

## CHARGE YOUR ENGINES

The electric vehicle market is gaining strength thanks to careful consideration of the future charging-point infrastructure.

By Anne Harris



Will the charging infrastructure be in place for UK EVs?

IN AMERICA, the Obama administration has set a goal of one million electric cars on the road by 2015 to reduce air pollution and dependence on fossil fuels. In the UK, the government has similarly ambitious targets, but all of this is dependent on public confidence that the charging infrastructure will be in place.

Although the vast majority of owners will charge their vehicles at home there is a need for a safety net of roadside charging options required for top-ups, or 'grazing' as it is termed within the industry.

In the UK the Plugged-In Places programme has made £30m available to match-fund eight pilot projects

installing and trialling recharging infrastructure in the UK. This will support the Carbon Plan commitment to install 8,500 chargepoints.

In its strategy document, the UK government expects to see tens of thousands of plug-in vehicles on the roads by 2015, with manufacturers bringing increasing numbers of models to market. In the period from 2015 to 2020, it is expected that the number of plug-in vehicles will accelerate as costs reduce and vehicle manufacturers bring forward a wider range of models to meet their stringent targets under the European New Car CO<sub>2</sub> Regulation.

The rate at which the UK plug-in vehicle market develops will be

determined by a range of factors including consumer acceptance and oil prices, which are difficult to predict. Independent forecasts suggest that hundreds of thousands of plug-in vehicles could be on the road by 2020. The government has accepted that it needs to be equipped to deal with this growth but it also needs to be prepared to accommodate an even more rapid rate of growth should this occur.

### The recharging infrastructure

The approach is not to mandate a chargepoint on every corner as this is uneconomic and unnecessary to support market growth. For plug-in vehicles to appeal to and be a viable

The network of public charging posts is growing rapidly, intended for 'grazing' or topping up



➤ solution for consumers, the recharging infrastructure needs to be targeted, convenient and safe.

"We want to see the majority of recharging taking place at home, at night, after the peak in electricity demand," the UK government charging strategy says. "Home recharging should be supported by the workplace, with a targeted amount of public infrastructure where it will be most used, allowing people to make the journeys they want."

"After home recharging, we want to see workplaces providing recharging opportunities, both for fleet vehicles and employees for whom recharging at home is not practical or sufficient."

Given that the majority of recharging is likely to be done at home and at work, an extensive public recharging infrastructure would be uneconomic.

"We want public infrastructure to be targeted at key destinations, where consumers need it, such as supermarkets, retail centres and car parks, with a focused amount of on-street infrastructure, particularly for residents without off-street parking," the document adds.

"Although central and local government is currently playing a key role in establishing the early public infrastructure, in the longer term a commercial market needs to develop. Public infrastructure needs to be easy to locate and easy to access, to give the public the assurance that they need to

use the full range of their vehicles and to support the commercial case for public charging."

### Public charging points

In a study undertaken by Elektromotive, a provider of recharging solutions for electric vehicles, two-thirds of motorists would be more likely to consider the purchase of an electric car if charging posts were readily available at roadsides and in car parks across the UK.

The current coalition government plans to expand existing EV charging infrastructures by installing charging stations in areas where people are most likely to plug in for a reasonably long period of time, in public car parks and on the roadside in focused areas.

"With over 2,000 of its charging stations already installed worldwide for public and private use, Elektromotive is highly respected in the industry and plays a major role in advising government, local councils, car manufacturers and energy suppliers on the best solutions to providing public charging infrastructures," Calvey Taylor-Haw, managing director of Elektromotive says.

"We are also ranked number one in Europe and third in the world for recharging post-manufacture in a 2011 study by market analysts Pike Research."

Based in Brighton, the firm has

installed charging stations across the UK as part of various government and private-led schemes, including the Brighton and Hove City Council's EV Charging Point scheme and CABLED, a scheme run by the Transport Strategy Board and Advantage in the West Midlands. Elektromotive has also installed 200 charging stations across Ireland as part of the 'e-cars' initiative launched by the Electricity Supply Board (ESB).

"We have developed an extensive range of charging stations for use by passenger cars, public service vehicles and commercial vehicles," Taylor-Haw adds. "We were the first company to install charging stations in the UK, beginning with the Elektrobay in Westminster, London, in 2006. There are now nearly 900 Elektromotive products installed in various locations across the country."

The Elektrobay is a safe, secure unit, with a simple, future-proof design. Last year the company was awarded a patent to protect the innovative design of the controller within a charging station. This controls the user's access and activation of the charging station via a personalised wireless key fob, and safely initiates the charging process when the secure, weatherproof door at the front of the unit is closed over the inserted plug.

A small colour screen and light at the top of the unit indicates when charging is in progress. With a power output of 240V AC and 13 to 32A, they are fully compliant to BS.7671:2008 and BS EN 61851 Mode 1, 2 and 3 charging (dependent on model) in the UK. It is also compatible with all fully-electric and plug-in electric hybrid vehicles.

The range has now been extended to include a twin-head Elektrobay. Able to charge two vehicles at once, this will reduce the amount of street furniture required.

"There's been a lot of scepticism about EVs, and now is the time to trumpet the message that EV drivers haven't been affected by spiralling fuel costs or the recent fuel crisis," Erik Fairbairn, CEO of EV charging company POD Point, says. "The lifetime costs of running a petrol or diesel car continue to escalate, and when you can charge your car for under £1.50, the £80-a-tank cost doesn't make financial sense."

"The public charging infrastructure for electric vehicles is being rapidly installed in car parks, railway stations and designated on-street parking bays. There is also a growing network of rapid chargers at motorway service stations."

### Charging time

One concern that many early adopters have expressed is the amount of time that it takes to charge their vehicles. With battery technology continuously improving, some of the latest production EVs – such as the Nissan Leaf and Mitsubishi i-MiEV – can now take a much higher voltage, thus reducing their charging time. With this in mind, Elektromotive launched the DC-DC 50KV Rapid Charger, compliant with the CHAdeMO protocol, which can charge a compatible EV to 80 per cent of its capacity in just 20 minutes. The Rapid Charger is currently being rolled out in car parks on main roads and conurbations where they will be of most use.

The network of public charging posts is growing rapidly. Public charge posts are intended for ‘grazing’ or topping up, and a rule of thumb is: 10 miles/hour of charge on a 13A socket; 15 miles/hour of charge on a 16A socket; 30 miles/hour of charge on a 32A socket.

POD Point already has 424 active bays (two bays in each post) in the UK, with over 70 more waiting to go in the ground.

“It is already possible for EV motorists to drive from coast to coast in the UK. The biggest challenge is not the distance between charge points, but locating the charge points while en route. POD Point is working with the Office for Low Emission Vehicles to produce the National Chargepoint Registry with an interactive map to show the location and availability of charge points and enable developers of apps, satnavs and websites to create platforms showing this,” Fairbairn says.

### At-home charging

While roadside charging is vital, the vast majority of charging will take place in the home. “Elektromotive has recently launched its Home Charger and has a new range of exciting chargers in development for the home and workplace. These feature innovative back-end management systems, demonstrating Elektromotive’s ability to stay ahead of the technological challenges associated with EV charging,” Taylor-Haw says.

“The number of public charging stations is set to increase since the International Electrotechnical Commission ended a long-standing debate over a plug and socket standard for charging stations in Europe. The decision to specify the Mode 3 62196 Mennekes-style plug and socket as the charging standard for all European EVs has boosted confidence in the industry.” ❄



While four different modes of electric vehicle (EV) charging have been established, the minefield of standardising one generic plug for public charging stations is still an ongoing saga. Modes 1, 2, 3 and 4 refer to the rate of charging of the EV, with the most basic level referred to as mode 1, a simple and slow AC charging method in the home. Mode 2 is also slow charging, introduced as a safer interim solution with in-cable protection, and as with mode 1 it must conform to standard BS 1363-2:1995. Mode 3, compliant with BS EN 62196-2, is predicted to be the most popular form of EV charging, used in public, work and household charging points, delivering both slow and fast charging within 10 hours using an EV socket. Mode 4 is the fastest, and the most expensive to equip and install of the four, delivering fast-charging DC charge converted from AC.

The IET has recently produced a code of practice for installing charging points, a specialist publication for electrical installers not aimed at the general public. While the IET believes that dedicated charging equipment is most appropriate for use with EVs, it is permitted to use an ordinary 13A plug to charge an EV if that type of cable is supplied with the vehicle.

The Code of Practice recommends that if intending to use a 13A plug and socket, the socket should be on a dedicated circuit so that in the event of a trip the whole house is not affected. This is similar to the usual advice for wiring showers and electric cookers, as they take a similar load.

In an effort to at least partially standardise the plug and socket for EV charging, the International Electrotechnical Commission has produced a standard comprising of two parts called the IEC 62196. Part 1 refers to plugs as specified in IEC 60309 for multiphase and industrial and power plugs and sockets which have been

adapted for use in electric vehicle charging, while part 2 refers more specifically to plug types used during the active process of charging.

Three plug types that have been authorised by the IEC 62196-2 include Type 1, 2 and 3 as part of battery charging and ideal smart grid compatibility. Type 1 is a single phase vehicle coupler, favoured by the US electric vehicle market, and is displayed in Yazaki’s round SAE J1772/2009 plug, featuring five pins: two AC wires, two single pins and a ground. Type 2 is single and three-phase vehicle coupler as shown in Menneke’s VDE-AR-E 2623-2-2 plug specifications which has been accepted as standard by car makers across most of Europe, but has received criticism as being the most expensive. Type 3 is a plug proposed by Scame/EVPlug Alliance that is already in use in light electric vehicles and is the cheapest of the three.

Currently, each type’s popularity is determined by regional preference of a particular mode of charging. For example, in the US and parts of Europe, including Italy, limited Mode 1 charging is used on grounds of safety, while Mode 3 is receiving a lot of interest for public charging points.

Mode 4 is the favoured type in Japan. But while the United States and Japan, for example, currently favour Type 1 connectors, various European countries favour Type 2 connectors and other international regulations mean Type 3 connectors could be required.

The IEC is currently in the process of developing a standard which will address mode 4 fast charging called the IEC 62196-3. It is unlikely that EV users will see one generic international connection any time soon, but many in the industry believe that at the very least the plug connecting directly into the charging station should be standardised, leaving the car side open to preference.