps and found the greatest number of charging points for the Washington DC area is with PlugShare, as can be seen in the image above. There are other apps like Blink Network but these offer only the charging points on their own network.

These public charging points sometimes charge and are sometimes free to use. PlugShare also include private residences that allow people to plug in for a small fee, in a similar way to Airbnb enables people to rent out their spare rooms. This has moved in on dedicated EV plug sharing apps' territory like EVMatch, but on EVMatch you can find certain EV evangelists who won't charge you money to charge your car! This app isn't well populated for certain areas like Washington DC but is better used in Southern California where the startup was launched.

## Etiquette

As happened with the internet when it emerged in the early 1990s, a new culture has emerged around EVs as this technology was born and has grown. There are a number of formal and informal rules that are considered the right thing to do among all EV users to keep everyone happy and ultimately to help the number of users grow.

The first rule everyone should observe is that where you are using a public charging point (or at work should your office have fewer charging points than EV users) is to only leave your car in the parking space as long as it is charging. Someone may be travelling a distance and have too few miles to make the next charger so it is only good form to allow charging points' use to be maximised.

If you know you won't be able to get back immediately the car is at full charge, leave some contact details on your dash so people can contact you and ask you to move your vehicle for them or allow them to just unplug yours when at full charge to plug theirs in. Newer models of EVs often have locks on the cable to prevent unwanted un-pluggings so again a polite note of how to contact you is the right thing to do.

Are you driving a PHEV? Be considerate to BEV users as they will often point out that you can drive on gas while they need electricity to get where they are going. There are BEV users that might be described as militant and who dislike PHEV users in much the same way as people of certain faiths dislike agnostics. No PHEV on the market today takes anything more than a Level 2 charge so though you can plug into a fast charger you will still only get a trickle from it. At times of high demand, for instance a Friday evening, then it may pay to avoid busy charging stations for these reasons.

## Ready to go?

So there you have it, all you really need to know about charging your electric vehicle. Not so bad is it? If you think about it, if ICE cars were new and EVs under threat, we would likely have to write a similar in depth piece on how you couldn't fuel your car at home and had to pour highly flammable liquid into your tank that could explode if your cellphone goes off while doing it. You'd be just as perplexed and

confused! As with gas cars once you get your head around the system and conventions it will be easy as pie.

Happy charging!