An introduction to Electric Vehicle home chargepoints

When you buy an Electric Vehicle, or even when you buy a solar PV system, you may be offered the option of having a home chargepoint installed as well. The Renewable Energy Consumer Code (RECC) has produced this guide to help you decide if it's right for you. As well as giving you basic information about home chargepoints, the guide lists 10 questions you should ask and tells you where you can find out more.

Charging your EV at home

If you're contemplating becoming, or already are, the proud owner of a Battery Electric Vehicle (BEV) or plug-in hybrid electric vehicle (PHEV), you will probably want to be able to charge it at home as well as at public charging points.

Charging either sort of electric vehicle (EV) is a simple process that requires you to connect it to a source of electricity via a cable. Manufacturers of EVs are recommending that users have an approved EV charging point (EVCP) installed at home when they buy an EV. [1]

Document Version Control

Version	Date	Author	Rationale
1.0	14/02/2019	SMB	Document issued to coincide with other REA/REAL work on EV chargepoints.

In theory you can charge your EV at home from any standard domestic 13 amp socket using a 3-pin

[1] Although the charging points are sometimes called "chargers", the actual charger is in the vehicle.

charging lead. But many wall sockets are ageing and regularly charging an EV this way may pose safety problems. And it will be slow: the supply from a household socket will typically take upwards of 12 hours – or overnight - to charge a 30 kW battery pack fully and even longer for the many fully electric vehicles that now come with larger packs.[2]

Can I have an EV charging point at home?

A qualified electrician will need to consider a few key issues to determine whether you can have an EVCP at home: whether you have somewhere suitable to locate the chargepoint and your EV while it's charging; whether it is safe to add an EV to the demands on your electricity supply; and whether you need permission to install it.

Location

The charger units themselves are fully weather- and water-proof, so can be located outside or wherever is most convenient BUT they need to be near wherever you keep your EV: the cables that you use to charge the car are not usually very long (5 to 10 metres), using an extension lead is not allowed and having cables running across the pavement into your home from a car parked in the street is not safe.

Ideally you need to have designated private off-street parking such as a garage, driveway or carport with good access for an EV. (This is a requirement to be eligible for the Office of Low Emission Vehicles grant for a home charger – see below.) An EVCP installer should carry out an initial 'remote' survey to identify what may be possible for you.

Safety

Charging an EV adds to the demand for electricity in your home. So it's very important to be sure that your existing electric cabling, sockets and the main household supply fuse will be able to carry the additional current drawn by the vehicle, and that there are adequate safety cut-outs.[3] Overloading the electrical installation at a property could result in a fire.

A qualified electrician, preferably one trained in installing EV supply equipment (or EVSE), can assess whether your electricity supply is adequate to deal with charging an EV on top of your existing electricity load.[4] Some, but not all, chargepoints are capable of managing the power drawn from your electricity supply so as to keep within the property's limits.

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[2] The new Hyundai Kona Electric offers 39kWh and 64kWh models, for example, the fully-electric Tesla Model 3 a 75kWh battery pack.

[3] We have assumed single phase electricity supply throughout, since most homes do not have three-phase.

[4] This is known as as a Maximum Demand Assessment. Where an electricity supply is found to be unsuitable for an EVCP installation it is possible to contact the local Distribution Network Operator (DNO) and request an increase in capacity.

Your installer must inform the company that provides the electricity network in your area (the District Network Operator or DNO) of the installation of an EVCP. And if you are applying for a second chargepoint at a single residence, your installer must inform the DNO that this is a second chargepoint, and give the combined current of the two chargepoints in amps, e.g. 2 x 16A charge points installed at a total of 32A.

Permissions

In most cases, you won't need planning permission to install an EV chargepoint: they are 'permitted developments'.

You will need planning permission if the installation is:

- near a highway
- in a listed building
- over 1.6m in height (for ground mounted units) or
- more than 0.2 cubic meters in volume (for wall mounted units).

It is your responsibility to ensure that you have any necessary permissions so you may want to double check with your local authority planning officer. You may also need permission from your landlord, if you have one, to install a chargepoint.

A dedicated EV chargepoint for charging at home

Domestic EVCPs are generally wall-mounted and compact and are easy to use: you connect your car, you just switch on and the charger does the rest. They're weatherproof too, so can be located outside if required. And they usually come with a 3-year manufacturers warranty.

For more on the Maximum Demand Assessment, see:
https://thephoenixworks.com/downloads/overview/EV-Charging-Overview.pdf

Many plug-in car manufacturers have deals or partnerships with charge point suppliers, and in some cases provide a free home charge point as part of a new car purchase – but it's worth checking if it's the sort of EVCP you want.

Around 40 charger manufacturers provide units that are suitable for residential charging, so there's plenty of choice.

What are the benefits?

Faster charging

EV charging speeds depend on the technology built into the vehicle itself and built into the charging infrastructure - no charger can charge a car faster than the EV's charging rate allows. But if the vehicle allows, a dedicated EVCP can cut the time it takes to charge your car by half or more. And the higher the power rating of the unit, the faster the charging will be. (See 'how long does it take to charge an EV?'). They will also switch off once the car is fully charged .

Safe charging

Domestic EVCPs are usually on their own circuit for safety and to enable monitoring separately from other electrical loads. And they have safety features such as Residual Current Detection (RCD circuit breakers).

'Intelligent' and 'smart' charging

The units have additional features such as 'intelligent' charge scheduling, meaning they can be set to charge the EV overnight and/or at times of off-peak electricity tariffs like Economy 7. And they can be monitored remotely, allowing you to check on it, to change settings or to switch charging on or off without being present.

'Smart' chargepoints can receive, understand and respond to signals sent by energy system operators or third parties to indicate when is a good time to charge or discharge in relation to overall energy supply and demand.[5]

Making money

You may even be able to 'rent out' your charge point to other EV drivers using so-called 'peer to peer' platforms such as Zap-Map's Zap-Home and Zap-Work or Bookmycharge to share your charger. The energy regulator, Ofgem, has said *'market based approaches will enable chargepoint owners to charge a competitively priced fee, and recover their installation costs faster.'*[6]

[5] From July 2019, only home chargepoints that use 'smart' technology will be eligible for government funding under the Electric Vehicle Homecharge Scheme.

[6] 'Ofgem Future Insights paper

What do chargepoints cost?

The Energy Saving Trust suggests the typical cost for a home charge point and installation is approximately £1000. But that is only a very rough guide: the cost of installing an EVCP depends very much on the individual situation such as whether an energy supply exists and has enough capacity or needs an upgrade, how far the installation is from a suitable energy supply and what surface the Charge Point is to be mounted on.

The price of the equipment can also vary depending on the specification: a tethered unit, with its own integrated cable, costs more than one into which you plug your cable, for instance. However, prices for domestic chargers are expected to fall in the coming decade as volumes increase. UK customers who are owners of an eligible EV may be able to get a grant of up to £500 towards the cost of a home EVCP[7]. For more information see the box below.

The Electric Vehicle Homecharge Scheme

The Electric Vehicle Homecharge Scheme (EVHS) provides a grant to UK customers who are owners of an eligible EV of up to £500 (the grant is actually up to 75 per cent of the cost, capped at £500 including VAT. It's payable for up to a maximum of two chargepoints at a single residence.

A cross-government team, the Office for Low Emission Vehicles or OLEV for short administers the grant. To qualify for the OLEV Grant, you must:

- have purchased an eligible electric or plug-in hybrid vehicle from 1st October 2016 onwards.
- have off-street parking with good access for an eligible vehicle to be charged safely.
- use an OLEV-approved home charging point installer who has approval from a chargepoint manufacturer to install their accredited equipment. Lists of approved chargepoints and authorised chargepoint installers are here:

You can find a full list of eligible vehicles, a list of approved chargepoints and authorised chargepoint installers here:
https://www.gov.uk/government/collections/government-grants-for-low-emission-vehicles

You can check if an approved installer is a RECC member here:
https://www.recc.org.uk/scheme/members

[7] as long as they took possession on or after 1 October 2016 and have not claimed against the previous chargepoint schemes or can evidence keepership of two eligible electric vehicles.

In Scotland, Energy Saving Trust will provide up to £300 further funding on top of this if you use an installer from their list. For more on this, see:
http://www.energysavingtrust.org.uk/scotland/grants-loans/domestic-charge-point-funding

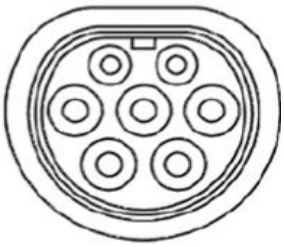
If you have received a grant towards the original installation, you must contact the DVLA at ChargePointGrantApps@dvla.gsi.gov.uk requesting permission to move the chargepoint, confirming the current post code and chargepoint ID and providing the address and post code to which you wish to move the chargepoint so that records can be updated.

Choosing a chargepoint

There are varous types of charging units available, operating in standard and fast modes, with different power ratings and operational features, the most basic of which are set out below. Talk to a few installers about your options and needs to identify the most appropriate EVCP for you.

Standard v fast
EVCPs for home use are usually available as 16A/3.7 kW (standard) and fast (32 amp, 7 kW).

Tethered v universal socket
To charge an EV, you plug a cable into the vehicle's socket or inlet, with different EVs having different types of inlets eg Type 1 (below left) or Type 2 (below right).[8] The cable that comes with the car will have a connector that fits the car's particular type of inlet.[9]



Type 1 Type 2

You can charge your EV by plugging the cable into a 'universal' socket in a chargepoint.[10] The socket in the unit is compatible with all makes and models of EVs on the road today. When the charge is finished you can disconnect the cable and take it with you to use elsewhere (at a public chargepoint, for instance.)

[8] These are the two most common types; there are also JEVS (CHAdeMO) and CCS Combo.
[9] Some models (such as the latest Nissan Leaf 40kW) have more than one inlet – one you use when you're 'slow' charging, the other for use with rapid chargers.
[10] EVs can be supplied with **two** cables, one for use with slow charging outlets (at home or at public slow and fast chargepoints) and one for fast AC 'rapid' chargers.

Alternatively, you can 'fill up' from a chargepoint that has its own cable attached (or 'tethered'), rather like filling a petrol car from a petrol pump.[11] The tethered cable, which can be coiled on the wall next to the charge point, has a connector on the end of its cable to fit the socket of your vehicle. This means it will only work with your EV and other EVs with the same type of socket. If you change cars later to an EV with a different type of socket, you would need either to replace the chargepoint or alter it to suit the new vehicle.

Charging from solar PV

If you have solar PV installed, it makes sense to use the electricity it generates to charge your EV – either directly by charging during daylight hours or via storing the renewable energy in a battery during the day and using the stored energy to charge the EV in the evening.

If you are planning to use solar PV to charge your car be sure to select a car chargepoint solution that enables effective solar charging. It needs to be able to charge at a lower power rate to suit solar PV production levels when that's available and at a faster rate at other times,. There are several such EVCPs on the market so it's best to shop around.

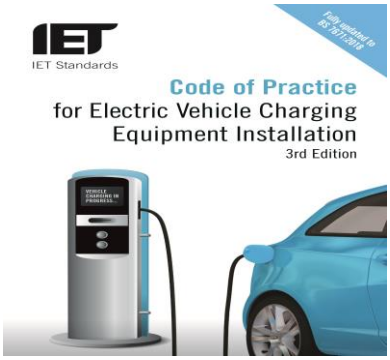
Finding an installer

It's best to shop around for an installer: check they are a qualified electrician and whether they are trained (and ideally experienced) in installing Electrical Vehicle Supply Equipment (EVSE) in line with the IET Code of Practice for EV Charging Equipment Installations. [12]

To qualify for the OLEV grant (see above), you must use an OLEV Certified installer who will be responsible for ensuring you meet the terms and conditions of the scheme when applying for the grant (unauthorised installers cannot claim the grant on your behalf). OLEV Certified Installers are qualified electricians who have trained in EVSE standards and are approved by the charge point manufacturer/s to install their products.

[11] In future, there may be no need for cables. Inductive, or wireless, charging uses an electromagnetic field to transfer energy between an electric car and a charging pad through electromagnetic induction. This promising technology would do away with charging cables. The first cars with inductive charging capabilities are expected to be introduced in the near future.

[12] Training courses include City & Guilds 2919-02, the NICEIC EV chargepoint course, and the forthcoming IET Academy EV Charging Installation course.



OLEV advises that you speak to a number of different installers to ensure you receive the best advice. See 'The Electric Vehicle Homecharge Scheme' above for the link to a list of authorised installers.

How long does it take to charge an EV?

This depends upon two things: the charging capacity of your car and its battery and the power output of your homecharge unit itself. The units come in a range of power ratings from 3.6kW up.

The larger the battery, the longer it will take. But as an example, to charge a 40kWh Nissan Leaf battery fully from empty takes:

- around 11 hours using a 3.6kW charger or
- close to 6 hours using a 7 kW unit.

Go Ultra Low (a government/industry website) has a calculator you can use to see how long it would take to charge your chosen EV here:

https://www.goultralow.com/electric-car-savings/home-charging-calculator/

How much does it cost to charge an EV at home?

The Energy Saving Trust suggests that charging a pure electric vehicle to give a range of 100 miles will cost £2 to £4 or 2p to 4p a mile. It notes that '*cost savings [over petrol vehicles are] … greatest when owners have access to an off-peak overnight electricity tariff*.'

What it will cost *you* to charge your EV depends on:

- what you're paying for electricity and
- when you charge the EV, if you have 'time-of-day' tariffs, and

- if you have a solar PV system, on how much of the energy it generates you can use to charge your EV.

Off-peak and 'time-of-day' charging

'*With the EV tariffs currently available, the best way to keep energy bills low for EV drivers who predominantly charge at home, is by choosing a tariff that offers lower prices at certain times of the day, and by charging their vehicle as much as possible during those times - most likely overnight. This includes Economy 7 tariffs and smart ToU [time of use] tariffs.*'[13] Citizens Advice

If you are on, or can switch to, an 'Economy 7'-type electricity tariff that provides cheaper electricity at certain times of the day (usually off-peak hours), then it will be cheaper to charge your EV when that cheaper tariff is in operation. [14]

There are also various 'smart' Time of Use tariffs on offer where you pay different prices for electricity at different times of the day: in theory a different price could apply every half an hour. Prices can be as low as 5p per kWh in the middle of the night ('super off-peak').

EV tariffs

You may also be able to sign up for various 'EV tariffs' which generally come bundled with offers such as some free charging or discounts on chargepoint installation (see the box below for 'Examples of EV tariffs').

Examples of EV tariffs

Green energy supplier **Tonik Energy** has launched an EV tariff offering customers 1,200 miles of charge from its 100% renewable supply every year they remain on the tariff. On top of the green supply offered across its other tariffs, drivers can also get £40 off the cost of an EV charger from its partner EO Charging.

Energy supplier **E.On** has launched a 100% renewable electricity tariff designed specifically for electric vehicle drivers, offering a fixed reward equivalent to driving 850 miles for free. E.On 'Fix and Drive' is a two-year fixed price tariff is available to drivers who own or lease a plug-in electric or hybrid vehicle. They receive a £30 credit on their electricity account six months after they sign up to the tariff and thereafter annually.

OVO energy's tariff for EVs, **EV Everywhere**, includes benefits such as 100% renewable energy, a fixed tariff for two years, POLAR plus membership giving access to the POLAR public charging network and, if you have an OVO smart meter installed, an Economy 7 version of the tariff for cheaper off-peak charging.

Scottish Power's new EV tariff, **SmartPower EV**, offers 100% renewable energy and cheap charging between midnight and 5am. It estimates that a Nissan Leaf with a 40kWh battery with an average annual mileage of around 6,000 miles would pay just £62 in charging costs each year.

- regular tariffs can be cheaper than the cheapest EV tariff BUT
- the monetary value of the EV tariff 'bundle' can balance this out
- half of the tariff deals analysed offered discounts on the installation of an EVCP from their chosen EV charger installer, worth from £40 to £180
- some offered deals on membership of a public charger network.

It's important to work out just what any EV tariff deal is worth to you before signing up. While they can be very cheap in off-peak hours, for instance, there are likely to be higher-than-normal prices during the day: Citizens Advice found one smart EV tariff where electricity was just 6.4p per kWh in super off-peak hours but almost 30p per kWh between 4pm and 6pm.

Using an EVCP safely

The manufacturers of approved chargepoints have an obligation to ensure the standards and requirements as set out in the EVHS minimum technical specifications are met. They must meet European electrical safety standards and provide safety features such as Residual Current Detection (RCD circuit breakers) and spike voltage protection.

It's important that you use your chargepoint safely too:

- Make sure the cable is dry and undamaged before use
- If your cable is coiled, fully unwind it before use
- Never use an extension lead to charge your vehicle
- When you've finished charging, store your cable away safely.

Sorting out problems

Your first port of call in the event of a problem is to return to the installer. Most units come with a 3-year warranty (it's required by OLEV for installers wanting OLEV certification) and you may have rights to redress for up to six years under consumer protection law.

If your chargepoint was installed under the EVHS grant scheme, you should still try to resolve complaints with the chargepoint installer in the first instance. If you feel that your issues are not being addressed, contact OLEV at: Chargepoint.Grants@olev.gsi.gov.uk.

If you think the problem is to do with the charging cable that came with the EV, then your first recourse is to the seller of the EV.

[15] Take Charge: An analysis of the domestic Electric Vehicle tariff market, January 2019

Exporting electricity from an EV

"*…you could use your car battery to power your house or earn money by selling its spare energy back into the network at peak times, and all of this whilst ensuring you have enough energy for your next day's commute..*" Ian Cameron, head of innovation at UKPN

Potentially EV batteries can have energy flowing to AND from the vehicle ('bi-directional' inverters make this possible). This means that drivers can connect to the grid during cheap-tariff periods (or to the solar panels in the middle of a sunny day when no-one's home) and use the electricity stored in the vehicle's battery to power their homes at other times.

EVs could also be connected to the grid via a smart plug that could be discharged and charged remotely in line with the needs of the grid, in return for a payment – in effect selling energy back to the grid and helping to balance the grid in periods of high demand, alleviating the risk of power cuts. This 'vehicle-to-grid' or V2G in effect turns an EV into a portable battery.

V2G technology is presently in the testing stage. It's being trialled but is not widely available yet. In January 2019, energy tech firm OVO Energy claimed a world first with the maiden install of a domestic vehicle-to-grid (V2G) charger in a customer's home; Energy company E.On has formed partnerships with the likes of Nissan, with whom it is developing vehicle-to-grid (V2G) charging capabilities; and District Network Operator UKPN is working with energy company Octopus Energy to trial V2G in the domestic setting (see 'V2G Trial)'.

V2G trial

UKPN, a District Network Operator, is working with green energy supplier Octopus Energy on the first large-scale domestic trial of vehicle-to-grid (V2G) charging in the UK. With around £3million of help from the Government, the £7 million Beating Home demonstrator will install 135 V2G chargers in a 'cluster' to research the impact of widespread EV rollout on the UK's electricity grid.

Customers of UKPN in the trial will get a smart meter and 100% renewable energy for their home and car. They will be able to:
- lease a new Nissan Leaf at a discount and with a free two-way V2G charger
- access a special V2G bundle, Octopus Powerloop, that will enable the driver to charge their vehicle intelligently
- use their vehicle battery to power their home during peak times or sell spare power back to the grid

- Can my electricity supply cope with the extra load of EV charging?
- How much does the chargepoint / the installation cost for a standard install? Will

installing at my property need extra work and how much will this cost?

- What is the power rating of the charger?
- Is the chargepoint 'smart'? (After July 2019, all must be).
- Will the chargepoint work effectively with my PV system?
- Is it a tethered unit or one with a Universal Socket?
- Is it eligible for the OLEV grant?
- Is the installer a qualified electrician? Have they trained in installing EV supply equipment?
- How long is the warranty?

Further information

The Office of Low Emission Vehicles
The Office of Low Emission Vehicles (OLEV) is part of both the Department of Transport and the Department of Business, Energy and Industrial Strategy, with a team working across government to support the early market for ultra-low emission vehicles.
https://www.gov.uk/government/organisations/office-for-low-emission-vehicles

Go Ultra Low
Go Ultra Low is a joint Government and car industry campaign, supported by Audi, Hyundai, Kia, Mercedes-Benz, Toyota, Volkswagen, the Society of Motor Manufacturers & Traders (SMMT) and OLEV. It aims to provide all the information you need and give the facts you're looking for to make an informed decision.
https://www.goultralow.com

Energy Savings Trust
Energy Saving Trust (EST) provides independent impartial advice to help you evaluate your options.
http://www.energysavingtrust.org.uk/transport/electric-vehicles
http://www.energysavingtrust.org.uk/scotland/grants-loans/domestic-charge-point-funding