

GREEN DRIVING – REPORT 3

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# Plug-in vehicle recharging. *The electric future.*



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# Introduction

The Government, motor manufacturers and vehicle charge point providers are collectively investing billions of pounds in delivering a ‘plug-in future’ for the UK.

The Government is using the motoring tax regime to encourage the uptake of ultra-low and zero emission vehicles and is giving financial support through grants for plug-in cars and vans and home and workplace vehicle charge points – as well as cash to local authorities to install charge points – to encourage demand.

Ultimately the UK Government says it will end the sale of new conventional petrol and diesel cars and vans by 2040 and by 2050 wants almost every car and van on the roads to be zero emission.

A critical aspect of achieving those goals, according to Jesse Norman, Future of Mobility Minister, is “getting the right infrastructure in place”.



*The increasing availability of shiny new plug-in hybrid and pure electric vehicles from motor manufacturers may be the ‘sexy’ aspect of a progressively zero emission future, but wheels will not turn without a charging network to deliver power. Indeed, 31 new plug-in electric cars are scheduled to make their UK showroom debut in 2019, according to the Society of Motor Manufacturers and Traders (SMMT).*

In 2019 demand for new alternatively fuelled vehicles is expected to rise more than a quarter to around 177,000 units. Some 86,000 of those cars are set to be ultra-low emission plug-in hybrids and battery electrics – taking plug-in new car market share to around 3.7% as an ever-increasing number of models come on sale.

Plug-in van demand remains minuscule, although that is anticipated to increase in 2019 and beyond as vehicle choice increases. However, some experts believe that the future fuel for particularly larger vans is hydrogen due to the perceived limiting factor of battery size and range capability on payload. Nevertheless, in terms of charging there is no difference between cars and vans.

Increasing sales of plug-in vehicles – some reports suggest there will be more than one million electric vehicles on UK roads by 2020 compared with almost 200,000 registered at the end of 2018 – naturally require the widespread availability of ‘fuel’.

However, while the number of public electric vehicle charge points across the UK is increasing almost daily – there are currently approaching 20,000 – a report by data science and software company Emu Analytics suggested there needed to be 100,000 by 2020 to provide an adequate infrastructure for ‘green’ drivers and fleets.

According to Zap-Map at the beginning of February 2019 the total number of locations – notably railway stations, car parks and motorway service areas – which have a public charge point installed was 6,774; the number of chargers at those locations was 11,179 and the total number of connectors within those chargers – some charge points have the capability of charging more than one vehicle at a time – was 19,399.

To provide an idea of the rate of increase in the number of electric vehicle charge points 244 new devices were added to the Zap-Map database in the first 30 days of 2019, which equated to 479 new connectors. The total number of connectors increased from just over 13,000 in November 2017 to more than 19,000 by December 2018, according to the company, which updates its map of UK public charge points weekly.

Importantly, as this report will explain, there has more recently been a focus by charge point providers on investment in 'fast' and 'rapid' units at the expense of 'slow' chargers. That, say experts, reflects the growing demand for higher charging rates as battery capacities increase and electric vehicles are driven on longer journeys.

However, according to Go Ultra Low, the collaborative campaign bringing together the motor industry, Government and the SMMT to promote plug-in models, electric vehicles are charged at home the majority of the time. Some reports suggest vehicles are charged at home 60% of the time, 30% of the time at work and 10% of the time at public charging points.

Additionally, with the average UK commute being less than 10 miles, the majority of plug-in car and van drivers can charge entirely at home or work, only occasionally using public charge points as a back-up or additional top-up for longer journeys. That highlighted, said the campaign, that the usability of the UK's roadside charging infrastructure was an important, but not critical, facility for most electric vehicle owners.

What's more with the range of an electrically-powered car expected to exceed 300 miles by 2025, experts predict that advanced charging technology and enhanced battery technology will end the need to physically 'plug in and fill up' cars.

That's because the next-generation of electric cars could have the ability to charge wirelessly while parked at homes or workplaces. Indeed it is claimed that by 2050 wireless charging and battery capacities are expected to increase so much that the act of 'refuelling' as we know it today will cease to exist.

On the following pages we highlight what you need to know about plug-in vehicle charging today along with a glimpse into the future.



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*Q: Can you identify the types of charging infrastructure that exist?*

*A:* It can be argued that there are as many as seven electric vehicle charging patterns. The most obvious are:

- **Home charging** – typically taking place overnight to take advantage of the cheapest electricity prices
- **Workplace charging** – employees top-up their vehicle while at work
- **Street charging** – recharging a vehicle from a lamppost outside a residence
- **Motorway charging** – charging a vehicle during a long distance journey
- **Destination charging** – topping up a vehicle with 'fuel' at one of the many public recharging points located at popular locations such as local authority, supermarket, hospital, cinema and gym car parks, town and city centre multi-story car parks and railway stations

- **Fleet charging** – recharging at a central hub operated by, for example, a business operating a fleet of taxis or delivery vehicles
- **Electric highway** – driving a car along dedicated electric vehicle-only roads.

Source PwC's report 'Powering Ahead! Making Sense of Business Models in Electric Vehicle Recharging'.

The above mentioned charging infrastructures are all at different stages of evolution with the electric highway very much looking to the future. Meanwhile, Highways England says by summer 2019 95% of the strategic road network it manages will be within 20 miles of an electric vehicle recharging point – a target set by the Government – a move, which hits back at claims that a perceived lack of public charging points is often identified as the biggest barrier to increased plug-in vehicle take-up.

*Q: There are, I believe, a number of different types of plug-in vehicle recharging points. Can you explain them?*

*A:* Chargepoints are categorised by the power they produce. It's measured in kilowatts (kW), and the higher the number, the faster a vehicle's battery will be recharged. Most network providers offer a mix of 'rapid' (22kW+), 'fast' (7kW-22kW) and 'standard' (3-7kW) charging options:

- **Rapid AC charging and rapid DC charging** (depending on whether a car requires an AC or DC connection) – defined as a charge rate greater than 22kW of electricity with some of the latest drawing 150kW, rapid charging stations can achieve an 80% charge in around 30 minutes. They are generally installed at motorway service stations enabling 100% electric vehicles to travel across the country, as well as retail outlets and other locations. In the UK, rapid DC chargers are more typically available.

- **Fast charging** – can fill up a battery in one to four hours and likely to be installed in numerous public locations including today in car parks and other 'destination' locations such as supermarkets and cinemas. They are all AC and are typically rated at 7kW or 22kW, and are compatible with most electric cars and vans.

Almost all electric vehicles and plug-in hybrid electric vehicles are able to charge on a Type 2 connector (see below), with the correct cable at least. It is by far the most common public charge point standard around, and most plug-in car drivers will have a cable with a Type 2 connector charger-side.

- **Standard or 'slow' charging** – generally what would be used at home and work and originally the most common in the UK as they could also be found in car parks and other 'destination' locations such as supermarkets and cinemas. However, 'destination' locations are now phasing these charging points out in favour of 'fast' and 'rapid' charging points. Even though 'slow' charging, up to about eight hours for a full charge, can be achieved through a standard single-phase 13 amp three pin domestic plug, it is recommended that a dedicated electric vehicle charging station is fitted by a qualified electrician, in order to achieve maximum amperage levels and a reduced charging time. Most slow charging units are usually untethered, meaning that a cable is required to connect the plug-in vehicle with the charge point. Most home units have the same Type 2 cable as found on public chargers, or be tethered with a Type 1 connector where it is suitable for a particular vehicle.

Home and work recharging points are AC. With regards to public charge points the network is split around 70/30 in favour of AC points. DC points are typically favoured at 'journey' locations – motorway service areas and trunk road service stations – and AC points at so-called 'grazing' locations – car parks, leisure centres, cinemas, hotels and park and ride locations. 'Rapid' charging can only be used on vehicles with 'rapid' charging capability. Each charger type has an associated set of connectors which are designed for low or high power use, and for either AC or DC charging. Regardless of whether the chargepoint is AC or DC (see later), generally the associated costs including installation and operation will rise with increasing power of the recharger. It is also critical to remember that as the RAC Foundation report, 'Development of the UK Public Chargepoint Network', highlights:

**"One of the most common misunderstandings at all levels is the false belief that any electric vehicle on the road can accept any charge rate available. This is absolutely not the case, as the chargepoint and the charger in the vehicle are in series, and therefore the actual charge rate will be the lower charge rate of the two chargers."** Therefore,

while a vehicle may be 'plugged into' a 'rapid' charge point if the on-board charger can only deliver electricity at 3.6kW the speedy discharge of the 'rapid' charger will not be felt. However, technology provided by charge point operators is improving all the time in terms of charging speed. For example, in 2018 Pod Point, one of the largest providers of public recharging points, announced it was introducing 150kW points across the country. Meanwhile, Ionity, a joint venture company formed in 2017 between BMW Group, Daimler AG, Ford and the Volkswagen

Group with Audi and Porsche is aiming to "create a network of powerful, reliable and accessible charging stations" throughout Europe, including in the UK. It is promising to develop a network of 350kW 'fast' chargers – Combined Charging System (CCS) compatible so stations are able to be used by a large number of vehicles without the need for adaptors (see below) – with a 'charging session' costing £8 during the current introductory phase. Payments will be made on-the-spot by smartphone with users scanning the charge point's barcode, entering their details and authorising payment. Ionity says it is aiming to provide an average of six charging points every 75 miles. The UK plan is for approximately 40 sites by the end of 2020. The first station in Maidstone is to open in March/April 2019 and will be equipped with four 'fast' chargers with further locations initially scheduled in Gretna Green, Thurrock and Milton Keynes.

Frank Plaschka, Ionity's head of marketing and brand, said: "We are seeing the new generation of electric vehicles offering range, comfort and performance at a similar level to conventionally powered cars now becoming a

viable alternative. We want to enhance the experience of electric vehicle travel, making it simple and enjoyable. The future is electric and our goal is to provide a charging experience that is so good it creates a new generation of e-mobility advocates."

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Similarly, battery advancements by manufacturers mean that not only are batteries getting larger, but speed of recharging is improving. The Jaguar I-Pace, which has a 90kW battery, is, for example, able to recharge to 80% capacity in 45 minutes from a 150kW point.





*Q: What is the difference between AC and DC charging?*

*A:* This is where it gets a little bit technical. AC describes alternating current charging and DC describes direct current charging. The power that comes from the National Grid is always AC power. When charging portable electronic devices, for example, mobile phones and electric vehicles, the power needs to be converted from AC to DC. The technical difference between AC charging and DC charging is whether the power gets converted outside or inside a device. In the case of day-to-day portable electronic devices such as mobile phones, a converter is usually placed inside a plug. In the case of electric vehicles, a converter is inside a car.

AC charging is the most common method for electric vehicles with a plug. Due to its lower costs – production, installation and operation – these are the more commonly found chargers at home and business addresses. When plugging an electric vehicle into a normal charge point, the power gets converted inside the vehicle, then moves into the car battery. Charging speeds depend on the output power of the chargepoint as well as the convertor's capabilities to convert the power to DC. Such a charging method is most

suitable for parking spots where a vehicle will stay parked for 20 minutes or longer and therefore DC charging is exclusively used for 'rapid' charging.

DC chargers convert the power before it enters a vehicle. After conversion, the power goes directly into a vehicle's battery, bypassing its converter. A DC installation requires a lot of power from the National Grid, which makes its costs (production, installation and operation) quite high, resulting in higher tariffs for charging. However, as it usually allows for much faster charging, it is the preferred charging method to quickly recharge during long-distance trips. Almost all zero-emission cars can accept DC rapid charging. Such chargepoints are usually found at locations other than at homes or business locations. Information source: electric vehicle charging solutions provider NewMotion – [www.newmotion.com](http://www.newmotion.com).

*Q: So please explain the current public charging infrastructure and the different types of connectors?*

*A:* I'm afraid this is also complex and far from straightforward. In many ways an analogy can be drawn with the mobile phone charging infrastructure with different motor manufacturers requiring different connectors. Additionally, those old enough will recall the video tape recording battle of the 1970s with Betamax, Philips and VHS systems competing for supremacy and eventually the latter winning. What is going on in the vehicle recharging market is similar, but whether there will be a 'winner' remains to be seen. Nevertheless, experts say that drivers should not worry because, if required, connectors to enable a vehicle to use a charger, are available. The systems currently available are the:

- Combined Charging System (CCS), which is typically used by motor manufacturers located



in Europe and the United States of America and is used by all European vehicles that have 'rapid' charging capability. The CCS connector incorporates a Type 2 AC connector, so only a single charging port is required on the vehicle for both DC and AC charging, enabling public, home and workplace charging.

- CHAdeMO charging standard, which is typically favoured by Japanese and Korean motor manufacturers, including Nissan which markets the Leaf, the UK's best-selling electric car, as well as Mitsubishi and Kia. A separate connector for AC charging at home and work, for example, is required on these vehicles.
- Tesla's supercharger network was designed from the outset to accept a charge rate of 120kW. The Model 3 is being sold equipped with CCS as standard, and the Supercharger network is being

retrofitted with both Tesla and CCS connectors. Tesla sells a CHAdeMO converter for its Model S and Model X.

As explained by Zap-Map the choice of connectors depends on the charger type (socket) and the vehicle's inlet port. On the charger-side, 'rapid' chargers use CHAdeMO, CCS or Type 2 connectors. 'Fast' and 'slow' units usually use Type 2, Type 1, Commando, or three-pin plug outlets. On the vehicle-side, European models (eg: Audi, BMW, Renault, Mercedes, Volkswagen and Volvo) tend to have Type 2 inlets and the corresponding CCS rapid standard, while Asian manufacturers (Kia, Mitsubishi and Nissan) prefer a Type 1 and CHAdeMO inlet combination. That doesn't always apply, however, with the Hyundai Ioniq Electric and Toyota Prius Plug-In being exceptions.

Most electric vehicle are supplied with two cables for 'slow' and 'fast' AC charging; one with a three-pin plug and the other with a Type 2 connector charger-side, and both fitted with a compatible connector for the car's inlet port. The cables enable an electric vehicle to connect to most untethered charge points, while use of tethered units require using the cable with the correct connector type for the vehicle. Examples include the Nissan Leaf which is typically supplied with a three-pin-to-Type 1 cable and a Type 2-to-Type 1 cable. The Renault Zoe has a different charging set up and comes with a three-pin-to-Type 2 and/or Type 2-to-Type 2 cable. For rapid charging, both models use the tethered connector which are attached to the charging units. Therefore, some charging points are compatible with both CCS and CHAdeMO standards to suit drivers of vehicles adhering to either protocol. In practice nearly all public DC 'rapid' chargepoints when installed are so-called 'double DC', which is a single chargepoint but with one CHAdeMO tethered connector and one CCS tethered connector.

Furthermore, in general, notes the RAC Foundation report, 'Development of the UK Public Chargepoint Network', manufacturers do not design plug-in hybrid electric vehicles to accept 'rapid' charging, although Mitsubishi, which manufactures the Outlander, the UK's best-selling plug-in hybrid electric vehicle, is an exception. The battery capacity of the 2019 model has increased to 13.8kWh – currently the largest available in the sector – but it has a maximum DC charge rate of 22kW, half the 44 kW minimum charge rate available at UK 'rapid' DC chargepoints. Meanwhile, the report notes that in the UK there are only four cars currently capable of charging at 100kW: the Tesla Model S and

Model X, the Hyundai Ioniq and the Jaguar I-Pace. However, that figure is likely to increase as more electric vehicles appear in showrooms.

The immaturity of the market means that effectively both electric vehicle manufacturers and the charge point providers are battling for supremacy in terms of the different technologies. Which will win out remains to be seen, but it would help immensely with marketplace development if one universal system was adopted, and some experts believe that will eventually happen. In the meantime, when choosing an electric vehicle, customers are advised to talk to their supplier about the configuration of the home charge point required and the connectors required to utilise both workplace charging and public charging facilities. A useful video guide is available at: <https://www.zap-map.com/charge-points/connectors-speeds> and an electric vehicle cable selection guide on a model-by-model basis is available at: <https://evconnectors.com/ev-cable-selection-guide>.



*Q: That is all very confusing. Can't anything be done so there is a single universal charging system?*

**A:** It is confusing and it is a major issue among many plug-in vehicle drivers, which has yet to be resolved. However, moves are afoot through Parliament to standardise charging for electric vehicles. We have grown used to filling-up with petrol or diesel at a fuel station irrespective of the make/model of vehicle being driven and the branded name displayed on the forecourt. Call in and the petrol or diesel pump nozzle will fit a vehicle and fuel will be dispensed. Unfortunately, that is not as straightforward with plug-in vehicles. Charging itself involves attaching an electric cable between the vehicle and the recharging point socket – around 90% of public charging points are untethered so require the user to have a cable connection, the remainder are tethered with the cable attached to the charger for plugging into a vehicle.

That's the relatively simple bit, but then it gets complicated as explained previously with different connectors required depending on

whether a charging point is 'slow', 'fast' or 'rapid'. Late in 2018, Conservative MP Bill Wiggin presented a 'Ten Minute Rule Bill' in the House of Commons proposing standardised connections for electric vehicle charging points and a nationwide payment scheme. With no objections to the Bill it will now be debated further in a 'second reading' in March 2019. The Bill seeks to standardise all electric vehicle charging points and thus overcome the problem outlined above of different connectors, cables and plugs. A further aim of the Bill is to standardise the payment process for charging electric vehicles and introduce a universal pay-as-you-go system across the UK. Like the physical infrastructure of electric vehicle charging, payment methods – typically today pay-as-you-go or subscription based – vary widely across different charging networks. While there is a slim chance of Mr Wiggin's Bill becoming law, the measures, with enough Parliamentary support, could be adopted by the Government and included in updates of either the Alternative Fuels Infrastructure Regulations 2017 or the Automated and Electric Vehicles Act.



**Q:** Does the Government provide grants towards the cost of installing recharging points at homes and places of work?

**A:** Yes, that is correct. The Government offers grants of up to £500 to support the wider use of electric and hybrid vehicles via the Office of Low Emission Vehicles (OLEV). The Electric Vehicle Homecharge Scheme (EVHS) provides grant funding of up to 75% towards the cost of installing electric vehicle chargepoints at domestic properties across the UK. All vehicles that have been approved as ultra-low emission vehicles (75g/km of CO<sub>2</sub> and below) by OLEV are eligible for the Scheme.

The Workplace Charging Scheme (WCS) is a voucher-based scheme that provides support towards the up-front costs of the purchase and installation of electric vehicle charge-points, for eligible businesses, charities and public sector organisations. The contribution is limited to 75% of purchase and installation costs, up to a maximum of £500 for each socket, up to a maximum of 20 across all sites for each applicant.

Further information on both the EVHS and WCS grants is available at: <https://www.gov.uk/government/collections/government-grants-for-low-emission-vehicles>.

How long both grant schemes will remain in place is at the behest of the Government. The Government has also announced, in a move claimed to keep electric car charging costs down, that all grant-funded home chargepoints must use innovative 'smart' technology from July 2019; it follows a similar mandate for workplace charging points in 2018 thus putting an end to so-called 'dumb' chargers that simply charge and provide no data. That means chargepoints must be able to be remotely accessed, and capable of receiving, interpreting and reacting to a signal. Smart charging can also reduce high peaks of electricity demands, minimising the cost of electric vehicles to the electricity system and keeping costs down for consumers by encouraging off-peak charging.

**Q:** What are the tax implications for employers and employees of vehicle recharging point installation and electricity provided by employers?

**A:** The Government announced in the 2018 Budget that it would extend the 100% first-year capital allowance for electric vehicle chargepoints for a further four years until March 31, 2023 for corporation tax and April 5, 2023 for income tax purposes. However, with regards to employees, tax rules are not as simple.

At Budget 2017, the Government clarified existing legislation so that from April 2018, there is no benefit-in-kind charge on electricity that employers provide to charge employees' privately-owned pure electric or plug-in hybrid vehicles. Importantly, the scope of the legislation means that the charging facility does not have to be provided at premises under the control of the employer, merely at a place at or near the workplace. The clarification came after a number of employers contacted HM Revenue and Customs (HMRC) asking if employer-provided electricity was a benefit-in-kind. The exclusion of electricity from the definition of fuel means that, according to the Association of Taxation Technicians, employers can pay for without a taxable benefit arising in respect of an employee driving a pure electric company car:

- A vehicle charging point to be installed at an employee's home
- A charge card to allow individuals access to commercial or local authority charging points.

However, those tax exemptions only apply to pure electric vehicles and not plug-in hybrid electric models. What's more, if an employee

uses their own electric car for business purposes taxable benefits do apply if their employer:

- Pays for a vehicle charging point to be installed at an employee's home
- Provides a charge card to allow access to commercial or local authority charging points
- Pays to lease a battery for an employee's car.

In each case, the taxable benefit will be calculated under usual tax rules and based on the cost to the employer.

**Q:** What's involved in having an electric vehicle recharging point installed at home?

**A:** Around 40 manufacturers provide charging units suitable for residential use. Typically the units are wall-mounted, and available either with a tethered Type 1 or Type 2 cable, which can be plugged straight into the car, or with a Type 2 socket for use with a vehicle's charging cable. A warranty is also included, although its length, which could be five years, varies depending on manufacturer. Manufacturers of electric vehicles invariably have struck a partnership with at least one charging point operator. What's more some vehicle manufacturers are incentivising demand for plug-in vehicles by including provision of a charging point in the purchase. As explained previously there is currently a Government grant available of up to £500 to help towards the cost of home charging point instalment. However, at some point in the future it is likely that those grants will end. Once that happens vehicle manufacturers as well as recharging point providers may have to look at the cost of installation.



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Prior to installation it is important to secure permission of the electricity network operator for a charge point. Most charge point providers will offer a technical location assessment that in the case of a home installation amounts to a site survey ahead of a single-point wallbox being fitted. For tenants and leaseholders it is important to gain permission of the site owner to have a charging point installed, although suppliers say that in their experience most are agnostic about the project as they can see a potential increase in the value of a property with the facility. In homes the key issue is the distance between the distribution board and the location of the charge point. That determines the amount of cabling required and whether it is run through walls or underground and, in turn, that impacts on installation cost. Most home chargers are either rated at 3kW or 7kW. The 'higher' powered wall-mounted units normally cost more than the 'slower' 3kW option, but halve the time required to three-four hours to fully charge a vehicle. All charging units are wired directly to a home's central metering unit, usually on its own circuit for safety and to enable monitoring separate from other electrical loads. The cost of a 7kW home charging point varies according to supplier, but installation of a socket typically costs approximately £300-£500 after Government grant depending on charger type. It should also be noted that some new homes are already fitted with recharging points.

To be eligible to apply for the grant scheme, vehicle owners must provide evidence of ownership/keepership, lease, be named as the primary user of an eligible electric vehicle (bought new or second hand), and have off-street parking facilities suitable for charge point installation. The charge point must also be installed by an Office for Low Emission Vehicle's authorised installer. Choosing a supplier that is

not on the list will most likely mean incurring the full cost of the unit and installation. Finally, the date of installation must not be more than four months ahead of the date of delivery of start date of vehicle.

The average UK day and night rates for electricity are calculated by the RAC Foundation to be 15.5p kWh and 8.6p kWh respectively. Adding in the standing charge element increases those to a total electricity cost of 17.6p kWh and 10.8p kWh respectively. Assuming that a 7kW home charger is fitted, in a 10-hour overnight charge (8pm to 6am), a car with a 3.6 kW on-board charger will take on approximately 36 kWh at a cost of £3.89, and a car with a 7kW on-board charger will take approximately 70 kWh at a cost of £7.59.

Charging point installers can provide a variety of tools to help home owners manage charging and energy usage. For example EO Charging's Genius Charger can be connected to an eoHUB mini-computer delivering the ability to monitor energy usage via eoCloud, the company's software platform, and control the charger from a smartphone – including start, stop and pay-for on the go options – thereby managing the energy supply in real-time. Looking to the future EO Charging says its eoHUB will, during 2019, integrate with the smart-grid, solar photovoltaics systems and battery storage.

**Q:** *What's involved in having an electric vehicle recharging point installed at business premises?*

**A:** While workplace charge points are similar to home-based units, power-ratings tend to be higher with more 7kW and 22kW units installed. More business units are also double socket allowing them to charge two cars at the same time. The higher power units also enable plug-in company fleets to 'opportunity' charge in



the middle of the day to increase the effective number of business miles driven per day without having to use more expensive charging on the public 'rapid' network.

Prior to any charge point installation, it is recommended that permission from the landlord/landowner is obtained alongside the permission of the electricity network operator. Installers highlight that it is rare that any objection is raised as the ability to charge electric vehicles on site is likely to prove to be a benefit in future lease discussions. The main issues for installation of chargepoints at a workplace are how many charge points to provide and the availability of, or lack of, an adequate electric supply so a site survey is essential. Most charge point providers will offer a technical location assessment ahead of recommending the type of charge point required taking into account user demand and electricity supply. Depending on the business and the site that could amount to a single or dual-point wallbox for a small business to a series of free-standing chargers in a vehicle compound or car park for larger

businesses. Some workplaces may require charge point installation for employees (7kW) and 'rapid' charge points for visitors.

As explained previously a Government grant is available to help with the funding of charge points. The charge points are required to have a need declared for them on application, which could include: existing electric fleet vehicles, to add an incentive for the uptake of plug-in vehicles with staff, to provide a charging solution for visitors, or to charge electric vehicles planned to be purchased by the business. Charging for customers, where applicable, is not eligible for grant aid. Standard three-pin sockets are not eligible for funding, and the charge points can only be fitted by accredited Office for Low Emission Vehicle installers. Charge points must provide a minimum of 3kW, with the supply not diminished by charging multiple vehicles simultaneously. Companies cannot claim for existing charge points, with the grant available only for new charge points yet to be installed. A company also has to have dedicated off-street parking for staff, visitors or fleet use.

As Zap-Map highlights, electric vehicles likely to use workplace charging points will have different charging connectivity needs, so it is important to install a charging point most likely to be compatible with the widest range of vehicles possible. The most common workplace installation is a wall-mounted Type 2 7kW charger, which is compatible with most of the best-selling electric vehicles and will charge a vehicle fully in around three-four hours. Some businesses may wish to install a faster 22kW unit or even a 'rapid' charger if cost and space allow. Most workplace installations select wall-mounted units as they are typically cheaper to install. The alternative



is a post, which are good on-street options but usually have higher installation costs due to the need to get the electricity to the post under the ground.

For businesses that plan to install their charge point in areas that are publicly accessible, it is essential to consider access issues. Most charge point manufacturers offer units that can be accessed with either a key or radio frequency identification (RFID) card to prevent unwanted usage.

The two key costs of workplace charging are the price of the unit and the installation costs, including digging trenches for foundations, running in cables, fixings, parking bay markings and signage. Some installers may offer a choice of purchase and lease options. Based on a standard project, a fully installed Type 2 7kW double-header would typically cost around £1,500, after Government grant. Likewise, a 22kW double-headed post unit costs £2,500-£5,000 (inclusive of grant), while a fully installed rapid charge unit can cost up to £35,000. Once a suitable unit has been selected, an installer will be able to provide a quote for the unit and installation costs. A warranty is also included, although its length varies depending on manufacturer. As with other business infrastructure projects, it is recommended that employers obtain a couple of quotes from potential suppliers.

Furthermore, depending on supply an additional grid connection, or energy storage facility, may be required. With charging technology – as well as plug-in vehicle battery technology – moving at a rapid pace, experts suggest that businesses should aim to future-proof charging points. That's because requirements tomorrow maybe radically different from today in terms of number of plug-in vehicles entering sites and speed of charging. Both developments may, for example, require businesses to increase electricity supply. Such forward-thinking may result in businesses leasing rather than buying the hardware so they can upgrade to the latest technology when available, but still paying installation costs. Future demand may also have an impact on electricity capacity across the business with any requirement for an upgrade likely to be expensive and require conversations with the distribution network operator. However, some

charging installers, including NewMotion, provide a 'halfway' solution which is a so-called 'power-sharing' or 'power-management' tool that enables businesses to spread the electricity available and 'turn-up or 'turn-down' power based on demand. Meanwhile, EO Charging's 'smart fleet consultation' includes analysis of charge point requirements now and in the future through analysis of vehicle usage, mileage patterns etc and includes any requirement for electricity load management. The company says its revolutionary smart energy device eoHUB, which manages up to 32 chargers online following installation, will be upgraded to a 100-charger with launch of the next-generation technology in Q2 2019.

However, it should be noted that some new office and factory developments are being built with charging points already installed in employee car parks. Indeed some supporters of electric vehicles believe a minimum of 25% of workplace parking spaces should be fitted with a 7kW charger. BP Chargemaster, the UK's largest provider of charging points, says businesses have four different options for managing or recouping the cost of energy consumption:

- **Free** – provide staff and visitors with unlimited free charging
- **Recover energy costs** – apply charges based on the amount of energy consumed with the aim of recovering energy costs to the business
- **Recover energy and unit costs** – apply charges based on energy consumed as well the monthly lease/purchase price of charge points
- **Generate profit** – charge a set amount with the aim of generating profit from the charging network beyond cost recovery.

BP Chargemaster says employers can switch from one option to another based on individual

site requirements or as a business grows and the number of electric cars increases. To further help businesses fund the installation of charging points:

- The Government extended first year capital allowances for electric vehicle charge points for four years in the 2018 Budget. That means the cost of installation can be written down in year one with allowances extended to March 31, 2023 for Corporation Tax and April 5, 2023 for income tax purposes.
- Other grant schemes may be available to some organisations as a result of their location (in Scotland from the Energy Saving Trust), some local authorities and some charities.

*Q: What back office support is available to businesses to help manage use of electric vehicle charging points?*

**A:** The majority of charge point manufacturers offer some form of back-office support to manage charge point usage, set applicable user charges, report on energy use, charge point use and carbon dioxide (CO<sub>2</sub>) impact as well as provide numerous other tools. The level of assistance varies and can usually be tailored as a package for a company buying a service, from basic maintenance to full network support via leading-edge software with a 'master unit' controlling networked charge point usage. BP Chargemaster, for example says all of its communicating workplace and commercial units automatically connect to its Chargevision data management system, enabling users and site owners to view live analytics giving real-time access to charging points highlighting how and when they are used and historical reports on usage. Reports can also be downloaded for accounting purposes and the management of systems.

Meanwhile, EO Charging says its revolutionary smart energy device eoHUB, which puts up to 32 chargers online – and in Q2 2019 will be upgraded to a capacity of 100 – following installation, monitors energy usage, calculates employee benefit-in-kind tax bills for company car drivers, bills for energy and manages power supply. It is future-proof so it can receive new software upgrades over the air and has the capability to monitor the power usage of a building in real-time and turns up and down the chargers based on the energy available, a process known as 'dynamic load balancing'.

Having installed charge points, NewMotion, Europe's largest electric charging partner, provides business customers with an online portal. While available services depend on the charge point fitted and type of subscription, it delivers the ability to view and manage: the duration and the status of charging sessions, including charging time and whether a point is occupied or offline through remote charge point control to maximise usage, kWh-usage, costs and CO2-savings. Access controls are also available, for example giving the ability to allow only employee to plug and charge and manage their usage, set specific tariffs – pricing per kWh and time-based – for visitors and guests and manage all registered charge cards and costs. Through the dashboard customised reports can be created and downloaded for administration and tax purposes.

*Q: What is required by way of maintenance of home and work-located charging points?*

**A:** Once installed, charging points, whether at home or work, require very little if any maintenance. What's more, with the Office for Low Emission vehicles mandated rollout of smart chargers for business premises in 2018 and for homes from summer 2019, providers suggest any problems

may well be resolved remotely. Nevertheless for 'old-style' so-called 'dumb' chargers that do not transmit any data, any fault requires an engineer call-out.

Typically charge points, depending on demand and how well they are looked after will have a 10-year life, or perhaps longer. However, some installers do offer maintenance packages that vary from annual plans to pay-as-you-go and emergency callout. Maintenance will, if possible often be arranged to be undertaken at off-peak times. EO Charging recommends an annual charge point 'health check' and for heavy users, for example, van delivery fleets, a 'health check' supported by a 24-hour callout facility.

*Q: What are the rules for managing employees' plug-in vehicle mileage reclaims from the point of view of both staff and employers?*

**A:** In simple terms the current rules, such as they are, remain a mess which is why ACFO, the UK's premier fleet decision-makers' organisation, believes they have contributed to a slow take-up in demand of plug-in models from fleets and drivers. However, following a long-running campaign by ACFO with backing from the wider fleet industry including the British Vehicle Rental and Leasing Association, motor manufacturers and leasing companies, HMRC did announce the introduction on September 1, 2018 of a 4p per mile Advisory Electricity Rate for 100% electric cars. However, under Advisory Fuel Rate rules plug-in hybrid cars continue to be treated as either petrol or diesel models for mileage reimbursement purposes.

Advisory Fuel Rates apply where employers reimburse employees for business travel in their company cars, or require employees to repay the cost of fuel used for private travel. They are deemed to be tax and National Insurance-free.

However, employers can use their own rate which better reflects their circumstances if, for example, their cars are more efficient, or if the cost of business travel is higher than the guideline rate. But if they pay a rate that is higher than the Advisory Fuel Rate and can't demonstrate the electricity cost per mile is higher, they will have to treat any excess as taxable profit and as earnings for Class 1 National Insurance purposes.

Advisory Fuel Rates are reviewed quarterly and similarly, the new Advisory Electricity Rate will be kept under review. Employers have the option of applying the appropriate Advisory Fuel Rates for petrol or diesel cars to plug-in hybrid vehicles. However, with plug-in hybrid vehicles' fuel use varying by up to 300 mpg depending on a driver's journey and charging practice, reimbursing for fuel used by those vehicles at a flat rate will rarely be realistic or fair. Therefore, suggests TMC, the provider of fuel management and business mobility solutions, mileage reimbursement in respect of plug-in hybrid electric company cars could see the first 25-50 business miles – depending on battery range – paid at one rate, e.g. the Advisory Electricity Rate, and the remainder at another, e.g. the Advisory Fuel Rate. The company argues adopting that formula is simpler than estimating a 'blended' pence-per-mile rate for plug-in hybrid electric vehicles and simultaneously encourages drivers to aim to start trips with a fully-charged battery.

When employees drive their own cars on business trips mileage reimbursement is through the tax-free Approved Mileage Allowance Payments (AMAPs) scheme of 45p for the first 10,000 miles and 25p thereafter to reimburse business mileage. The AMAP rate is intended to cover the vehicle's ownership and running costs, including fuel. However, there is not an official 'fuel element' in the AMAP rate, which makes calculating the 'real' cost with regards to

plug-in vehicles complex. TMC recommends that employees driving their own plug-in vehicle, which was not funded through a cash allowance, should receive the full AMAP rate due to the higher purchase price of the car.

However, said Paul Hollick, managing director of TMC, and chairman of ICFM, the organisation dedicated to advancing the profession of car and light commercial fleet management through training and qualifications, it was also accepted practice to apply the appropriate Advisory Fuel Rate in circumstances where fuel needed to be calculated. For example, employers could pay the AMAP rate, less the applicable Advisory Fuel Rate and then add the 4p Advisory Electricity Rate in respect of a pure electric vehicles.

With regards to plug-in hybrid electric vehicles a company could adopt the policy as outlined above in respect of company-provided plug-in hybrid electric vehicles – apply the relevant cost per mile for electricity for the first 20-50 miles, then apply full AMAP rates thereafter. As a result, for owner-drivers at the wheel of plug-in cars, 'fuel' would account for a smaller proportion of their total cost of motoring than it would for the employee driving their own petrol or diesel car on business.

In relation to a cash allowance driver, Mr Hollick said: "The employer needs only to pay for the fuel element of an employee's business use of the vehicle, since ownership overheads are ostensibly covered by the allowance. Applying the Advisory Electricity Rate of 4p per mile would result in a significant business saving compared to internal combustion engine cars. Cash allowance drivers can then claim tax relief (41p) on the difference between the rate they receive and the full 45p AMAP rate."

If driving a pure electric car with an employer paying for all 'fuel' – private as well as business – then no car fuel benefit charge arises due to HMRC not recognising electricity as a fuel. If driving a plug-in hybrid electric vehicle then the Car Fuel Benefit Charge applies. TMC has produced a guide, 'Electric Vehicle Fuel Rates', which can be downloaded at: [www.themilesconsultancy.com](http://www.themilesconsultancy.com).

**Q:** When I'm planning a journey or out on the road how can I locate electric vehicle charging points?

**A:** Zap-Map – <https://www.zap-map.com/live/> – provides regularly updated access to a UK-wide map of publicly available electric vehicle charge points downloadable via desktop PC or app. The map identifies any combination of charge point type ('slow', 'fast', 'rapid' AC and 'rapid' DC), connectors, location type, payment and access type. The map also has a route planner. In late 2018 Google Maps also started to provide charge point locations along with other information.

**Q:** How do I pay for electricity when I use a public recharging point?

**A:** It is a good question and I'm afraid there is no simple answer. Once again it is not typically as straightforward as paying for petrol or diesel at a fuel station, but that is changing. More than 20 different public charging networks are currently available in the UK, with some offering national coverage and others only found in a specific region. The major UK-wide networks include BP Chargemaster (Polar), Ecotricity, Pod Point and Charge Your Car. Payment and access methods across networks vary widely, with some networks providing a Radio Frequency Identification (RFID) card and others a smartphone app to use their services.

While many require an account to be set up before use, some 'rapid' units with contactless pay-as-you-go card readers are starting to be installed. The majority of 'fast' and 'rapid' chargers require payment via pay-as-you-go, but pre-paid and subscription charging is available depending on provider. However, just as smart charge points are coming to the fore so some kind of uniformity of charging is starting to take shape with the majority of tenders received by charge point providers now requiring a pay-on-use or pay-as-you-go facility, which overcomes any requirement for an account or network membership.

Charging tariffs tend to comprise a flat connection fee, a cost per charging time (pence per hour) and/or a cost per energy consumed (pence per kWh), according to Zap-Map. However, some charge points are free to use and they include the February 2019 launch of 'Plug in Suffolk', which claims to be the UK's first 'fully open' public electric vehicle fast charging network. Suffolk County Council has partnered with EO Charging, one of the UK's leading charge point manufacturers, to deliver 100 electric vehicle charging stations (up to 400 individual sockets) that will be installed by local businesses across the county and made publicly available to support increasing number of plug-in vehicles. 'Fully open' means electric vehicle drivers pay by contactless payment with no need to register with networks or become members of organisations. Charlie Jardine, founder and CEO of EO Charging, said: "Suffolk's

**existing charging infrastructure is simply not fit for purpose if we are to see the mass adoption of electric vehicles across the county. The 'Plug In Suffolk' network will play a vital role in increasing the density of publicly available 'fast' electric vehicle chargers and will ensure that driving electric in Suffolk is**

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**hassle-free. Charging should be as easy as buying groceries, simply tap-and-go!"** EO Charging says it is in discussion with "three strong prospects with a further seven or eight expressions of interest having been received" from other counties and local authorities across the UK to launch similar projects to support the growing popularity for electric and plug-in hybrid vehicles.

In Europe an Open Charge Point Protocol (OCPP) exists that enables communication between electric vehicle charging stations and a central management system, also known as a charging station network, similar to cell phones and cell phone networks. It enables drivers to 'refuel' at any charge point. However, such a facility does not exist in the UK due to, it is claimed, the 'protectionist' attitudes of some charge point providers. Nevertheless, experts suggest that 'roaming' is the key for the long-term introduction of a simple payment solution that does not require drivers to have potentially multiple accounts and that could be hastened by the sector arrival of global energy providers such as BP and Shell or by Government intervention.

For example, Shell already offers businesses a 'hybrid' fuel card that enables electricity as

well as petrol and diesel and other products to be bought at its forecourts. As highlighted previously, the cost of 'filling up' a vehicle at a public charging point varies according to a number of different factors: Type of vehicle and the speed it is capable of charging at, speed of the public charger, price of electricity and length of time vehicle is 'plugged-in'. Zap-Map provides a useful online public charging calculator – <https://www.zap-map.com/tools/public-charging-calculator/>. Using the best-selling Nissan Leaf as an example and selecting the 40kWh Acenta Auto model (estimated real-world electric range of 188 miles) 'plugged-in' to a 50kW 'rapid' charger with no connection fee, a 30p per kW cost for electricity and assuming a 20% battery level at the start of charging and a 100% level at the conclusion the charge cost is £9.60; the charging time is 38 minutes and 32kW of charge are added to give a range of 150 miles and a cost per mile of 6.4p. The cost for the same charge using a home charging point would be £4.48 assuming an electricity cost of 14p kWh, according to Zap-Map. Further information on UK network coverage and costs is available at: <https://www.zap-map.com/charge-points/public-charging-point-networks/>.

*Q: Can I be assured that a public charge point will work when I park alongside one?*

*A:* Arriving at a charging point to find it is 'out of order' remains a major concern of the public. However, experts say there has been an improvement in charge point reliability. Latest data suggests the number of 'out of order' charge points is around 8% of the total at any one time – down from about 15% in 2017. Charge point failure is usually related to mechanical or software weaknesses or no data signal, which is essential to the operation of a charge point. It allows the charge point to send data to the network operator such as confirmation of user authorisation to allow a charge to start, charge data and error codes amongst others, and for the network operator to send data to the charge point to initiate a remote start or stop and carry out a reboot amongst others.

*Q: I've heard about electric vehicle charging hubs opening. What are they?*

*A:* They are effectively the equivalent of today's fuel station forecourt. One of the complaints of many plug-in vehicle drivers is that charge points are open to the elements and all that such a location entails – no protection from the weather, a lack of lighting if using the facility during the hours of darkness, cables lying on the floor and possibly on muddy ground, charging bays unmarked and with no wi-fi connection. An electric vehicle charging hub, where multiple charge points are gathered under one roof, provide all the facilities that drivers require for a charge and are in effect be the plug-in vehicle equivalent of a modern filling station.

In 2018, Dundee Council opened three early concept electric vehicle charging hubs in the city, with further hubs planned at the city's three main multi-storey car parks. Each hub is equipped



with both 50kW 'rapid' chargers and 22kW 'fast' chargers. Chargers at the hubs are available to the public, local taxi and private hire fleets, NHS vehicles and local businesses. Today the city has more than 75 charging points and the City Council operates a fleet of 87 electric vehicles, which it claims is more than any other UK local authority.

*Q: I've heard about recharging point 'blocking', what is that?*

*A:* The latest battery-only cars need only five minutes at the quickest 'rapid' chargepoints to take on enough electricity to add about 15 miles of range. However, because of the limitations of their on-board control units, it will take almost all plug-in electric vehicle hybrids an hour or so – or 12 times as long – to achieve a similar amount of charge (the average UK plug-in hybrid electric vehicle battery capacity is presently 9.1kWh meaning it will take about two hours to charge from 20% to 100% state of charge for a real-world driving range of less than 25 miles). That mismatch, it is claimed means that expensive, high-specification recharging equipment which is essential to battery-only vehicles on long journeys could be 'blocked' by other, slower-charging vehicles.

Concerns about recharging point 'blocking' were highlighted in a late 2018 report published by the RAC Foundation entitled 'Development of the UK Public Chargepoint Network'. Author Harold Dermott argued that until plug-in electric vehicle hybrids had both a greater electric-only range and could accept electricity at a faster rate, chargepoints at motorway service areas should be reserved solely for battery-only cars. The study recommended that chargepoint locations for battery-electric vehicles – particularly the larger hubs that are now being trialled – needed to offer the services and facilities routinely found at traditional fuel stations, such as: protection from the weather, food and drink facilities, toilet provision and good lighting. RAC Foundation director Steve Gooding, said: "Ever-faster and

**more powerful chargepoints might sound like the answer to creating the electric car recharging network we need, but if the cars themselves can only be recharged at a certain rate then at best we're going to be disappointed and at worst we're going to waste money. Compatibility between car and charger is key. In an area where policy, technology and the market are almost falling over themselves, such is the pace of change, communication between all parties is fundamental. Neither society nor drivers will reap all the potential rewards of 'greener' transport if there is confusion about how it should best be delivered. Ultimately, 'refuelling' electric vehicles should be at least as convenient and fuss-free as filling up with petrol or diesel. As the report makes clear we may be on the right road but we are not there yet."**

*Q: As demand for plug-in vehicles increases are energy companies expected to publish special home charging tariffs?*

*A:* It's a good question and some energy providers have started to do just that in the knowledge that for many electric vehicle drivers, charging at home is a crucial part of ownership. Nevertheless, charging at home, whilst cheaper than paying for petrol or diesel or public charging, will increase electricity bills. In response, and to add incentives for electric vehicle drivers to charge at off-peak times, several energy companies have introduced energy tariffs tailored specifically for plug-in vehicles. Such tariffs typically have lower unit costs during the night, when demand on the National Grid is reduced, a renewable energy promise and some offer added benefits such as reducing the cost of a home recharging point, a free subscription of a limited period of time to a public recharging scheme and electric vehicle mileage 'credits'.

Scottish Power, at the end of January 2019, became the latest energy company to announce an electric vehicle tariff providing discounted off peak (midnight to 5am) charging prices at home. The business claimed that the cost of charging an electric vehicle via the SmartPower Green EV tariff would be a 10th of the cost per mile of running a standard petrol car when comparing electricity costs with the cost of fuel. The company calculated a 10th cost saving based on a comparison between electricity unit rate per mile (1.06p) and petrol cost per mile (11p) between a Hyundai Kona electric vehicle and Hyundai Kona petrol engine utilising off-peak charging between midnight and 5am at 4.736p/kWh. To benefit from the tariff a range of conditions must be met.

There are a number of other energy tariffs available, such as E.ON's 'Fix and Drive' and British Gas's 'Green Drive' and some that may suit electric vehicle drivers but without being labelled as such. Zap-Map publishes an electric vehicle energy tariff guide at: <https://www.zap-map.com/ev-energy-tariffs/> and further information is available from the Energy Saving Trust at: <http://www.energysavingtrust.org.uk/transport/electricity-tariffs-electric-vehicles>.

**Q: What is electric vehicle wireless and induction charging?**

**A:** Drivers of plug-in vehicles could benefit from recharging their cars using easy and convenient wireless charging technology within the next decade. That's because future generations of battery-powered vehicles could have the ability to charge wirelessly while parked at homes or workplaces and even be charged while on the move, the latter known as induction charging. With improvements in battery technology resulting in ever-increasing range for electric cars – the average range of an electric vehicle is likely to be about 300 miles by 2025 – drivers could be at the wheel of electric vehicles capable of travelling for miles on end, without having to 'plug in'.

Experts at TRL, the leading transport research and consultancy, claim that in future wireless charging for electric vehicles could be commonplace on driveways across the UK, and at other locations. However, for successful consumer adoption the key is likely to be efficiency and speed of charge. TRL suggests that in years to come, while wireless charging is phased in, owners of plug-in electric cars will continue to be able to use the existing infrastructure or could opt to cost-effectively add wireless capabilities to their existing cars. The technology used in wireless charging has been in development for a number of years and,

in addition to being used in consumer electronic devices today, is presently being trialled at locations internationally. What's more, it is already being used in Korea by buses, which have the capability to recharge when stationary at traffic lights, for example.

Meanwhile, technology that will enable plug-in cars to 'top up' while on the move is also being developed. The vision of the electric road of the future would require vehicle manufacturers to incorporate induction charging pads into vehicles. That may be a long stretch as road infrastructure companies would need to install multiple numbers of pads under road surfaces to make the idea a reality. It is also understood that initial trials of induction charging by one German motor manufacturer resulted in cars overheating and a slow rate of power transfer. However, further improvements in technology could make induction charging viable in the future. But it should also be remembered that, according to Go Ultra Low, by 2050 wireless charging and battery capacities are expected to increase so much that the act of 'refuelling' as we know it today will cease to exist.

**Q: I've heard about vehicle-to-grid (V2G) power discharge. What is that?**

**A:** Energy experts say that UK, as well as many other countries, will face an energy shortage notably as a result of ending coal-fired power generation. Simultaneously demand for electricity is expected to increase in part due to demand for plug-in vehicles. One idea to fill the so-called 'energy gap' is to tap into the potential of the electric vehicle market and how the switch can be reversed to power the grid.

Vehicle-to-grid (V2G) describes a system in which there is reciprocal, bi-directional electrical energy flow between plug-in electric vehicles and the power grid. FleetCarma, a clean-tech information

and technology company that provides solutions to manage and accelerate the transition to electric vehicles, says studies showed that most vehicles were not in use for up to 95% of the time. Therefore, electric vehicles were an "untapped power source" that could see energy flowing from a vehicle's onboard storage system to the national grid to support peak hours usage. Other types of V2G technology, said FleetCarma, consisted of load-sharing sources with the power grid. That could include, for example, subsets of V2G like vehicle-to-home (V2H) and vehicle-to-building (V2B), both of which could draw power directly from an electric vehicle rather than through the power grid. Therefore, an electric vehicle could be used to power a home as energy stored in the vehicle could be used to avoid peak tariffs at times of demand and an extra strain on the power grid. What's more, according to a study by the National Grid and global engineering firm Ricardo, V2G could provide £600 to £8,000 of income each year for Britain's electric vehicle owners.

In 2018, the Government invested £9.8 million in a V2G charging trial led by Nissan. The project will install 1,000 V2G charging points over the next three years to evaluate a commercial offer to electric vehicle fleet customers. Nissan is leading a consortium that includes V2G infrastructure/aggregator provider Nuvve, National Grid, UK Power Networks and Northern Powergrid. Furthermore, OVO, which claims to be the UK's largest independent energy technology company and supplier, claimed in 2018 that it had launched the world's first widely available V2G charger saying users may never have to pay to be on the road again. Called VCharge, the system is said to also optimise vehicle charging to take advantage of cheaper electricity when it's available and when there are more renewables in the system.



**Q: Does the switch to plug-in vehicles mean the end of fuel station forecourts as we know them?**

**A:** Not at all, at least in the foreseeable future although ultimately there is likely to be a 'changeover' from petrol and diesel pumps to forecourts having banks of electric charge points. However, the pace of change will depend on the speed of electric vehicle adoption. Currently, the plan seems to be that, for at least the next 20-30 years, many fuel station forecourts will offer electric vehicle charging points alongside traditional petrol and diesel pumps. BP, Shell and Total among oil giants are all installing charging points on selected UK forecourts. For example, in 2017 Shell started to roll-out its on-forecourt electric vehicle rapid charging service – Shell Recharge. Promising to charge most cars from zero to 80% capacity in approximately 30 minutes via 'rapid' 50kW DC chargers, users pay via the Smoov app, a subscription-free system. With no connection fee, customers only pay for the power used to recharge their vehicle. The current cost, a half-price promotion offer available until further notice, is 25p per kWh. What's more, in 2019, Shell says it will be introducing 150kW 'super chargers' at selected sites – typically delivering an 80% charge in 10 minutes.

Meanwhile, Tesco in late 2018 announced a major tie up with Volkswagen to provide the largest retail electric vehicle charging network in the UK – more than 2,400 charging bays across 600 stores (19 stores had electric vehicle charging bays at the time of the announcement). The charging points, powered by installer Pod Point, will enable customers to charge their electric cars using a normal 7kW charger for free or a ‘rapid’ 50kW charger for a small cost in line with market rates.



What's more some fuel companies have moved to protect their future revenues as witnessed by Shell's acquisition of charge point provider NewMotion in late 2017 and BP buying rival Chargemaster in 2018. At the time of Shell's acquisition the company said the move was an early step towards “ensuring customers can access a range of refuelling choices over the coming decades, as new technologies evolve to co-exist with traditional transport fuels”. The statement added: “This move provides customers with the flexibility to charge their electric vehicles at home, work and

“on the go. When you add this customer offer to our current roll out of fast charging points on Shell forecourts, we believe we are developing the full raft of charge solutions required to support the future of electric vehicles.”

Chargemaster was renamed BP Chargemaster following acquisition and the oil giant said at the time that it was “an important step to scaling up and deploying ‘fast’ and ‘ultra-fast’ charging on BP’s UK forecourts”. The statement continued:

“The acquisition adds to the growing number of investments by BP in electric vehicle technology and infrastructure and builds on plans to extend the range of fuels on offer for its customers changing needs. A key part of BP’s strategy to advance the energy transition is to develop new offers to meet changing customer demand and grow new businesses that support customers to reduce their emissions.” Additionally, Total has an agreement with NewMotion to allow fuel card customers to use its electric vehicle charging network across Europe. Signed in 2017, the oil company said: “With this partnership, Total is doing everything to support its professional customers in the evolution of their vehicle fleet in order to offer them an integrated management of their whole energy expenses.”

# Conclusion

*As PwC's report 'Powering Ahead! Making Sense of Business Models in Electric Vehicle Recharging' makes clear, the UK, indeed the world, is “very much in the early stages of this electric vehicle revolution”.*

Furthermore, it is obvious, as the PwC report also explains, that an electric vehicle recharging environment must be as easy as ABC if plug-in vehicle demand is to rapidly increase as the UK Government hopes.

It has to be said that utopia has some way to go with so much to be resolved in terms of plug-in vehicle connectors, charging point systems and ‘fuel’ payment methods.

The mix of business models from vehicle manufacturers and charge point suppliers available is to some extent complex and confusing. But, as the plug-in vehicle market continues to evolve simplification is also likely. Nevertheless, it remains to be seen whether through legislation or vehicle manufacturers and charge point operators co-operating which systems will win out to ensure a first-class customer experience.

## Sources and for further information

- BP Chargemaster:** <https://bpchargemaster.com/>
- Electric Vehicle Connectors:** <https://evconnectors.com/>
- EO Charging:** <https://www.eocharging.com/>
- Energy Saving Trust:** <http://www.energysavingtrust.org.uk/transport/electric-vehicles>
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- TMC (The Miles Consultancy):** [www.themilesconsultancy.com](http://www.themilesconsultancy.com)
- Zap-Map:** [www.zap-map.com](http://www.zap-map.com)

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Venson Automotive Solutions Ltd  
Venson House  
1 A C Court  
High Street  
Thames Ditton  
Surrey KT7 0SR  
Tel: 08444 99 1402  
[www.venson.com](http://www.venson.com)  
email: [sales@venson.com](mailto:sales@venson.com)



@Venson\_Fleet

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