

CHARGING YOUR NEW ELECTRIC VEHICLE

Everything You Need to Know for
Anxiety-Free, Money-Saving Travel



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INTRODUCTION

Maybe you're motivated by environmental concerns, maybe it's energy security, or maybe it's just because you're tired of living at the mercy of the gas pump, but whatever the reason, you've decided to drive home in your first electric vehicle.

And now you've realized that—as cool as this new vehicle is—it comes with a bit of a learning curve. Like, for instance, where and how do you charge this thing?

If your dealership experience was like many you got the bare basics of an education (except for maybe you, Tesla drivers). But don't despair. We've got you covered in this all-you-need-to-know guide to charging your electric vehicle, either at home or on the road.



CHAPTER 1 :

CHARGING YOUR ELECTRIC VEHICLE ON THE GO

As convenient as electric vehicles are to charge at home, as you'll learn in the next chapter, it can be a different story on the road. That's because it's not as simple as stopping at one of the hundred thousand-plus gas stations in the United States.

That's why EV drivers often talk about *range anxiety*. That's the feeling between concern and panic that starts to kick in as your battery percentage starts dropping—and you're not sure you can make it to your destination without a charge.

To combat range anxiety, it helps to have a plan for where you can top off your battery *en route*. But since electric vehicles are still relatively new, the infrastructure to support them is not as widespread or consistent as the country's network of gas stations.

Plus, using chargers on the go isn't as intuitive as filling up at the pump. For one thing, you can't just roll up at a charger, dip your credit card and start charging. That's because there are different types of chargers that are only compatible with certain cars, and the different charging networks each have their own system for payment.

It may feel overwhelming at first, but with this guide you'll learn everything you need to know to beat range anxiety and start charging your electric vehicle on the go.

KNOW YOUR PORT

Your electric vehicle has one or more ports that you can use to charge. Know your ports before you go so that you can find compatible charging stations for your vehicle.

J1772



J1772
Double



CHAdE MO



Tesla
Combo



	AC Level 1	AC Level 2	DC Level 3
The Basics	AC Level 1 charging allows you to charge anywhere there’s a regular 120v outlet. Your car should have come with an adapter that allows you to plug one end into your car and the other end into an electrical outlet.	Common in public charging stations, Level 2 uses either 240v or 208v electrical service. It uses the same charging port as AC Level 1.	Using direct current (DC) instead of alternating current (AC), Level 3 chargers provide a much faster charge. Before you use a Level 3 charger, make sure you have the right plug for the charger you’re using. There are three different types.
Plug Type	J1772	J1772	Combined Charging System (CCS) CHAdE MO Tesla Combo
Charging Speed	2 to 5 miles of range per hour	10 to 20 miles of range per hour	60 to 80 miles of range per 20 minutes
Which EVs can use this?	All EVs	All EVs (Tesla requires an adapter)	Chevrolet and BMW use CCS Kia, Nissan, Mitsubishi, and Toyota use the CHAdE MO Tesla uses its own combo connector. With an adaptor, Teslas can use CHAdE Mo or J1772 Combo plugs. Non-Teslas cannot use Tesla plugs.

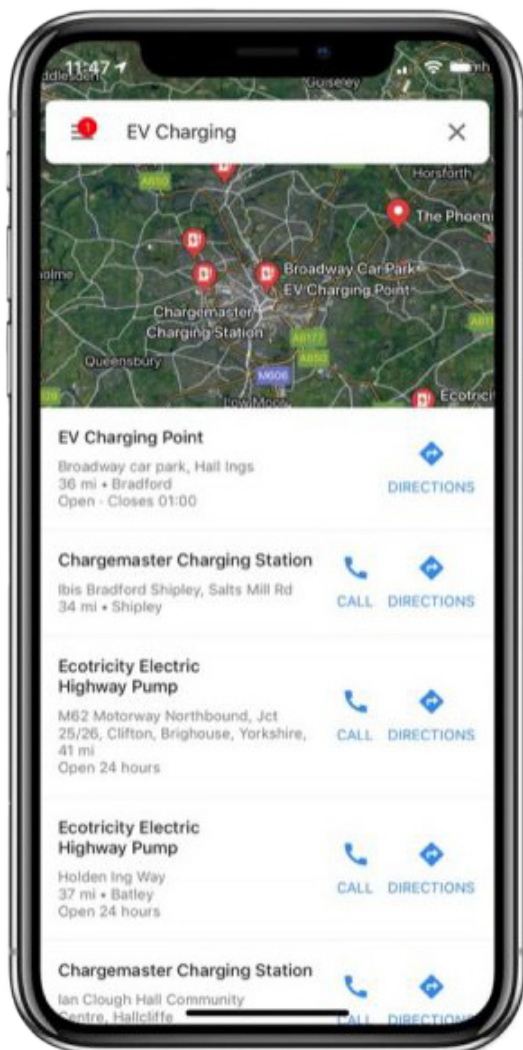
Source: “Developing Infrastructure to Charge Plug-In Electric Vehicles,” US Department of Energy

FIND A STATION

Now for some good news: With the increasing popularity of EVs, as well as clean energy goals of municipalities, businesses and some government agencies, the nation's EV charging network is growing—and that's only going to continue. In 2018 there were some 18,000 publicly accessible EV charging stations nationwide, according to the U.S. Department of Energy's Alternative Fuels Data Center.

Before you embark on your first journey that may require an away-from-home charge, load up your phone with these apps. They'll tell you not only where to find chargers, but also what kind of plugs they use, whether they charge, and how they've been rated by other users. Some apps even allow users to check in when they're charging so you don't waste your time going to a charger only to find it occupied.





GOOGLE MAPS

If you already have Google Maps on your phone, you're ahead of the game. In late 2018, Google announced it would support searches for EV charging stations on the Google Maps app. All you need to do is type "EV Charging Stations" or a related term into the search bar, and you'll see a list of stations near you. Also included: the plug type, whether it's free or paid, and how many chargers are available.

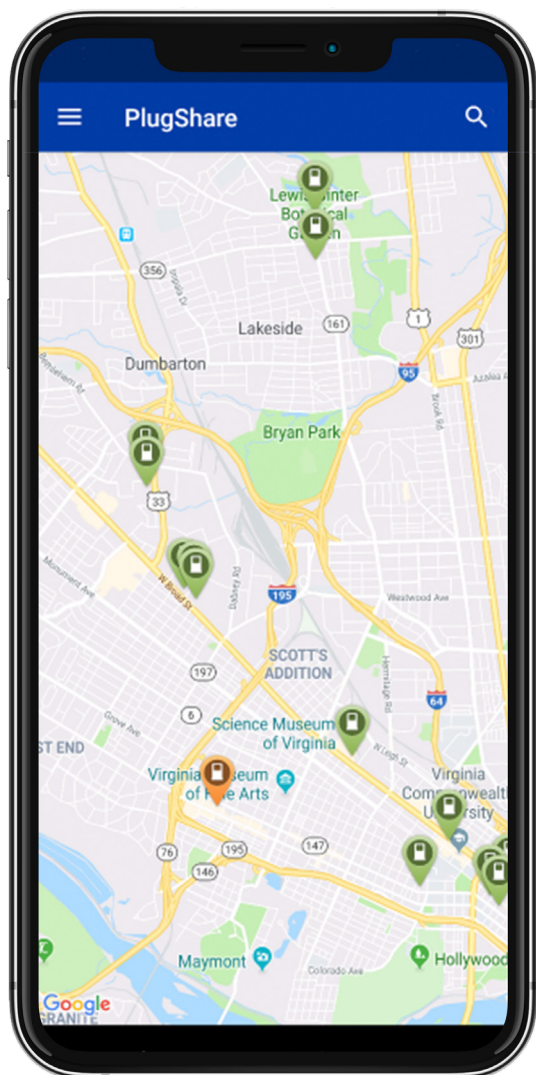
www.google.com/maps



Apple App Store



Google Play



PLUGSHARE

PlugShare is one of the more popular apps for EV drivers. It provides information about public charging stations around the world and allows users to post check-ins, ratings and reviews. It also allows you to filter by your charger type and even provides a trip planner tool.

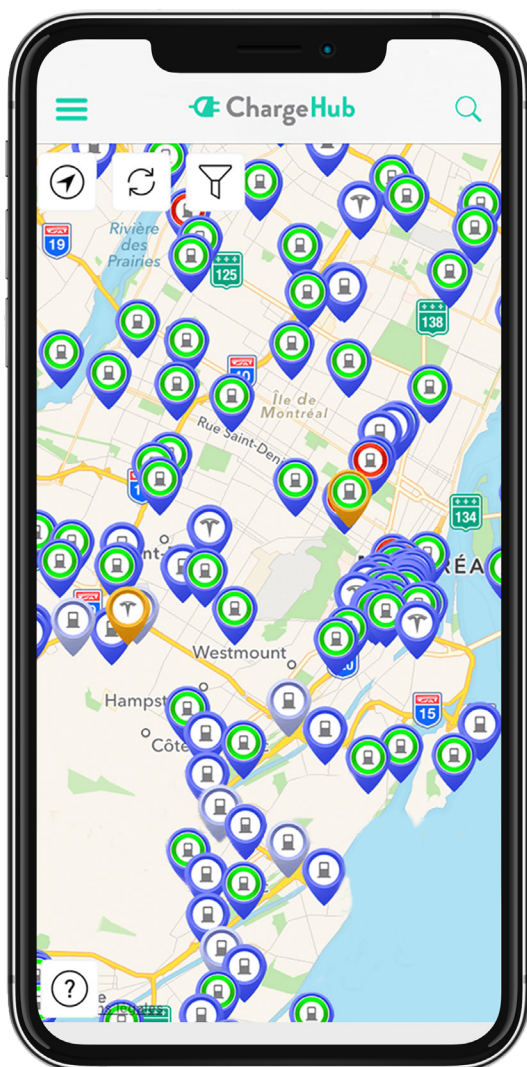
www.plugshare.com



Apple App Store



Google Play



CHARGEHUB

ChargeHub is a community-augmented charger finding app that allows you to see charger type, find out if a charger is available, add your own personal charger to the network to share the love, and even pay for charging using the app. The ChargeHub website offers discounts on EV products, savings calculators, a trip planner and lots of EV-related content.

www.chargehub.com/en/



Apple App Store



Google Play



TESLA

If you're a Tesla owner, you're really missing out if you're not using the Tesla app. Not only does it link you up with Superchargers on your route, it also works as a veritable remote control for your car. It allows you to check charging progress and start or stop charging, heat or cool your car before getting into it, lock or unlock your car from afar, and more. Non-Tesla owners, the only reason to download this app is to stoke your Tesla envy.

www.tesla.com



Apple App Store



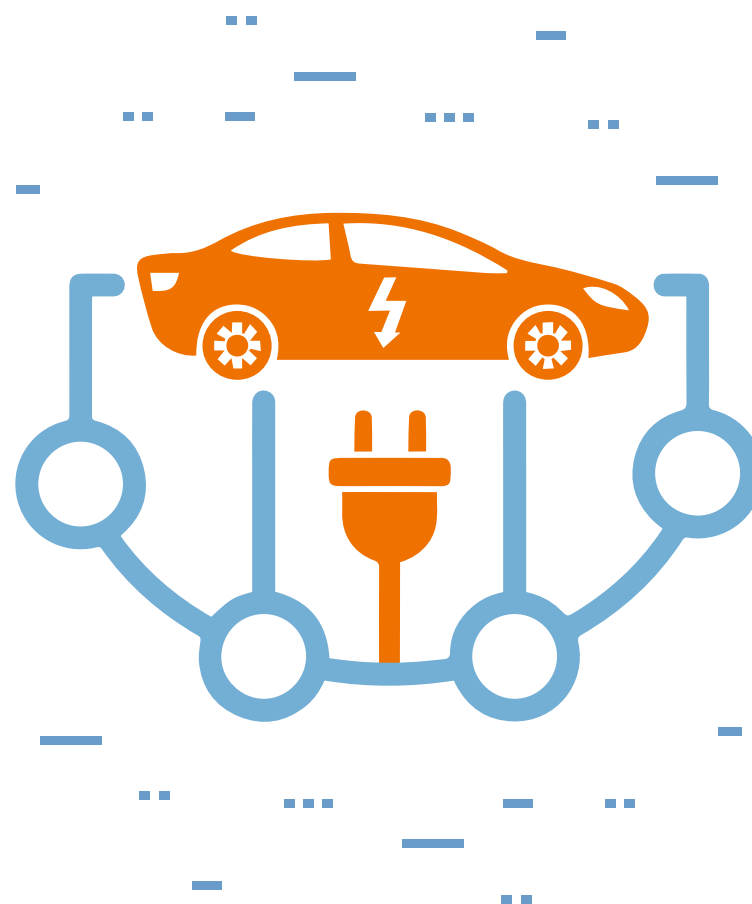
Google Play

JOIN THESE CHARGING NETWORKS

One of the main complicating factors in EV charging on the road is that many different companies own and operate their own charging stations, and many of those companies require you to be a member in order to use the station. Those memberships are often free, but you'll want to sign up for them in advance and either get the membership card or download the company's app. You'll preload your credit card info so that when you get to the charging station, you can scan your card or the app and get charging.

There are also some free stations available—often at government-owned facilities like libraries or recreation centers, or at grocery stores. But they tend to be popular, so you shouldn't rely on them as your only option for on-the-to charging.

Here are some of the most popular charging networks. See which ones operate near you and decide which you'd like to sign up for.



Network

-chargepoint+



blink



SemaConnect



Membership Required

YES. Membership is free and you can pay for charging using your ChargePoint card (which is mailed to you after you sign up) or with the app.

NO. Membership is free and gets you discounted charging rates and a free Incard for use at stations, but you can also visit the website to get a single-use guest code to pay as you go.

YES, but you can activate your membership and pay for charging from the ChargeHub app.

Network

EVgo
FAST CHARGING



 **greenlots**
A Member of the Shell Group



 **TESLA**
SUPERCHARGER



Membership Required

Registration required for pay-as-you-go charging, but paying a monthly membership fee gets you better rates. If you want to use an EVgo charger without registering, call from the charging station.

YES, Request an RFID or use the mobile app to charge. You can preload a balance or pay as you go with a credit card on file.

NO, but only Tesla vehicles can use them.

ONE CARD TO RULE THEM ALL

The fragmented nature of EV charging infrastructure is never more clear than when you're flipping through your stack of network-specific charging cards to find the right one for the station you're at.

A couple car manufacturers have sought to ease that burden by offering programs that bundle several networks together under the banner of one card.

If you're a Nissan Leaf driver, you should have been given an EZ-Charge card, which—once registered—will get you access to Aerovironment, Blink, ChargePoint, Greenlots, JNSH, and EVgo stations.

For Kia Soul EV drivers, the ChargeUp program will get you similar benefits at stations run by Aerovironment, Blink, Car Charging Group, EVgo and Greenlots.



CHARGING ETIQUETTE

Nothing is worse than pulling up at a charging station when you're running on proverbial fumes, only to find that all chargers are in use—or worse, blocked by a non-electric vehicle. Do your part to make charging a reliable and smooth experience for EV drivers by following these etiquette rules.

- 1 ONLY CHARGE WHEN YOU REALLY NEED TO.** If chargers are scarce and you can complete your trip without charging, leave the spot available for someone who really needs it.
- 2 MOVE YOUR CAR WHEN YOU'RE DONE CHARGING.** If you're taking up a charging spot, don't spend three hours window shopping. Come back after you're adequately charged and free up the space for the next driver. Apps can help with this by notifying you of your charging status.
- 3 CHECK IN.** If you use an app like PlugShare, check in and out to let other drivers if the charger is available.
- 4 LEAVE REVIEWS.** Did you pay a parking garage fee only to find that the chargers aren't available on weekends? Leave a review on PlugShare or other apps to let other drivers know to look elsewhere.
- 5 LEAVE A NOTE—NOT A NASTYGRAM.** There's a term for being blocked from charging by a non-electric vehicle; it's called being ICed (short for "internal-combustion engine"). It's incredibly frustrating, but it's also a good learning opportunity. Feel free to leave a polite note on the windshield explaining the problem with blocking a charger and asking the driver to park elsewhere in the future.

WASN'T MY EV SUPPOSED TO BE CONVENIENT??

While it's true that the EV charging infrastructure in this country is still finding its legs, we can expect greater convenience as more municipalities, EV manufacturers and charging networks work out the kinks of collaboration. Elon Musk recently stated that he's open to working with other car manufacturers to make the Tesla charging network available to non-Tesla vehicles. That's still a long way off from being a done-deal, but it hints to the potential cooperation ahead.

For now, most EV charging is done at home—largely because of the convenience and reliability a dedicated charger provides. Learn more about that in Chapter 2.



CHAPTER TWO

CHARGING YOUR ELECTRIC VEHICLE AT HOME



CHAPTER 2 :

CHARGING YOUR ELECTRIC VEHICLE AT HOME

If Chapter 1 taught you anything, it's that EV drivers need to invest more planning and forethought into staying fueled up on the road than standard vehicles do.

But on the flip side is one of the main perks of EVs: The ability to charge up at home instead of at a gas pump. Not only is home charging convenient, it's also cost-effective.

Depending on electricity rates where you live, what type of electric rate you have and the efficiency of your EV, your costs will vary. But if you assume electricity rates of 10 cents per kilowatt hour and drive an EV that can go 3 miles per kilowatt hour, your cost per mile will be just around 3 cents.

How does that compare to a gas-powered vehicle? Well, for a car that gets 22 miles per gallon, fuel costs almost 16 cents per mile when gas prices are \$3.50/gallon.

You may be able to further reduce your charging costs if your utility offers time-of-use rates. These programs allow you to charge at off-peak times, such as overnight, and pay less per kilowatt hour.

Either way, it usually makes sense to make home charging the mainstay of your EV fueling routine.

DO I NEED A DEDICATED CHARGER?

The first decision you'll need to make about home charging is whether you need a Level 2 charger or if a plain old wall outlet will meet your needs.

If you don't typically drive your vehicle very far during the day, you may be able to get by with Level 1 charging. For Level 1, you can just use the charging cord included with your car. One end plugs into your EV and the other plugs into any standard 120v wall outlet. It's the more flexible and cost-free option—but it's also slow. For instance, a Chevy Bolt charges at a rate of 4 miles per hour with a Level 1 charger. That means if you need to add 40 miles of range to your car, it'll take 10 hours.

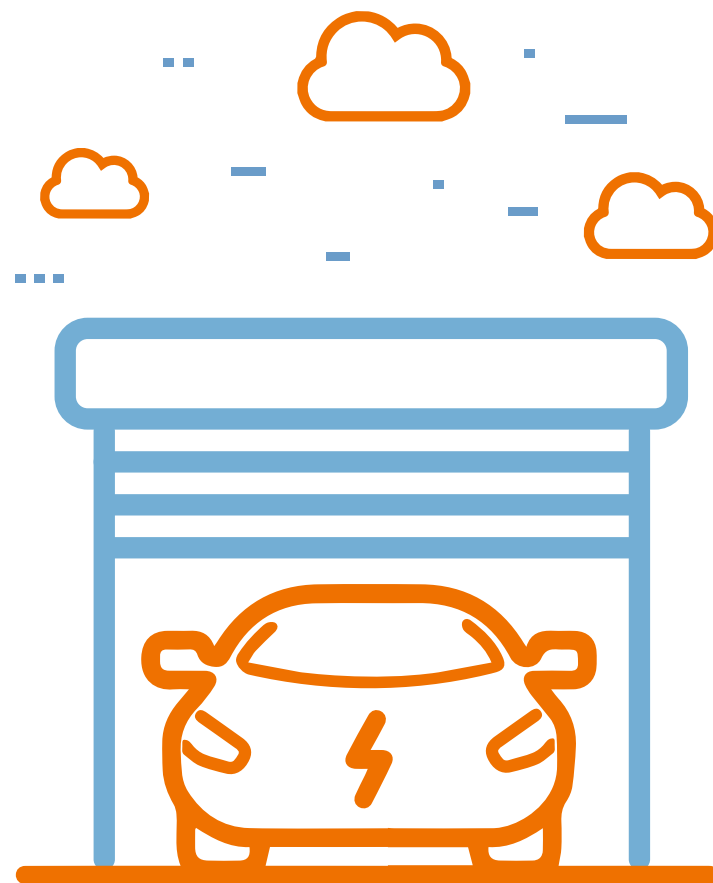
Level 2 chargers can cut that time drastically—down to only about 90 minutes. So if you want or need the option of adding miles to your range quickly, it pays to install a dedicated Level 2 charger at home.



Before we jump into the logistics of installing a Level 2 charger at home, though, a quick note about terminology: In this guide and in many other resources, you'll see these wall units referred to as "chargers." Technically, that's not quite accurate. Your car's charger is actually part of the vehicle. It's what converts the AC energy from the outlet into the DC power the battery needs. The correct term for the equipment we're discussing here is ESVE—short for Electric Vehicle Service Equipment. But since the term charger is so commonly used for ESVEs, we're using it here.

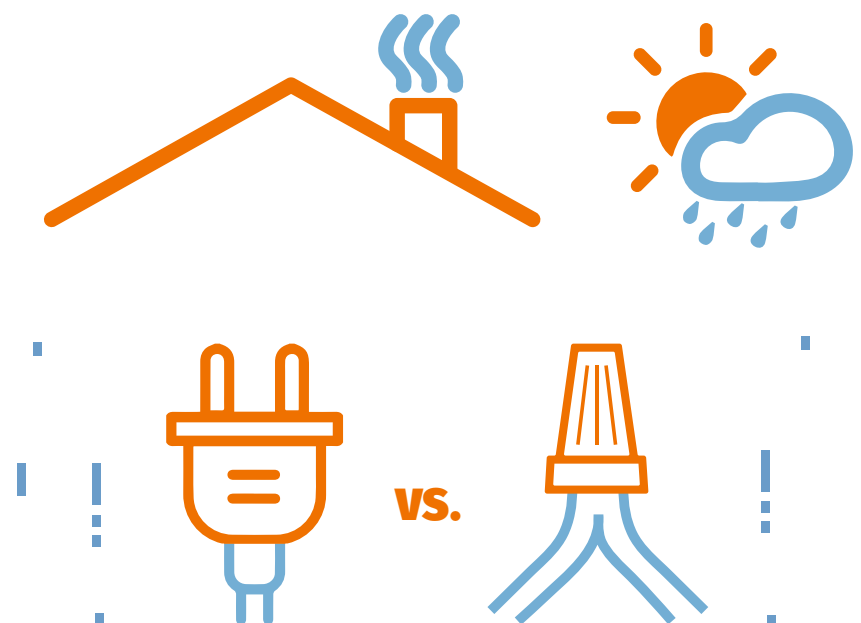
CHOOSING A SITE FOR A LEVEL 2 CHARGER

Before looking into which charger will be the best fit, you'll need to decide where you want to charge your vehicle. The site you choose will need to have 240-volt electricity available (or you can have an electrician run 240-volt to your chosen site).







Choosing your site in advance will allow you to choose the best charger based on:

- **INDOOR VERSUS OUTDOOR.** If you want to charge outdoors, you'll need a charger that's specifically designed for outdoor use.
- **CORD LENGTH.** Decide how you'll park your EV for charging and measure from the site you'll place your charger to the charging port on your car. Make sure to get a charger with ample cord length.
- **PLUG-IN VERSUS HARD-WIRED.** Do you anticipate moving your charger? For instance, do you want to be able to bring it with you on trips or use it in different sites? If so, opt for a plug-in version, which only requires a 240-volt outlet—not professional installation.



HOW TO CHOOSE THE BEST EV CHARGER FOR HOME USE

In Chapter 1, you learned how to identify which type of port your car has. You'll notice that in the U.S. market, all level 2 chargers use J1772 plug chargers. That means that any Level 2 charger you choose that's intended for use in the United States will work for your vehicle. That means your decision will come down to things like cost, amperage, whether it's WiFi enabled, and other considerations specific to your needs.

Charger name/model	Amperage	Safe for outdoor use?	Cable Length	Plug-in/ Hard-wired	WiFi Enabled?	Cost
 ZEF ENERGY 7.7kWh Single-Head Wall Mount	40	Yes	25'	Hard-wired	Yes	\$1,839
 ZEF ENERGY 10kWh Single-Head Wall Mount	50	Yes	25'	Hard-wired	Yes	\$1,909
 JuiceBox Pro 40	40	Yes	24'	Plug-in	Yes	\$579
 -chargepoint+ Home	32	Yes	18' or 25'	Plug-in or Hard-wired	Yes	\$779 for plug-in w/ 25' cord

REBATES

Some states, local governments and utilities offer rebates for home ESVE installation. Check to see what rebates are available where you live.

REGULATIONS

The City of San Jose, California, was one of the first to issue requirements for installing vehicle charging systems in single-family homes and duplexes to explain the permitting process and location planning for a home charging unit.

WHY WIFI?

As our world becomes more and more connected—think smartphones, smart thermostats, virtual assistants and home managers like Alexa and Google Home—we have more opportunities to interact with our devices in innovative ways.

WiFi-enabled Level 2 chargers are no exception. They allow you to use your smartphone to do things like control how long your vehicle charges, monitor power levels, set up notifications, and review your charging data.



A FINAL NOTE ON HOME INSTALLATION

Whichever home charger you choose, be sure to consult with a qualified electrician before making your purchase. You could potentially avoid a lot of headache by confirming in advance that your home is adequately wired to support the charger, and that the site you have chosen will work from a wiring standpoint.



CHAPTER THREE

ELECTRIC VEHICLE CHARGING FAQs



CHAPTER 3 :

ELECTRIC VEHICLE CHARGING FAQs

Still have questions about EV charging? We're here to help.

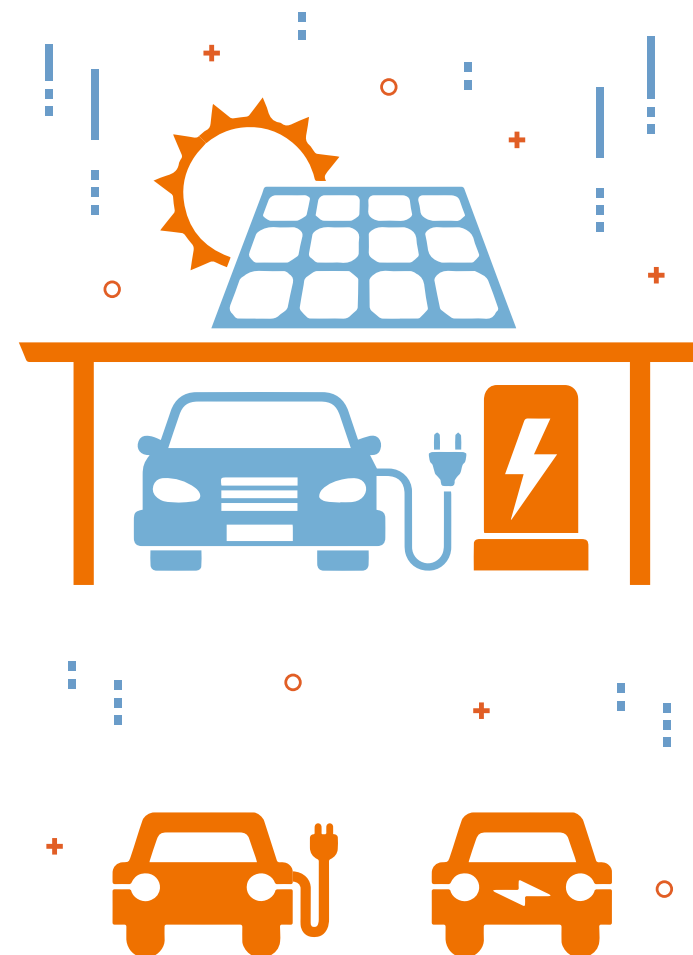
CAN I USE RENEWABLE ENERGY TO POWER MY ELECTRIC VEHICLE?

Short answer: Yes. You can install solar panels on your home to supply the charge for your vehicle. Check with a trusted solar provider to determine how big of a system you'd need to meet your driving needs. If solar panels aren't an option, you can always contact your utility to find out if you can opt in to its green energy program.

If your hope is to power your EV with a cartop solar panel, unfortunately we're not there yet. The panels simply can't provide enough power to meet the needs of the vehicle on the go.

WHAT'S THE DIFFERENCE BETWEEN AN EV AND A PHEV?

An EV is a purely electric vehicle. It doesn't have a backup fuel option. A PHEV is a plug-in hybrid electric vehicle. It can run off electric power or gas power.



HOW CAN I FIND OUT ABOUT REBATES AND TAX CREDITS?

Different states, municipalities and utilities offer a variety of rebates and incentives for purchasing both electric vehicles and charging equipment. [Learn more here.](#)

WHAT HAPPENS IF I RUN OUT OF CHARGE ON THE ROAD?

Ahh, good old range anxiety. The best solution, of course, is to avoid that situation by making sure you have adequate charge to get to where you need to go. But if the dreaded 0 percent battery should occur, you're going to need to get towed to the nearest charging station. Unfortunately roadside assistance can't come with a gallon of gas to top you off.

WILL MY ELECTRIC BILLS INCREASE? If you're doing a lot of charging at home, yes. But not by nearly as much as your gas station bills will go down.

HOW CAN I REDUCE MY ENERGY BILLS? Ask your utility about TOU rates, which allow you to charge at off-peak times for a reduced rate. In addition, make sure to set a timer or unplug your vehicle once you've reached your desired level of charge.



CONCLUSION



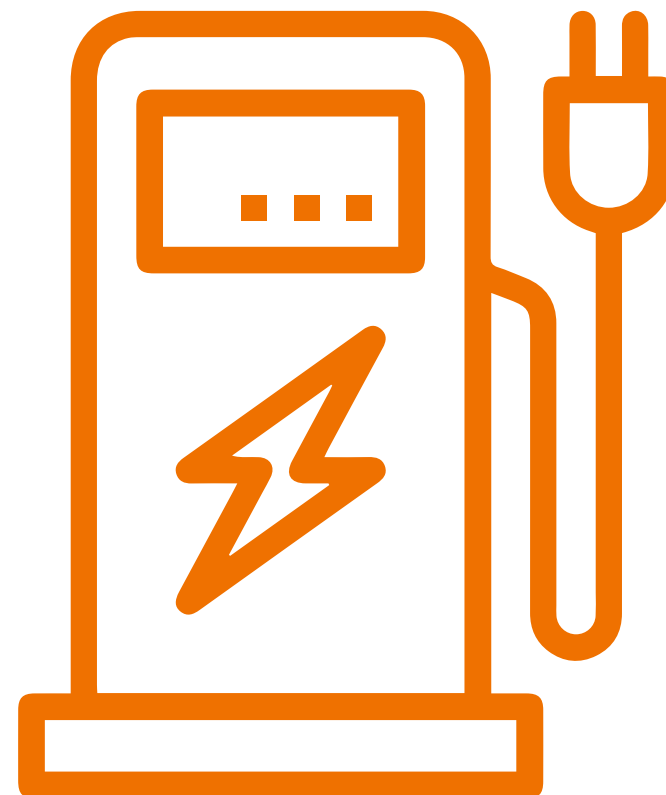
CONCLUSION

THE FUTURE OF EV CHARGING

As EVs gain more and more market share, the infrastructure to support them is racing to catch up. The automaker Tesla led the initial charge with its impressive network of Superchargers, which will continue to grow. For now they're only open to Tesla drivers, but talks continue about the possibility of opening up the network to other vehicles.

But other manufacturers aren't sitting back and waiting for Tesla to invite them into the fold. Volkswagen subsidiary Electrify America is investing in some 5,000 charging ports throughout America by mid-2019. And a research group with members from BMW and Porsche recently rolled out a charger that can top off a battery three times faster than a Tesla Supercharger.

The at-home charging environment is poised for big changes as well. As energy grids adapt to keep up with increased demands and opportunities EVs present, we may see a shift in how we interact with utilities.

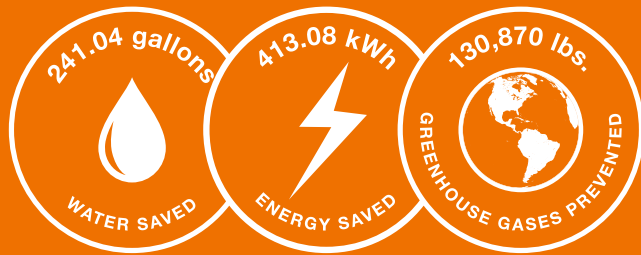


For instance, electric vehicles may begin to be used as distributed energy storage solutions—having the capacity to fill up at off-peak hours and then supply energy back into the grid when demand is high.

And for a truly revolutionary view of electric vehicle charging, we only need to look to Sweden. The country just installed the world's first electrified road to charge electric vehicles while they drive. Transportation departments in Europe, the United States, and elsewhere are investigating the feasibility of implementing similar projects in their own road systems.

While such a radical transformation is likely a long way off—if it becomes a reality at all—it does hint at the ingenuity and outside-the-pump thinking we can expect to see in EV charging in the coming decades.

Digital Content Savings



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Publisher: DSB Communications, LLC • www.dsbcommunications.com