Milton Keynes Council

Zero-emission Vehicle Operations

Technology Overview

Report 1

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1 Introduction

This report provides an overview of the current electric vehicle domain, with the intent that it can be used to help inform the development of planning policies by the local authority in Milton Keynes.

2 Motivations for growth in electric vehicle uptake

Electric vehicles which use battery cells as their energy storage medium are now established as one of the elements of a revolution in commercial, private and public mobility. Changes in vehicle powertrains, together with increasing levels of automation and changes in private ownership models are occurring at the same time as an increased political, media and public focus on poor air quality and carbon emissions.

Electric vehicles comprise of two main types; pure battery and hybrid. In the case of pure battery vehicles, the traction energy is stored within a rechargeable battery pack within the vehicle.

For hybrid vehicles, energy is stored in a rechargeable battery pack, which can normally also be charged by an internal combustion engine within the vehicle. There are several different classes of hybrid vehicle which include mild hybrids, where the battery is usually charged by regenerative braking and plug-in hybrids (PHEV), where the battery can be charged by plugging into an external electricity source in addition to the charging by regenerative braking. There are two main types of plug-in hybrid vehicles:

- Series hybrid, where the vehicle wheels are driven only be electric motors and the internal combustion engine acts as a generator to recharge the vehicle battery
- Parallel hybrid, where the vehicle wheels are driven by both the internal combustion engine and electric motors

In general, hybrid vehicles have smaller battery capacities than pure battery electric vehicles, but because of their internal combustion engine they generally have a longer combined range than most battery electric vehicles.

Hydrogen vehicles can also be considered as electric vehicles, where the wheels are still driven by electric motors but the energy storage medium is hydrogen, usually in a pressurised fuel tank. The hydrogen feeds a fuel cell in the vehicle which in turn produces electricity, with the only emissions being water. At present there is no widespread distribution for hydrogen and only a limited number of ‘filling stations’ in the UK. This information has been included for completeness.

In the UK, the political motivation for the adoption of zero-emission vehicles is evidenced by fiscal policies which are directed at making battery electric vehicles more affordable to purchase and more convenient to operate. In addition to the

current direct grant funding, the UK Government is currently consulting[1] on plans for a total ban on the sale of new internal combustion engine cars and vans by 2035. The proposed ban will also include hybrid vehicles and the UK Government would like to ban the sale earlier if a faster transition to zero-emission vehicles is thought to be feasible. After the date of the ban, owners of existing internal combustion engine cars and vans will still be able to use their vehicles and they will be able to buy and sell them on the used vehicle market.

Encouraged by the upcoming sales bans in the UK and elsewhere, established vehicle manufacturers are rushing to incorporate many new electric cars and vans into their product ranges. In addition, several new companies have emerged who are producing or planning to produce zero-emission passenger and freight vehicles.

2.1 Commercial and fleet operations

For companies which operate mostly in cities, there is a growing pressure to adopt low or zero-emission vehicles. Government incentives fluctuate, but in general there are taxation advantages to companies and to individuals who own and operate electric vehicles. For company car drivers the benefit-in-kind rates for electric vehicles remain attractive, though the rates for hybrid electric vehicles have recently been raised – causing a marked drop in the number of hybrid electric vehicles being adopted by fleets.

Government pressure is being augmented by organisations' desire to show a commitment to sustainable operations and many companies have publicly announced net-zero emissions strategies, which they are also imposing on their suppliers through formal contracts.

Cities which are adopting low or zero-emission zones are effectively forcing companies which operate within them to adopt appropriate vehicle technologies or shift to alternative non-vehicle based modes.

2.2 Private adoption

Private adoption of electric vehicles remains a small percentage of overall vehicle sales, though the numbers are increasing due to greater awareness of the technology and the growing affordability of electric vehicles. Purchase cost and range anxiety are often stated as the causes for the low adoption rates. Range anxiety is directly linked to the ability to easily recharge a vehicle when necessary during a journey.

Several cities are trying to encourage the adoption of electric vehicles by their residents, with UK Government funding through schemes such as the Office for Low Emission Vehicle's (OLEV) Go Ultra Low City Scheme providing capital funding. One example of this city encouragement is the Milton Keynes Electric Vehicle Experience Centre, which provides independent advice and opportunities

[1] As of April 2020, the consultation is due to end on 31th July 2020.

to try a wide range of electric vehicles in a city centre shopping environment, without any sales pressure from the car manufacturers.

In the UK adoption of plug-in electric vehicles is being incentivised by the Government through the OLEV plug-in vehicle grant. This grant is available to a range of eligible electric vehicles including cars, vans, motorcycles, mopeds, taxis and large trucks. To qualify for the plug-in vehicle grant the EV must; cost less than £50,000, have emissions of less than 50g/km, have zero tailpipe emissions and a range of more than 70 miles.

At the time of writing (May 2020) the maximum grant available for new electric cars is £3,000 while the maximum for a new electric van is £8,000, taxis can get up to £7,500 and motorbikes up to £1,500.

There are other savings which are associated with electric vehicle ownership, including reduced maintenance costs, zero vehicle excise duty and reduced running costs due to the use of electricity rather than liquid fuels.

It should be noted that whilst the cost of electric vehicles is reducing and the number of different models available from the manufacturers has increased rapidly over the past two years, the availability of electric vehicles is still limited. The automotive industry is striving to develop its supply chains to provide components for their new electric vehicles. Batteries in particular are currently in short supply – because of a combination the global demand and limited production. Waiting lists of between 12 and 18 months are typical for some popular electric vehicle models.

2.3 City Emission Zones

The links which have been made between poor air quality and health have added public pressure to existing legislative pressure for cites to respond to poor air quality. Local authorities are responding to these pressures by introducing or planning to introduce emission control zones. These measures are providing an additional impetus for commercial organisations and private motorists to consider switching to battery electric and hybrid powertrains.

The heavily publicised link between poor air quality and health has seen a steep upturn in plans for low- or zero-emission zones in towns and cities. Considerable emphasis is being placed upon reducing or removing diesel-engine vehicles from city centres, due to the high volume of particulate emissions associated with older forms of diesel engines (pre-Euro6 vehicles). A number of cities are developing plans to restrict and or ban all internal combustion vehicles from their town centres and instead focus on zero-emission public transport services.

Some local authorities are going still further by trying / planning to restrict all private vehicle usage in their city centres, regardless of their powertrains.

A list of the major cities who are planning to establish emission zones is shown in Appendix A[2].

3 Trajectory of electric vehicle ownership

The uptake of electric vehicles in the UK has been consistently optimistic, with actual registration numbers lagging projections. There are several reasons why this may be the case, they include:

- General optimism bias
- The cost of electric vehicles remaining higher than internal combustion vehicles, even with government grants
- Range anxiety by potential users, caused in part by a perception that there are insufficient public charge posts available to use
- Availability anxiety by potential users who fear that charge posts may be occupied (in use by other electric vehicles, or blocked by an internal combustion vehicle), or that they may be out of service

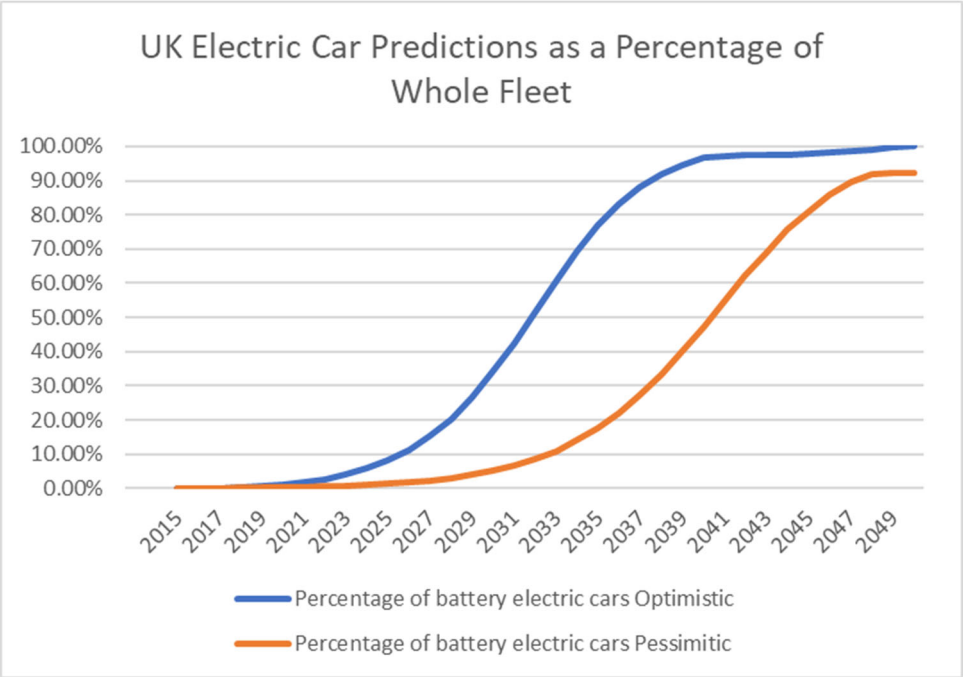
3.1 United Kingdom

There are a multitude of predictions of the uptake of electric vehicles in the UK, most of which focus on prediction of sales rather than, in the context of this report, the more useful prediction of the total number of vehicles in the UK parc.

One widely used prediction of the number of vehicles is that provided by National Grid in their Future Energy Scenarios (FES) document, the latest version of which was published in 2019 and can be found at http://fes.nationalgrid.com/fes-document/ . The data behind the scenarios is also available in a comprehensive Excel spreadsheet entitled the fes-data-workbook-v30-optimistic-pessimistic_anaysist.xlsx, the spreadsheet can be downloaded from the National Grid Future Energy Scenarios. These predictions have been adopted for planning purposes by entities such at the distribution network operators and have been used to produce the information which follows for the UK in this report.

The FES predictions recognise the uncertainty in the uptake and represent this by providing both pessimistic and optimistic predictions. In this report we have concentrated on the percentage number of electric cars within the whole car parc. The data are shown in the figure below:

[2] It should be noted that the impact of the 2020 Coronavirus in the UK has meant that many schemes have been delayed.



The FES prediction takes into account the UK Government's proposal to ban the sale of internal combustion engine cars and vans by 2040, but the 2019 FES results **do not** account for proposals to bring the date of the ban forward to 2035.

3.2 Milton Keynes

It is very difficult to know how many electric vehicles are being used in any one place in the UK. Vehicle registration data can be misleading, particularly when manufacturers register all of their UK sales in one location.

Nevertheless, it is clear, by observation and through the continuing efforts of the local authority that Milton Keynes has a high proportion of electric vehicles within its overall car parc relative to the rest of the UK. In the absence of any more reliable information it is considered reasonable to adopt the optimistic National Grid projection as a proxy for electric vehicle uptake in Milton Keynes.

Different cities have adopted fiscal measures to encourage the adoption of electric vehicles. In London electric vehicles are exempt from the Central London congestion charge and all new taxis have to be zero emission capable. Whilst in Milton Keynes, the provision of free parking for electric vehicles and the wide availability of public charging facilities (which removes any availability anxiety) also provide a considerable incentive to operate an electric vehicle.

The corresponding estimated percentage of electric vehicles in the total parc is shown in the table below:

Year	Estimated Percentage of EVs in Milton Keynes	
	Pessimistic Projection	Optimistic Projection
2020	0.29 %	1.05 %
2021	0.40 %	1.77 %
2022	0.55 %	2.74 %
2023	0.74 %	4.05 %
2024	0.98 %	5.82 %
2025	1.31 %	8.18 %
2030	5.10 %	33.98 %
2035	17.73 %	76.93 %
2040	47.32 %	96.81 %
2045	81.12 %	97.88 %
2050	92.20 %	99.99 %

The concentration of electric cars and vans in any one location is notoriously difficult to estimate with any certainty. Factors like falling car ownership figures add to the complexity together with the drop in young people learning to drive.

There are thought to be around 33 million cars on the roads in the UK[3] of which around 300,000 are plug-in vehicles. This equates to around 0.91% of vehicles spread across the UK. In total around 500,000 cars are reported as being registered to MK post codes[4].

The numbers in the table can be compared to the maximum parking standards quoted in the Mayor of London's London Plan, which makes provision for 20 % of all spaces to be for electric vehicles, with an additional 20% passive provision for electric vehicles in the future. These requirements are believed to constitute the highest planning requirements in the country. London mayors have consistently supported the uptake of zero-emission vehicles with fiscal measures such as an exemption from the Central London congestion zone for EVs, hence

[3] www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#licensed-vehicles VEH0101

[4] www.gov.uk/government/statistical-data-sets/all-vehicles-veh01#licensed-vehicles VEH0122

the optimistic uptake may also be appropriate for London. That being the case the 20% provision would relate to around 2028 and the 40% to 2031.

4 Electric vehicle chargers

Most electric vehicles can be charged from a standard domestic three-pin socket and most vehicles are supplied with a standard EVSE (electric vehicle supply equipment) charging cable for this purpose. These cables enable charging at around 2.3kW and are only appropriate for charging over long periods of time when there is no EV charger available. The use of long extension cables in conjunction with EVSE chargers is to be discouraged due to several safety and security concerns which include trip hazards and electrical safety.

4.1 Types

There is now a range of electric vehicle chargers available in the UK from an ever-growing number of suppliers. The units fall into two physical types: wall mounted and free standing.

Wall mounted units are generally associated with lower powered systems based upon a either a single phase electricity supply and charging at 3.6kW or 7kW, or a three phase electricity supply and charging at 11kW of 22kW. Wall mounted units come with either a single or twin Type 2 socket. They can be provided with several alternative access control systems if required. Wall mounted units can be supplied with open, or lockable sockets, or with tethered cables and plugs.

Floor standing posts are also available for lower powered systems again based upon a either a single phase electricity supply and charging at 3.6kW or 7kW, or a three phase electricity supply and charging at 11kW of 22kW. Floor standing units come with either a single or twin Type 2 socket. They can be provided with several alternative access control systems if required and can be fitted with a guard post to prevent damage from vehicles. Floor standing posts are available in a variety of diameters and colours.

Rapid chargers and ultra-rapid chargers are generally much larger units and will be supplied with tethered cables. These larger units may be subject to planning permission due to their height, though some units have been designed to fall within the envelope of equipment that does not need planning permission in the UK. Most rapid and ultra-rapid chargers are supplied with a number of tethered cables to suit a range of vehicle types. They can often provide either DC or AC charging to suit different vehicle types. The power range for this class of charger range from 50kW DC / 43kW AC to 350kW DC.

The unit cost of chargers and the cost of installation increases with the power supplied, with rapid and ultra-rapid chargers costing orders of magnitude more than post and wall mounted units.

4.2 Asset life

The working life of charge posts is in excess of ten-years. Warranties of up to three years are usually supplied with the equipment and it is general good practice to undertake regular proactive maintenance to ensure a long service life.

In the majority of cases where charge posts fail, the cause of the failure stems from accidental damage (such as a vehicle hitting the post), or from vandalism.

4.3 Maintenance

Charging equipment needs to be maintained in good working order. Maintenance requirements will be provided by the post manufacturer and will generally include cleaning and periodic electrical safety testing.

For installations involving multiple posts, it is normal best practice to establish a maintenance contract that includes a service level agreement with the post supplier, or other suitably qualified organisation to ensure the availability of the charging posts.

5 Business Models

5.1 Milton Keynes

The Milton Keynes charge post estate is administered on behalf of the Council by BP Chargemaster on a rolling term contract basis. The scheme dates back to the first round of Plugged-in Places funding provided by the UK Government's Office for Low Emission Vehicles (OLEV).

In Milton Keynes any driver of an electric vehicle who is plugged into any of the town centre parking bays is able to park for free. Access to the electric vehicle charge posts is gained via the Polar network app (pay-as-you-go), or RFID card (subscription service). The Polar scheme provides access to a nationwide network.

Milton Keynes also offers a Green Central Milton Keynes parking permit for electric vehicles which enables drivers to park in any of the towns 'purple' parking bays without charge.

5.2 Elsewhere

5.2.1 Charge Your Car

Charge Your Car (CYC) administers a network of charge points all over the UK. The network has grown from its early days as the provider of charge posts in the North East of England. As a back office provider CYC delivers access control enabling EV owners to access a network of charge posts across GB. CYC will pass on fault reports to the owner or maintainer of charge posts when such reports are received. There are around 2,640 charge posts which are accessible on the CYC system.

5.2.2 D2N2

The D2N2 is an estate of charge posts in Nottinghamshire and Derbyshire, which comprises a mix of BP Chargemaster rapid and fast chargers. The estate is managed by the Charge Your Car back office and has around 230 charge posts delivered under the areas Go Ultra Low programme. Residents in the D2 and N2 post codes enjoy a discount rate for accessing the scheme, with an annual fee of £20 and a cost of £0.20 per kilowatt to charge.

5.2.3 GMEV

The GMEV network provides an extensive network of public charge posts in the Greater Manchester area. The GMEV network is operated by Charge Your Car, with an annual charge for an access card of £20. Access to the charge points is obtained by using a Charge Your Car access card, using the Charge Your Car mobile app or by telephoning the access number which is displayed on the side of each charge post.

Charging in the Greater Manchester area is free on the GMEV network, though there are other commercial operators in the area where a charge is payable. Greater Manchester is hoping to treble the size of its GMEV network through government funding for its clean air plan.

6 Main UK Charge Post Providers

There are an increasing number of charge post available in the UK as new and established providers vie for part of the anticipated electric vehicle charging market. Some suppliers are establishing commercial networks of charge posts with the ambition of realising a commercial revenue from charging. Others are using charge posts as a means to sell commercial and domestic energy. Many new business models are being trialled within the charge post market.

The most comprehensive source of charge posts and charge post providers can be found at the UK Government's Office For Low Emission Vehicle's website, where a list of charge posts that are approved for government grant funding can be found for both domestic and commercial charge post installations.

The OLEV list of approved home charge units should be used as a guide to all domestic installations in Milton Keynes, in order that these domestic installations can benefit from any available grant funding schemes.

Domestic:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/876480/electric-vehicle-homecharge-scheme-approved-chargepoint-model-list.csv/preview

Commercial:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/880044/workplace-charging-scheme-approved-chargepoint-list.csv/preview

7 Matching charger specifications to users

There are several types of charger which are available on the market. These now provide a range of power capacities to suit different applications. These chargers can be considered in four groups:

Slow Charging	Generally, 3 kW	Suitable for overnight charging / home charging
Fast Charging	7 kW and 22 kW	Suitable for vehicles which are parked for more than 1 hour
Rapid Charging	43 kW and 50 kW	Suitable for vehicles which are stopped for only 20~30 minutes
High Power Charging	150 kW and 350 kW	Emerging technology being deployed to enable 'filling station' type charging during short duration stops

It is important to note that approximately 95% of daily journeys are within the range of most electric vehicles and the average daily mileage is only 31 miles. This indicates that many electric vehicles do not need to be charged every day.

7.1 Offices in town

Where a town-based office has its own dedicated parking, it is likely that there will be three possible use cases.

- Employees who spend the day in the office. For this use case 3 kW and 7 kW chargers would be appropriate, provided that commute distances warrant charging at work
- Employees who come to the office and then use their cars for business trips. For this use case 7 kW and 22 kW chargers would be appropriate, but consideration should be given to 50 kW chargers if daily mileages warrant rapid charging
- Visitors. For this use case a 7 kW charger would be appropriate as a courtesy if there are no pubic chargers nearby

7.2 Office parks out of town

The initial choice for an out of town office park will concern whether to provide a central charging 'hub' to be shared by all users of the office park, or whether to install charging infrastructure at individual 'units'. For use cases associated with individual units the descriptions outlined above for offices in town will provide guidance.

Where a central charging hub is proposed a mix of 7 kW and 50 kW[5] units is recommended. Where 50kW chargers are adopted mechanisms may need to be put in place to prevent vehicles which are not charging preventing other users gaining access to the charge post.

7.3 Retail and leisure parks

Retail and leisure parks can generally be assumed to have common parking areas, serving the whole park. Generally, there are two categories of customers on these parks; those who quickly visit one specific retail store and those who stay for a few hours – either to visit several stores, to eat or to visit leisure facilities.

- Electric vehicle drivers who go to a retail park to visit a specific store are unlikely to be there for enough time to make use of an electric vehicle charger
- For other visitors to out of town retail and leisure complexes charge rates provided by 7 kW and 22 kW will provide sufficient power for drivers to obtain a usable range, thereby providing an attractive reason to visit that particular location. Higher power chargers are also installed at these locations, but these are mostly attractive to electric vehicle owners who are stopping for a short space of time during a longer journey.

7.4 Industrial premises

In general, the likely charging requirements for staff and customers of industrial units will be the same as those for offices in those locations. There may be some additional requirements for charging vehicles in a workshop environment and where a flexible solution is required, the adoption of overhead power rails with movable charge points may provide a suitably flexible solution.

7.5 Residential

Residential property falls into two categories when electric vehicle charging is being considered.

- For property which has access to dedicated off-street parking 3 kW charge posts are generally adopted. In some cases, where the power supply allows 7 kW charge posts are installed. For most residential property with adjacent off-street parking wall chargers, connected directly to the residential consumer unit are fitted.
- For properties with no off-street parking there is no consensus on the most appropriate vehicle charging infrastructure. OLEV are funding a number of projects to research and trial potential solutions. These solutions range from low power chargers connected to existing lamp standards, telescopic

[5] It should be noted that most 50 kW chargers will provide 43 kW AC output and 50 kW DC charging.

low power charge posts that raise and lower into the ground and high-power charger hubs that are located close to residential properties.

Some authorities have promised to install charge posts outside resident's property if that property does not have any off-street parking and the resident wants to own an electric vehicle. These schemes have proven to be difficult to realise however, as it has been found that there are high numbers of objections from neighbours who fear the loss of a communal car parking space. Some cities have abandoned these schemes.

7.6 Community charging hubs

Community charging hubs are growing in popularity and are seen as a means to provide electric vehicle charging facilities in communities where there is little or no off-street parking and where kerb-side charging is difficult to arrange.

The hubs often provide a mix of 7kW fast and 50kW rapid chargers and address the growing concerns about charge post availability. Hubs are intended for drivers who will need to charge their vehicle before returning to their normal place of parking and are not intended for long-term parking.

Hubs are often located at points which also provide additional facilities such as cafes and convenience stores.

Ultra-fast charging hubs which include chargers with powers up to 350kW have been proposed. The power demands for multiple ultra-fast chargers requires careful consideration of the site location and may involve reinforcement of the distribution grid.

8 Installation considerations

8.1 Safety, best practice and regulation

In the UK the installation of electric vehicle charging points is covered by The Requirements for Electrical Installations, British Standard BS 7671 in Section 722 and best practice is covered by the IET's Code of Practice for Electric Vehicle Charging Equipment Installation, 4th Edition (2020).

The Code of Practice provides a clear overview of the different electric vehicle charging equipment. It sets out many of the considerations needed prior to installation in order to ensure operation safety, covering both the physical and electrical requirements. The code covers the installation of charging equipment in different locations and for different users, covering domestic homes, on-street locations, commercial and industrial applications.

The most recent version of the code now covers Vehicle to Grid (V2G) applications, smart infrastructure integration and wireless charging.

8.2 Power availability

Power availability is a key factor when considering the installation of electric vehicle charge points. The amount of available power and the location of the distribution board relative to the proposed charge post locations will need to be taken into account at the feasibility stage.

For many building types the electrical capacity and usage will be available from the site's electricity invoices. In other cases it may be necessary to consult with the building's facilities team in conjunction with a review of the building's distribution board.

8.3 Interoperability

Interoperability should be a prime consideration when planning the concept of operations for an electric vehicle charge post, or posts. In particular, the means of providing access to a secured post should consider any other (public) charging schemes in the area. For the benefit and convenience of electric vehicle owners, new posts should be interoperable with most public posts in an area.

8.4 Access and charging

Access and charging are decisions which are the prerogative of the site / electric vehicle charge point owner. For public posts which are to be installed with the help of a grant from OLEV, there are requirements that the post should be available for pay-as-you-go customers and that the post should have 'smart' functionality. These principles were first introduced in the 2018 Automated and Electric Vehicle Act.

Access controls can include RFID card readers, simple key locks and remote unlocking via an app, or phone call to the back office provider.

9 Enforcement of EV only parking bays

EV parking management is becoming an important topic as there are many instances of charge posts being occupied by either internal combustion engine vehicles, or by electric vehicles which are not charging.

Enforcement can be a significant issue for rapid and ultra-rapid chargers, where the expensive asset needs to have a regular flow of users who stay only for a short time (circa 30 minutes).

Charging times are often limited by parking time allowances in local parking regulations. However, in most cases the enforcement is managed by council parking wardens.

There are commercial organisations who provide EV parking management services, which may be appropriate in some circumstances. One such organisation is EV Parking Management (www.evparkingmanagement.com), who use CCTV to monitor the use of marked electric charging bays and issue parking charge

notices to unauthorised users of these bays. They are regulated by the British Parking Association and are a member of the Approved Operator Scheme.

10 Considerations for planning requirements

When considering parking provision in conjunction with electric vehicle charging, it must be remembered that any car park space for a new build will see use for several decades during which time the number of electric cars in use will increase considerably (on the basis of current projections). That said, it is also important to reflect on the number of cars in use generally and the decreasing trends in vehicle ownership – particularly in urban environments. Policies which seek to reduce private car usage and encourage active transport and the use of public transport will naturally lead to a reduction in parking demand. Innovations including car sharing and transport as a service subscription schemes threaten to disrupt parking demand.

The type of charge posts provided in any location will impact the number which may be required. For example, a 50kW charger could provide a similar charging capacity to several 7 kW chargers, provided that the throughput of vehicles using the higher-powered charger can be maintained throughout a reasonable period of the day and that, for example, no vehicle is parked at the 50kW charger overnight.

Flats with communal or allocated parking bays could reasonably be treated the same way as other domestic properties and should have an EV charger of either 3kW or 7kW capacity. There are some advantages to the user with 7kW posts where the supply allows.

Different local authorities have adopted a range of provisions for charging electric vehicles. Most of these have been published as supplementary planning documents (SPD). Links to a selection of the published SPDs have been included in Appendix B.

10.1 Charging Requirements

It should be noted that not all parking spaces will need to be equipped with charging facilities, even when 100% electric vehicle ownership is reached.

Department for Transport statistics show that total annual car mileages have been slowly reducing and in 2018 the average stood at 7,600 miles per vehicle. This equates to an average weekly mileage of 146 miles. Whilst it is recognised that there will be many drivers who exceed the average mileage, it is clear that most electric vehicles will not need to be charged on a daily basis, nor following every journey. Western Power Distribution currently estimate that a range of 150 miles can be provided by a single charge every six days[6].

There will clearly need to be a significant shift in behaviour if charge posts are to be shared equitably amongst electric vehicle users and it is probably unrealistic to think that a single charging socket could be shared by four or more users. In the

[6] Western Power Distribution 'Electric Vehicle Strategy', April 2020

event that 2 user were to ‘share’ a single socket then it could be considered that no more than 50% of parking bays would need to have electric vehicle charging facilities. Where rapid chargers are available and a proportion of users are able to charge at home the figure of 50% could be considerably less.

10.2 Parking area design

For domestic properties where the parking space is right next to the house, a wall mounted charge post is the preferred solution. This wall-mounted ‘box’ can provide a convenient socket, or alternatively wall boxes can be fitted with a tethered cable and suitable plug.

The design of parking areas and the provision of electric vehicle charging within a shared parking area should take account of the position and the environment around the parking area. For an existing car park the location of the power source is a prime consideration; positioning the charge posts as close as practicable to the power source will be the most economic option. Similarly, for new parking areas, the provision of a power source at a suitable point in the car park should be considered at the design stage. In most applications, the primary power supply will be connected to an electrical feeder pillar, that will include an electricity meter and from which the individual charge posts will be connected.

There is no common position for charging locations on cars or vans, so locating charge posts at the ends of parking bays where vehicles can be parked either forwards or backwards presents the most useful location. A post located at the junction of two bays can serve either of those two bays. If there is a suitable structure or wall adjacent to the parking spaces a wall mounted charge point ‘box’ can be adopted.

Appendix A

Planned Emission Zones in the UK

A1 Planned Emission Zones

The following table provides a list of known UK emission zones which as of 2020 are either operational or planned. It should be noted that at the time of writing the impact of the coronavirus pandemic has led to the postponement of many of the schemes.

City	Planned intervention
Aberdeen	Plow Emission Zone, planned for 2020
Bath	Limited Clean Air Zone, planned for 2020
Brighton	Private Vehicle ban, planned for 2023
Bristol	City Diesel ban and Clean Air Zone, planned for 2021
Cambridge	Clean Air Zone, no date set
Cardiff	Clean Air Zone, no date set
Derby	Clean Air Zone, no date set
Dundee	Low Emission Zone and vehicle ban, planned 2020
Edinburgh	Two-tier Low Emission Zone and vehicle ban, planned 2020
Glasgow	Low emission Zone in place for buses, extended to cars in 2022
Leeds	Clean air zone for HGVs, buses, coaches and taxis, planned 2020
London	Ultra-low Emission Zone, introduced in 2019, planned to expand in 2021
Manchester	Clean Air Zone for HGVs, buses, coaches, taxis and vans, planned 2021

City	Planned intervention
Newcastle	Clean Air Zone for HGVs, buses, coaches, taxis and vans, planned 2021
Oxford	'Red Zone' charge for ICE vehicles, introduced in 2020
Portsmouth	Clean Air Zone for HGVs, buses, coaches and taxis, planned for 2021
Reading	Planning Clean Air Zone or Low Emission Zone, no date announced
Sheffield	Clean Air Zone for HGVs, buses, coaches, taxis and vans, planned 2021
Slough	Potential Clean Air Zone or Low Emission Zone, no dates announced
York	Clean Air Zone for buses only, planned in 2020

Appendix B

Published SPDs from Internet Search

B1 Local Authority SPDs

The following table was compiled from a Google search for "Electric Vehicle SPD"

Area	Document	Link to Document
Arun	Arun District Council Draft Parking Standards Supplementary ...	https://democracy.arun.gov.uk/documents/s1558/Agenda%20Item%2010%20-%20Appendix%202%20-%20Background%20Paper%20ADC%20Parking.pdf
Aylesbury Vale	ED129 SPD suggested changes	https://www.aylesburyvaledc.gov.uk/sites/default/files/page_downloads/ED129%20SPD%20suggested%20changes%20%28Matter%207%29.pdf
Basingstoke	Parking Standards SPD	http://www.basingstoke.gov.uk/parking-standards
Basingstoke	Parking SPD Consultation Statement	https://www.basingstoke.gov.uk/content/page/57814/Parking%20SPD%20Consultation%20Statement.pdf
Bedford	Parking standards for sustainable communities · Bedford Borough ...	https://www.bedford.gov.uk/planning-and-building/planning-policy-its-purpose/other-planning-policy-documents/parking-standards/
Birmingham	Draft sustainable parking strategy set for consultation | Birmingham ...	https://www.birmingham.gov.uk/news/article/490/draft_sustainable_parking_strategy_set_for_consultation
Bournemouth	Parking	http://www.bournemouth.gov.uk/PlanningBuilding/PlanningPolicy/PlanningPolicyFiles/PlanningConsultations/Parking-SPD--Consultation.pdf
Bracknell Forest	Parking Standards Supplementary Planning Document | Bracknell ...	https://www.bracknell-forest.gov.uk/planning-and-building-control/planning/planning-policy/supplementary-planning-documents/parking-standards-supplementary-planning-document
Cambridge	Air quality guidance for developers - Cambridge City Council	https://www.cambridge.gov.uk/air-quality-guidance-for-developers

Area	Document	Link to Document
East Hants	3 Parking standards	https://www.easthants.gov.uk/draft-vehicle-parking-standards-spd-pdf-195-mb
East Staffs	Parking Standards	https://www.eaststaffsbc.gov.uk/sites/default/files/docs/planning/planningpolicy/spd/Parking%20Standards%20Final%20V2.pdf
Havant	Electric vehicles | Havant Borough Council	https://www.havant.gov.uk/electric-vehicles
Hertsmere	DOC52 - Parking Standards SPD July 2014	https://www.hertsmere.gov.uk/Documents/09-Planning--Building-Control/Planning-Policy/Local-Plan/EWC-DOC52--Parking-Standards-SPD-July-2014.pdf
Hertsmere	Parking Standards SPD July 2014	https://www.hertsmere.gov.uk/Documents/09-Planning--Building-Control/Planning-Policy/Planning-Publications/Parking-Standards-SPD-July-2014.pdf
Kingston	Sustainable Transport SPD | Supplementary Planning Documents ...	https://www.kingston.gov.uk/info/200207/local_development_framework/290/supplementary_planning_documents/4
Leeds	Parking SPD, Additional Guidance on Electric Vehicle Charging ...	https://www.leeds.gov.uk/docs/Guidance%20on%20Electric%20Vehicle%20Charging%20Points.pdf
Lewes - Eastbourne	Supplementary Planning Guidance and Supplementary Planning ...	https://www.lewes-eastbourne.gov.uk/planning-policy/supplementary-planning-guidance-and-supplementary-planning-documents/
Milton Keynes	Parking Standards - Milton Keynes Council	https://www.milton-keynes.gov.uk/highways-and-transport-hub/parking/parking-standards
New Brighton & Hove	Parking Standards	https://new.brighton-hove.gov.uk/sites/default/files/migrated/article/inline/Parking%20Standards%20SPD144oct.pdf
North Herts	Vehicle Parking at new development SPD	https://www.north-herts.gov.uk/sites/northherts-cms/files/files/vehicle_parking_at_new_development_spd_sept_2011.pdf
Northampton	Northampton Parking Standards Supplementary Planning Document	https://www.northampton.gov.uk/info/200205/planning-for-the-future/2485/northampton-parking-standards-supplementary-planning-document-2019

Area	Document	Link to Document
Richmond	Electric Vehicle Charging Strategy	https://www.richmond.gov.uk/media/10795/electric_vehicle_charging_strategy.pdf
Sefton	SPD Sefton Metropolitan Borough Council	http://modgov.sefton.gov.uk/moderngov/documents/s79721/1.1b%20Travel%20SPD%20-%20January%202018%20for%20decision.pdf
South Tyneside	SPD 6 Parking Standards	https://www.southtyneside.gov.uk/media/9378/SPD6-Parking-Standards-December-2010-/pdf/Parking_standards_SPD6_Adopted_Version_v3_(December_2010).pdf
Southampton	Parking Standards SPD	https://www.southampton.gov.uk/policies/parking-standards-spd-final-adopted-version-2011_tcm63-367716.pdf
Stratford	Development Requirements SPD Part R - Air Quality	https://www.stratford.gov.uk/doc/208509/name/PART%20R%20clean%20version%20Cabinet%20June%202019.pdf
Surrey	Vehicular and Cycle Parking Guidance	https://www.surreycc.gov.uk/__data/assets/pdf_file/0005/155660/January-2018-Parking-Guidance-for-Development.pdf
Tandridge	Parking Standards SPD	https://www.tandridge.gov.uk/Portals/0/Documents/Planning%20and%20building/Planning%20strategies%20and%20policies/Current%20and%20adopted%20planning%20policies/Supplementary%20planning%20guidance/Parking-Standards-SPD.pdf
Walsall	Air Quality SPD	https://go.walsall.gov.uk/Portals/0/images/importeddocuments/black_country_air_quality_spd.pdf
Warrington	Parking Standards SPD	https://www.warrington.gov.uk/sites/default/files/2019-08/parking_standards_spd_-_march_2015.pdf
Woking	Electric vehicle (EV) position statement	https://www.woking.gov.uk/sites/default/files/documents/Nature/WBC%20Electric%20Vehicle%20Position%20Statement.pdf
Wycombe	AIR QUALITY SUPPLEMENTARY PLANNING DOCUMENT (SPD ...	https://www.wycombe.gov.uk/uploads/public/documents/About-the-council/Have-your-say/Consultations/Air-Quality-SPD-consultation/Air-quality-SPD-consultation-draft.pdf