Hub Guide 10 - Electric Vehicles

1. Introduction

This guide, produced by the Greater South East Energy Hub, stems from requests for support received from local authorities and other stakeholders with electric vehicle (EV) projects. The guide covers the range of project stages for which support has been sought, from initial considerations, through to technical guidance, procurement and management models.

Local authorities across the UK are declaring climate emergencies as a response to the Intergovernmental Panel on Climate Change (IPCC) special report, on the impacts of global warming of 1.5°C above pre-industrial levels. In June 2019, the UK Parliament passed legislation to amend the Climate Change Act 2008, to require net UK carbon emissions to be net zero by 2050. Many local authorities have made a commitment to achieve this even sooner, in some cases as early as 2028. The development of EV charging points and infrastructure to prepare for the transition to EV, is one way in which local authorities can act on their climate emergency declaration, as well as prepare for an earlier switch over to EV (2030-35) as recommended by the Committee on Climate Change.

2. Initial Considerations

2.1 Different Types of Charging Points & Charger Adaptors

There are different scenarios for charging EVs, which influence the charge point and rate of charge. The key scenarios are: Charging at home, charging on a long journey and charging at a destination.

EV charge points are mainly defined by the power they can produce and how quickly they can charge an EV. The length of time it takes to charge an EV depends on how much electrical power (kW) the charge point delivers. Currently, there are three types of charging points. Each type requires a different amount of electrical power and so will vary in the time it takes to charge a vehicle. Figure 1 below represents the various charging options available to motorists with an EV, based on a 30kWh battery. Please note that some of the latest EVs have larger, 90kWh batteries, so may take longer to charge than the rates highlighted in the table.

The connector also needs to be considered, as there is more than one type of charging plug available. Plugs can be configured for slow, fast or rapid charging, and to be compatible with either direct current (DC) charging or standard alternating current (AC) charging.

Type	Time to charge	Transfer	Power	Suitable Locations
Level 3 (Rapid)	1 hour	DC	<50 kW	Public car parks, supermarket car-parks, taxi ranks, bus depots and motorway service areas
		3-Phase	<43 kW	
Level 2 (Fast)	1 - 2 hours	3-Phase	<22kW	Parking on public streets, in public car parks, leisure facilities, shopping centres and tourist attractions, workplace parking and depots
	2 - 4 hours	Single Phase	<7kW	
Level 1 (Slow)	8 - 10 hours	Single Phase	<3 kW	

Fig 1: Charging Options (Based on a 30kW Battery)

2.2 Future Proofing

One of the early barriers to EV uptake in the UK was the use by manufacturers of different charging adapters. There was also a limited number of charge points and these were often not universally compatible with every vehicle.

In order to address these barriers and ensure that EV technology is future proofed, the Alternative Fuels Infrastructure Regulations (AFIR) 2017 seek to provide technical specification and customer experience standards for EV charge points.

The Regulations require all providers of public chargers to include a *Mennekes Type 2* connector where Level 2 (Fast) charging is made available, and a *Combined Charging System* (CCS) connector where Level 3 (Rapid) charging is provided. While this only applies to equipment installed or upgraded after 17 November 2017, it is still helping to ensure an improved level of consistency. For further information on specific charger types, including their capabilities and how to distinguish them, please refer to this guide from Zap-Map.

The issue of membership charging, where several payment cards and memberships are required in order to recharge at different points, has also presented a barrier.

The government announced in 2019 that it wants to see all newly installed rapid and higher powered charge points provide debit or credit card payment by spring 2020. The government signalled that it expects industry to develop a roaming solution across the charging network, to allow electric vehicle drivers to use any public charge point through a single payment method, without the need for multiple smartphone apps or membership cards.

Local authority initiative Plug in Suffolk is actively helping to address this issue, by enabling car park operators across the county to install EV charging that can be used by anyone with a contactless payment card. *Plug in Suffolk* is the first 'fully open' public fast-charging network in the UK.

3. Smart Charging and Vehicle-to-Grid

The current electricity system has been designed to meet peak demand between 17:00 - 20:30. For the rest of the day there can be large amounts of underused generation and network capacity. Generation during these off-peak periods is usually cheaper and cleaner. EV users can therefore support the transition to a smarter energy system by charging overnight, and during daytime off-peak periods. This practice will help to reduce EV demand on electricity supply at peak periods and make it cheaper for people to charge their vehicle. It will also reduce the need for investment in infrastructure to increase capacity at peak demand periods, thus integrating EVs into the electricity system in an affordable way.

3.1 Smart Charging

Smart charging allows for 'intelligent' charging of EVs. Owners of EVs are incentivised by their energy supplier to opt into a programme that allows the supplier to curtail EV charging at peak demand times. EV owners can use the Internet-of-Things (IoT) through a mobile app to communicate with their supplier about when they require their EV to be fully charged. This method also gives EV owners the option to opt out of this arrangement on certain days. In future, all new OLEV-funded charge points will be smart-charging units.

3.2 Vehicle to Grid (V2G)

Vehicle to Grid enables energy stored in electric vehicles to be fed back into the network, to help balance the grid and supply energy at peak demand times. This provides a revenue stream for homeowners and private businesses under a managed contract and helps 'balance' the electricity market in a smart energy grid system. While V2G is still a relatively untested technology in the UK market, there are a number of pilot projects underway as part of the £30m Vehicle-to-Grid-Britain study. The study aims to understand the key drivers necessary to support the rollout of V2G. Customer concerns, including range anxiety and battery maintenance, will need to be addressed, as will technical issues relating to interaction with the distribution network. The findings of the study have now been published and should help policy makers to make an informed decision around implementing the technology.

4. Financial Considerations

The cost of installing an electric vehicle charge point will vary depending on factors such as the number and type of charge points. In addition to the equipment itself and installation costs, there are other factors to be aware of in relation to the wider networks and grid connections.

To install Rapid Chargers, grid reinforcement or a new sub-station may be required for the connection, due to the resulting increase in electrical power, which in turn may need planning permission. Other points to consider include the location, as street works may be required, which incur additional costs for road closure and excavation, as well as legal costs for easement or wayleaves if required.

4.1 Future Proofing

Distribution Network Operators, including Scottish & Southern Electricity Networks, UK Power Networks and Western Power Distribution, have produced their own guides to EV infrastructure which provide useful advice and information about connection costs.

4.2 Procurement

One route to procurement when installing electric vehicle charging is via an existing public sector framework.

- The ESPO framework provides access to a vast range of EV charging infrastructure solutions including rapid/fast/standard electric vehicle chargers and compatible back-office solutions from market-leading suppliers. Awarded suppliers can supply, deliver, install and commission EV charge points. Both purchase and lease options are offered through this framework. Emerging technologies, including battery energy storage, vehicle to grid, car port chargers, bus chargers, mobile chargers, charging test equipment and parking bay sensors, are also available.
- The Electric Vehicle Charging Points Network (CPMI) framework for the NHS and wider public sector includes the delivery, supply, installation, management and maintenance of EV charging infrastructure goods and services. This includes: a fully managed service, back-end solutions, pre-booking, mobile-apps, maintenance and repairs, space management, signage, radio-frequency identification (RFID) tags, single and multi-vehicle charging, on-street charging solutions, slow and rapid charging options, load-balancing systems, self-contained energy storage units, induction charging and solar parking.
- The Central Southern Regional Framework for Electric Vehicle Charging Infrastructure is open to all public bodies in and around Berkshire, Hampshire, Oxfordshire, Surrey and West Sussex.
  It includes opportunities for the public sector to understand, develop and deliver their requirements for EV charging. This covers feasibility, installation and adoption of existing charging points, as well as service and management. The locations for charging points include all areas and assets within public-sector estates and facilities: public car parking, fleet charging, on-street parking and off-street parking and staff home charging.
- KCS Professional Services created and now lead on the National Framework for the Provision of Electric Vehicle Charging Points. The framework covers a range of delivery models, including design, supply, installation, support and maintenance of electric vehicle charging points.

4.3 Funding

OLEV have a range of schemes to fund EV projects. One of these is the OLEV On-Street Residential Scheme (ORCS) to which local authorities can apply for funding to help with the costs of procurement and installation of on-street charging points for residential use. To date, 28 local authorities have applied to install over 1,000 charging points. For the period 2019-20, OLEV has allocated £4.5m of funding to local authorities for eligible projects, on a first come, first-served basis.

The ORCS funding provides 75% of the capital costs of procuring and installing a charging point and associated dedicated parking bay. Applicants must demonstrate their commitment to meeting on-street residential charging need and will be required to secure 25% (minimum) of capital funds via sources other than OLEV.

For additional funding schemes available from OLEV, please refer to the funding page of the Greater South East Energy Hub's website.

Funding is still available under ERDF Priority Access 4, which provides up to 50% match funding for projects which support the shift to a low carbon economy in all sectors. Although not specific to EV, if a project can demonstrate a clear level of innovation, then it may be eligible. ERDF funds are allocated to Local Enterprise Partnership areas and proposals should demonstrate alignment with local development need and priorities.

4.4. Management Models

Public-sector bodies can enter into a partnership with a charge point supplier, who can install, manage and maintain the charge point on behalf of a local authority, and provide them with an income stream from a proportion of the revenue generated from the charge point. This approach has been adopted by East Hampshire District Council and Havant Borough Council in Hampshire. EV charge points were installed for the Councils without cost (apart from the Councils needing to provide the land) and the Councils now obtain an income from the revenue they generate.

Gathering high-quality data from EV charge points is essential to measure their usage, evaluate their benefits and monitor energy consumption, and can help to inform future schemes. It is recommended that, in any scheme entered into by a local authority, the charge points supplied should be Open Charge Point Protocol (OCPP) compliant. The OCPP protocol supports communication between the EV charge points and the central data management system used in the scheme, and it enables any type of software to be used for this purpose. The option to change the software and/or software provider allows for future flexibility in the type and/or quality of data captured.

5. Case Studies

This section shows examples where EV charging points are being successfully installed across the UK. This includes Go Ultra Low Cities, where funding has been received to develop new, innovative projects that encourage people to consider switching to EV.

- Milton Keynes – The Council has installed 170 standard/fast electric vehicle charging points and 56 rapid electric vehicle charging points, all of which are publicly available and located throughout the borough, with a significant concentration in Central Milton Keynes.
- Nottingham – Over 200 charging points are being installed across the East Midlands region. These will be a mix of fast and rapid charge points at strategic locations on the major road network, at council owned car parks, public transport interchanges and retail outlets.
- Oxford – Run by Oxford City Council and Oxfordshire County Council, six different charging technologies are being tested to find the best options for residents who are required to park on Oxford's narrow streets.
- Dundee - Dundee is introducing three rapid-charging hubs in priority locations across the city, providing essential access for electric vehicles. Local car franchises will be utilising the newly built hubs to promote their own electric vehicles for sale.
- Hampshire – East Hampshire District Council and Havant Borough Council have partnered with ChargePoint Services to provide new electric vehicle charge points in the borough, enabling residents and visitors to charge quickly and efficiently on the go.
- Oxfordshire – SSE Enterprise will be installing innovative charging hubs, to enable residents, visitors and businesses to charge EVs at up to 35 local authority owned car parks across the county, working as part of a consortium with partners that include Oxfordshire County Council.

5.1 Statistics

Statistics on the roll out and development of EV and infrastructure are available.

To find out about the number of vehicles in your locality that utilise EV infrastructure, details about the licensing of ultra-low emissions vehicles by local authority area can be obtained from the GOV.UK website.

Information on existing electric vehicle charge points is available from Zap-Map and Open Charge Map. Existing statistics from Zap-Map show that, as of January 2020, there are charge points installed at 10,789 locations in the UK.

5.2 Learning

To share learning, the Greater South East Energy Hub can facilitate discussions with key contacts in local authorities and other organisations involved in the projects above. If interested, please contact info@energyhub.org.uk.

6. Why Install EV Charging Points?

6.1 Growth of EV

In 2017, the government announced plans to ban the sale of new diesel and petrol cars by 2040. This has resulted in the need for the government to speed up its preparations for the uptake of EVs and provide the right environment to support and encourage the transition. The cost of EVs is expected to be lower than conventional cars by 2030. According to the Net Zero Technical Report by the Committee on Climate Change, when considering purchase, maintenance, tax and fuel together, modelling suggests that electric vehicles will reach upfront cost parity with conventional vehicles in the second half of the 2020s[1].

There is expected to be a rapid increase in EV numbers in the UK, which is outlined in the government's Road to Zero strategy. By 2030, at least half of new cars sold, and as many as 70%, are projected to be ultra-low emission, alongside up to 40% of new vans. Analysis by the Renewable Energy Association has forecast that this increase may be achieved as soon as 2025. These vehicles will need access to charge points, and the use of these charge points is expected to increase rapidly as more vehicles come into use. A recent news article on edie highlighted how, "The number of public charging stations for electric vehicles (EVs) in the UK has surpassed the number of petrol stations for the first time".

Guidance for OLEV's Electric Vehicle Home Charge Scheme, highlights the expectation that most people are likely to charge their EVs at home, as this is likely to present the best value to them. Preliminary results from the Electric Nation study by Western Power Distribution indicate that over 80% of car charging will take place in home, and therefore future homes will need to have the necessary infrastructure.

However, there is also the need to ensure equality of access to EVs which are "an increasingly attractive option due to their lower running costs" (source: Energy Saving Trust). The need for equality of access applies especially to those without their own off-street parking, who are unable to have their own charging points, or are living in rented accommodation, where it may be difficult to get a charging point installed. Under the OLEV On-Street Residential Scheme (ORCS) local authorities can apply for funding to help with the costs of procurement and installation of on-street charging points for residential use, as covered in section 4.2 of this Hub guide.

[1] Committee on Climate Change (2019) Net Zero Technical Report (p 143, p 154)

While charging points can be installed on residential streets for public use, there are a range of other possible locations, including workplaces, shops and public car parks, where people may charge instead. According to the National Travel Survey: England 2017 published by the Department for Transport, on average, people spent about 36 minutes travelling by car per day. As the average battery range for an EV is approximately 250 miles between charges (source: National Grid) an EV will not typically need to be charged every day. Most daily driving can be completed by electric vehicles with only 50 miles of range, and as highlighted in the Net Zero Technical Report by the Committee on Climate Change, evidence suggests that a range of around 230 miles is enough to completely offset range anxiety.

6.2 Air Quality

Transport is the largest contributor to the UK's carbon emissions. In 2016, this represented 27% of all emissions (source: National Grid). Recent research shows how high levels of air pollution emitted by petrol and diesel vehicles is having a negative impact on the respiratory health of the UK's population. This is leading to 40,000 premature deaths and 6 million sick days each year, costing over £6bn to the NHS and £22bn to the UK economy (source: National Grid).

The government has recognised this in its case for change and its commitment to accelerating the shift to low carbon transport, through its Industrial Strategy, Clean Growth Strategy and Clean Air Strategy. Local authorities have a responsibility under Local Air Quality Management (LAQM) legislation to review air quality. Where concentrations exceed National Objectives, measures should be put in place to reduce emissions and be reported in a local authority's local Air Quality Action Plan (AQAP).

6.3 Other Drivers

The European Environment Agency (EEA) November 2018 report: Electric Vehicles From Life Cycle And Circular Economy Perspectives, reviews current evidence on the impacts that EVs have on climate change, air quality, noise and ecosystems, compared with conventional cars. The report concludes that battery electric cars emit less greenhouse gases and air pollutants over their entire life cycle than petrol and diesel cars.

Vehicle manufacturers are increasingly offering types of pure electric and hybrid models. Some are making commitments to stop manufacturing petrol and diesel vehicles after 2019 (Volvo) and 2020 (Jaguar Land Rover) and others making commitments to release more EV models by 2025 (Volkswagen and Mercedes-Benz).

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