

Transport and Environment Committee

10.00am, Thursday, 7 December 2017

Electric Vehicle Action Plan

Item number	7.4
Report number	
Executive/routine	Executive
Wards	All
Council Commitments	C18

Executive Summary

The profile of electric vehicles (EV) is now growing and is seen as a contributor to reducing carbon emissions and improving air quality. This report presents the first EV Action Plan designed to increase charging infrastructure across the city and to encourage the uptake of EVs. The Action Plan proposes an innovative zoned approach and a Strategic Business Case is being developed to determine the best locations, types of chargers and investment required within the zones. The Action Plan also proposes tasks to support infrastructure installation, collaboration on projects and keeping up to date with developments on this agenda. An EV Working Group will monitor the Plan which will be reported annually to Committee.

Electric Vehicle Action Plan

1. Recommendations

- 1.1 The Transport and Environment Committee is asked to:
 - 1.1.1 approve the Electric Vehicle Action Plan; and
 - 1.1.2 note that a Strategic Business Case for EV charging infrastructure will be reported to Committee in June 2018.

2. Background

- 2.1 New registrations of electric vehicles (EVs) hit a new record in 2016, with over 750,000 sales worldwide. In Scotland low carbon transport continues to grow and in particular, EV uptake is increasing. At the end of June 2016, there were 3,575 electric cars and vans licensed in Scotland compared to 2,050 at the end of June 2015. More EVs were sold in Scotland in 2015 than the previous four years combined. The Charge Place Scotland network has expanded to over 600 publicly available EV charging points including over 150 'rapid' charge points, one of the most comprehensive networks in Europe.
- 2.2 The profile of EVs is growing and now becoming an important element of UK and Scottish Government climate change and transport policies. While current ownership in the UK is small, recent statements by government and major car manufacturers¹ should lead to a substantive growth in this market. Assessments of scenarios on EV deployment indicate a good chance that the number of vehicles will range between 9-20 million by 2020 and between 40-70 million by 2025.
- 2.3 The latest announcement in September 2017 by Scottish Government is for a major expansion across Scotland of electric vehicle infrastructure by 2022 coupled with a phasing out of all new fossil fuel engines by 2032.
- 2.4 A number of Scottish Local Authorities are starting to address EV charging in response to meet anticipated demand and growth. Dundee for example, has the largest number of local authority owned EVs in the UK (83), and one of the most extensive charging infrastructure in the country.

¹ Manufacturers such as Volvo and Jaguar Land Rover have announced no more petrol or diesel cars will be manufactured from 2019 onwards. Renault, Nissan and Mitsubishi have announced a substantive increase in the production of hybrid cars.

- 2.5 There are benefits from EVs. Compared to conventional cars they emit substantially less carbon emissions. The vehicles are also cleaner with far less exhaust emissions so delivering direct air quality improvements. As a new market, there are also emerging economic development benefits. However, EVs are to be viewed as part of the solution with respect to overall transport objectives. The promotion of modal shift, public transport, active travel, walking and cycling are still key elements of the Council's wider sustainable transport agenda.
- 2.6 This report presents the Council's first Electric Vehicle Action Plan designed to develop an innovative and strategic approach for EVs across the city. This will develop the infrastructure for and encourage the uptake of, EVs in Edinburgh ensuring not only that the Council is up to date with developments but also maximises the benefits and opportunities of EVs.

3. Main report

- 3.1 The development of this agenda in the Council is captured in the Sustainable Energy Action Plan (SEAP), the Local Transport Strategy (LTS) as well as relevant planning guidance such as the Edinburgh Design Guide. The SEAP with its focus on the reduction of carbon emissions is particularly relevant as emissions from transport in Edinburgh are now increasing, constituting nearly 30% of all carbon emissions in the city. The LTS encourages transport choices such as EV which are more environmentally sustainable. In addition, the EV agenda supports air quality objectives, particularly relevant for Edinburgh when low emission zones are introduced by 2020.
- 3.2 While ownership of EVs in Edinburgh is small, it has been steadily growing. In 2011 there were just nine registered electric vehicles. At the end of June 2017 this had increased to 489. The number of available charging points for EVs in the city has also increased steadily. In 2013, there were eight charging points but as of October 2017, this has increased to 89 charge points, 58 of which are currently available to the public. In addition, the amount of electricity used at charging locations has also been increasing substantially.
- 3.3 Funding for most of these charge points has been through annual grants available from Scottish Government. The "Switched on Fleets" and "ChargePlace Scotland" programmes provide funding to the public sector that has allowed both the installation of charging points at specific sites and contributions to the buying of EVs as part of their fleets.
- 3.4 The types of EVs now in Edinburgh include private cars, fleet vehicles (including cars and vans) and taxis and buses. Lothian Buses, in particular has now procured a number of fully electric buses building on the success of their hybrid models. Funding is available for domestic charge points for private car owners through the Energy Savings Trust as well as for business. There are also grants available to local authorities via the Office for Low Emission Vehicles for on street charging infrastructure.

3.5 The statistics are supporting the growth of EVs in the city and the fact that over 23% of all licensed EVs in Scotland are in the Edinburgh city region means that there is a need to establish additional charge points to support the demand. This also needs to be supported by providing information to potential buyers and users of electric vehicles to encourage uptake.

EV Action Plan

3.6 Appendix 1 details the draft EV Action Plan with Appendix 2 providing more information on strategic context and technical issues. The Action Plan refers to EVs in a collective sense to include full battery electric, plug in hybrid and Ultra Low Emission Vehicles. This is the first such programme for the city for the next 12-18 months and has five strategic objectives:

- developing strategic EV charging hubs;
- taking a co-ordinated approach across the Council;
- collaborating with partners;
- trialling integrated smart grid charging systems; and
- encouraging wider e-mobility opportunities.

Strategic Charging Zones

3.7 A key objective is the development of strategic EV charging hubs across the city. This is proposed by adopting zones that considers the transport impacts and challenges in each and the appropriate technical response. During consultation on the draft Action Plan, feedback from key external stakeholders suggested that this approach being taken by the Council was innovative and the first of its kind by a Scottish local authority. There are three zones proposed, see Figure 1 below:

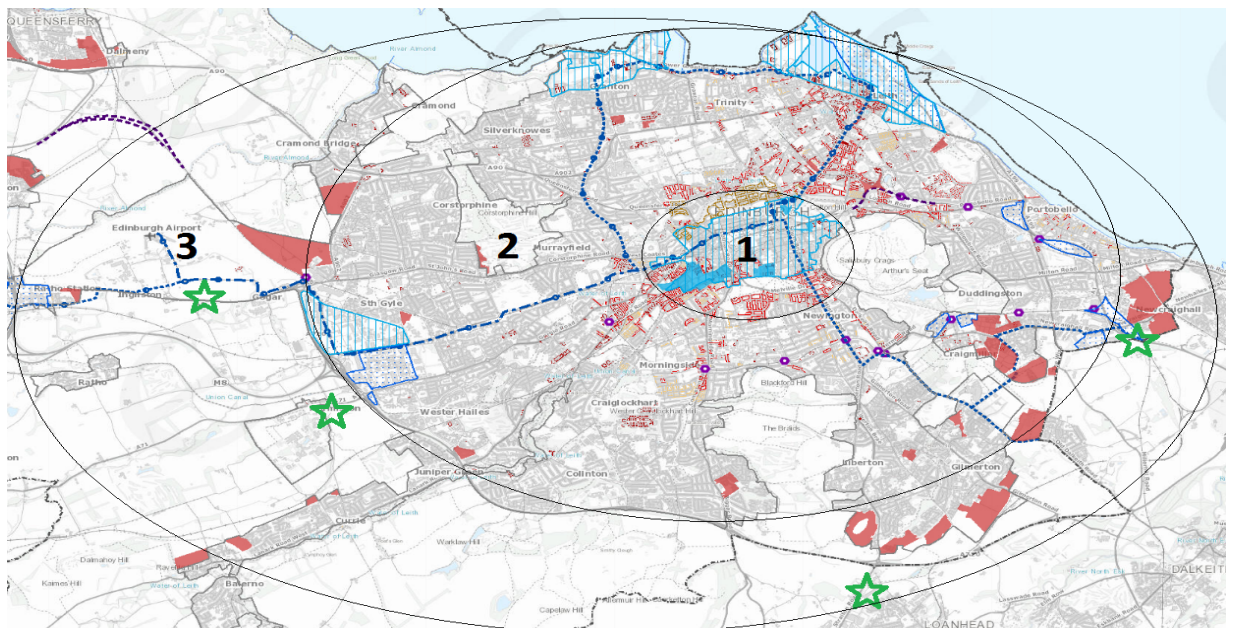


Figure 1: Proposed EV Zones (green stars indicate Park and Ride facilities)

- Zone 1: **City Centre**. This predominates with different vehicle types. The aim is to focus primarily on multi journey vehicles such as taxis, commercial

and fleet vehicles. Rapid charging hubs, both on and off street, would be the preferred solution with consideration given to some of these being for the sole use of taxis, car club vehicles and public-sector fleets. The use of cleaner vehicles will help to meet the objectives of any future low emission zone. Liaison will also include businesses based in the city centre encouraging the use of EVs;

- Zone 2: **Residential** area. This is a mix of residential properties including many tenements with no access to on-street EV charging. The priority locations for charging infrastructure would be these high-density areas. The preferred solution for this zone would be fast chargers for on street locations and the larger rapid chargers installed in off-street locations. A key aim would also be to encourage electric car club vehicles in this area.
- Zone 3: **Peripheral** area. The overall objective would be to create a strategic ring around the periphery of Edinburgh. This would target Park and Ride facilities encouraging commuters to leave their vehicles and choose public transport options to come into the city. A mix of rapid and fast charging hubs will be the preferred model for charging in this zone. Residential areas would also be targeted.

3.8 In developing infrastructure across these zones, there are some issues and complexities in installing the appropriate chargers. A key action therefore, is the development of a strategic Business Case for EVs that will look at the following issues across the three zones:

- the traffic movements;
- the number of potential charging points to meet future demand;
- the best location for these;
- the type of chargers required;
- any challenges in installing the infrastructure; and
- the level of investment needed and potential revenue streams.

3.9 A major challenge is electrical grid constraints particularly in dense urban areas. Bringing a new electrical supply to an EV site is not only costly and time-consuming but depending on location and the amount of power required, some sites may need new electrical substations.

3.10 The Council has received support from Transport Scotland to commission consultants to develop the Business Case for EVs in Edinburgh. This study will look at the growth of EVs and the issues above for the years 2020 and 2023. The Business Case will consider the growth of EVs for these two timescales.

3.11 The proposed study will also look at the level of investment needed and the possible revenue to the Council from a charging regime. This will provide the crucial information to allow the development of charging infrastructure across the city. The Business Case will be reported to Committee in June 2018.

Other Actions

3.12 The Action Plan includes other tasks. Some of these are supporting operational processes such as planning requirements, parking regimes, charging tariffs and maintenance. The role for fleet is also identified to ensure the Council leads by example. Other actions are focussed on collaboration with key partners such as the Transport Forum members, taxi companies, Enterprise Car Club and other public sector partners such as the Universities and Lothian Health. This will explore joint and shared infrastructure solutions. Collaboration with business will be explored particularly for solutions in the city centre.

3.13 Some highlights from the Action Plan include:

- development of a Business Case for EVs in Edinburgh;
- trialling on street charging at Marchmont;
- approval of the Edinburgh Design Guidance requirement for every six car parking spaces to have one EV charging unit installed at all new commercial and residential developments;
- assessment of parking standards for on street charging;
- 10% target for EVs in Council fleet by 2020;
- ongoing implementation of funding for EVs for the public sector;
- working in collaboration with key partners including business;
- participation in the CAN DO Innovation Challenge Fund to assess integrated energy solutions for EV charging; and
- an assessment of e -mobility solutions in partnership with key stakeholders.

3.14 A particularly interesting project will be the CAN DO Innovation Challenge Fund. The Council has been successful in its application to this Scottish Enterprise programme. Funding of £0.28m has been awarded to businesses to develop integrated solutions to EV charging that assess battery storage combined with renewable energy. The project will run over two years.

Monitoring Progress

3.15 In terms of governance, an EV Working Group has been set up to deliver a co-ordinated approach across relevant Council services and oversee the EV Action Plan. This group will provide updates to the Member Officer Working Group on Carbon Climate and Sustainability.

3.16 Progress on the Action Plan will be reported annually to Committee.

3.17 A final element of monitoring progress will be to ensure that the Plan stays up to date with changing technology or other options for charging vehicles. There are a few pilots exploring alternatives to stand alone infrastructure including the use of street lighting columns to provide power for charging. For tenemental areas in Edinburgh this might be a possibility where currently there is no access to on street charging. The outcomes of these pilots and any other options will be monitored to evaluate any potential use across the city.

4. Measures of success

- 4.1 The key measures of success will be an increase in the number of charging points across the city coupled with a growth in ownership of electric vehicles.

5. Financial impact

- 5.1 There are no adverse financial impacts for the Council associated with the activities outlined in this report.
- 5.2 The development of the Business Case will provide information on the level of investment needed to increase EV charging points across the city and the potential revenue stream to the Council. This will be reported to Committee.

6. Risk, policy, compliance and governance impact

- 6.1 By implementing an EV Action Plan the Council is helping mitigate any risks of non-compliance with the Climate Change (Scotland) Act 2009. In addition, the Action Plan meets the SEAP objectives and the Council pledge to reduce carbon emissions.

7. Equalities impact

- 7.1 There are no adverse equalities impact associated with this report.

8. Sustainability impact

- 8.1 The EV Action Plan will have a positive impact on sustainability. EVs emit substantially less carbon emissions and have fewer exhaust emissions than conventional cars. The sustainability benefits will include lower carbon emissions and air quality improvements.

9. Consultation and engagement

- 9.1 Consultation has been carried out with service areas including transport, environmental health, fleet, planning, licensing and procurement. The new EV Working Group has been used as the basis for internal consultation.
- 9.2 External consultation has been carried out with key agencies and organisations. The draft Action Plan was sent to all members of the Transport Forum including Lothian Buses, Taxi operators and transport groups. Feedback from the Forum was very positive. Consultation also took place with Transport Scotland who are leading on this agenda on behalf of Scottish Government. Their view was also

very positive in that the Council is taking a very practical but strategic approach to developing this agenda.

- 9.3 Engagement on the Action Plan also included cycling organisations such as SPOKES and particularly on the role of e-mobility solutions such as e-bikes. Opportunities to develop projects is part of the Action Plan.

10. Background reading / external references

None

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11. Appendices

Appendix 1: Electric Vehicle Action Plan

Appendix 2: Strategic Context and Technical Background

The City of Edinburgh Council

Electric Vehicle Action Plan



1. Aim of the Action Plan

This document presents the first Action Plan for the development of electric vehicles (referred to as 'EV') in Edinburgh. Its purpose is to develop a strategic and co-ordinated approach to the development of charging hubs across the city that will encourage the uptake of EVs, while reducing carbon emissions, improving air quality and unlocking wider economic benefits.

The development of a network of EV charging hubs offers significant opportunities for the city to transition to a low carbon and e-mobility future that provides a range of benefits across a large number of users in Edinburgh. The EV Action Plan will outline the reasons why electric vehicles should be promoted and encouraged, such as the positive impact it will have on Edinburgh in terms of meeting its carbon emissions targets and improving the city's air quality. This Action Plan will also set out Edinburgh's intentions and ambitions on EV up to 2020, ensuring that the city takes a lead in this developing agenda. The Action Plan is also supported by a Technical Appendix providing more information and context.

2. Context

The predominant road vehicle fuels remain as petrol and diesel. Although the current ownership of EVs¹ in the UK is small, this figure has been steadily growing with 2016 being a record year for sales. A number of major car manufacturers such as Volvo and Jaguar Land Rover have announced no more petrol or diesel cars will be manufactured from 2019 onwards, while Renault, Nissan and Mitsubishi have committed to substantially increasing the number of hybrid cars. This significant change is driven both by increasing concerns over climate change and ongoing air quality impacts from diesel and petrol cars.

National and Local Policies Supporting EVs

The Scottish Government has a number of policies contributing to the development of the EV agenda including creating Scotland's first electric highway on the A9, providing substantial support for significantly expanding EV charge points to 2022, a new Climate Change Bill that will increase the 2050 emission reduction target from 80% to 90% from the 1990 baseline. Introducing Low Emission Zones in the four largest Scottish cities by 2020, creating an Innovation Fund of £60 million that will include EV charging and the phasing out of new petrol and diesel cars and vans by 2032 (eight years before a similar commitment by the UK Government).

The Councils own policies supporting EVs include:

The Council **Sustainable Energy Action Plan (SEAP)** is the city wide energy plan aiming to reduce carbon emissions by 42% by 2020. This is the main policy driver behind the EV Action Plan linking in the issues of renewables and energy efficiency.

Edinburgh City Vision 2050, is building coalitions on how a successful Edinburgh looks in 2050. This includes innovative approaches to transport infrastructure; creating an active and green city; and ensuring we are prepared for the effects of climate change.

The **Local Transport Strategy (LTS)** 2014-2019 is the other key policy programme aiming to enable transport choices which are more environmentally sustainable. The LTS makes reference to supporting the increased use of low emission vehicles through working with partners to provide a network of electric vehicle charging points.

The **Air Quality Action Plan** in Edinburgh has identified six Air Quality Management Areas (AQMAs), five for the pollutant nitrogen dioxide (NO₂) and one for fine particulates (PM₁₀). A major source of these pollutants is diesel and petrol vehicles. EVs emit no pollutants or carbon emissions.

¹ For the purposes of the Action Plan, the term EV represents all types of plug in vehicles including battery electric and plug-in hybrid vehicles.

Rationale and Benefits

A key aim of the EV Action Plan is to build on the significant progress that has been made in Edinburgh in terms of plug-in vehicle adoption and the installation of EV charging infrastructure, by developing strategically located charging hubs at both on-street and off-street locations, to serve the needs of a range of users. The development of EV charging infrastructure at key strategic locations is a key strategic infrastructure undertaking which can be aligned with major infrastructure projects which require costly electrical upgrades or excavation works and thus offers a more holistic joined up approach to major infrastructure projects in the future.

In addition to the policy framework outlined above and the Council policies supportive of the agenda, there are a number of reasons and benefits in pursuing EVs. One major reason relates to increasing carbon emissions from transport in Edinburgh:

Carbon Emissions from Transport

The latest Department for Business, Energy and Industrial Strategy (BEIS) from 2015 indicate that carbon emissions from road transport in Edinburgh accounted for 26.5 per-cent of total carbon emissions. In 2013 the percentage of transport carbon emissions in Edinburgh in total was 20.9 per-cent, this is an increase of 5.6 per-cent. Over the same period, carbon emissions from domestic, industry and commercial sectors in Edinburgh both registered significant decreases in total CO₂

Electric vehicles produce far less carbon than conventional cars even using the current standard UK supply. If the electricity used for charging a car came from renewables the carbon emissions would be near zero. From an air quality perspective, EVs emit no harmful exhaust fumes and so can contribute to cleaner air. There is a growing market for EVs and in terms of suppliers and local installers there are opportunities for the local economy in Edinburgh in terms of jobs and investment. The continued uptake of EVs will improve air quality, reduce CO₂ emissions and reduce noise and therefore create a better environment for residents and visitors to the region.

There are also significant costs savings to both residents and businesses as EVs are cheaper to fuel and require less maintenance. Compared to the maintenance costs of a conventional vehicle EVs are much more cost effective to maintain as:

- the battery, motor, and associated electronics require little to no regular maintenance;
- there are fewer fluids to change;
- brake wear is significantly reduced due to regenerative braking; and
- there are far fewer moving parts relative to a conventional gasoline engine.

Challenges

The technological advances the EV industry has made has addressed some issues such as range anxiety. However there are still some challenges and issues in moving the EV agenda forward. The development of charging points especially rapid and fast charging hubs requires significant and costly grid upgrades and reinforcement. Dependant on the sites there may even be the need for new electrical sub-stations. A solution to this is the development of integrated battery and renewables solutions.

Part of the Transport Solution

A key objective of the Council’s transport strategy is to see modal shift to more sustainable forms of transport including active travel and walking. Consequently, the aim is still to see fewer cars not just cleaner cars. However, while not a total solution, EVs are important in meeting the challenge of climate change. While this Action Plan promotes the use of EVs, continued investment in walking, cycling and public transport will still be actively pursued by the Council through its transport policies. Residents not immediately interested in the purchase of an EV must also be encouraged to firstly look at active travel options, car club membership or alternatively replace their existing petrol or diesel vehicles with Ultra Low Emission Vehicles (ULEVs) which have significantly lower levels of exhaust emissions than conventional vehicles and which emit no more than an average of 75 g/km of CO₂.

3. EVs in Edinburgh

Ownership

At the end of June 2017 there were 489 EVs registered in Edinburgh compared to 9 at the end of 2011 (Fig. 1). Edinburgh also has the second largest share of licensed EVs amongst Scottish Local Authorities at 8.2%. This continued growth of EV ownership in Edinburgh and the fact that 23.8% of all licensed EVs in Scotland are within the Edinburgh city region, means that there is a need to establish additional locations and expand existing locations for publicly accessible charge points across Edinburgh to support the uptake of EVs.

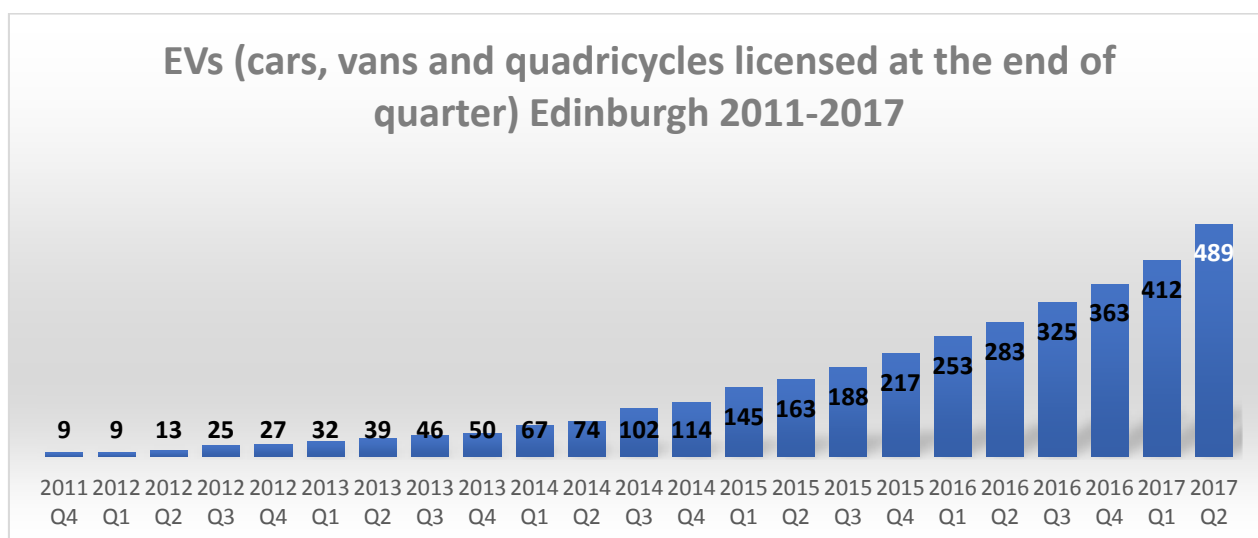


Figure 1: Number of Licensed EVs in Edinburgh

Source: [Vehicle Licensing Statistics \(DfT\)](#)



Example of an EV charging hub (APT Controls)

EV Charging Infrastructure in Edinburgh

Since 2012 the Council has benefited from various grants, managed via Transport Scotland to install publicly accessible charge point infrastructure in the city. These have resulted in a steady increase of accessible charge points for both public and non-public users. As of October 2017, in the Edinburgh city area there are currently 89 charge points of which 58 are currently available to the general public.

Charging points are primarily defined by the power (in kW) they can produce and the speed they are capable of charging an EV. There are three main EV charging speeds:

- Slow charging (up to 3kW) which is best suited for 6-8 hours overnight;
- Fast charging (7-22kW) which can fully recharge some models in 3-4 hours; and
- Rapid charging units (43-50kW) which can provide an 80% charge in around 30 minutes.

Fig. 2 below shows the location of the charging points in Edinburgh as of September 2017. A significant proportion of these are owned by the Council.

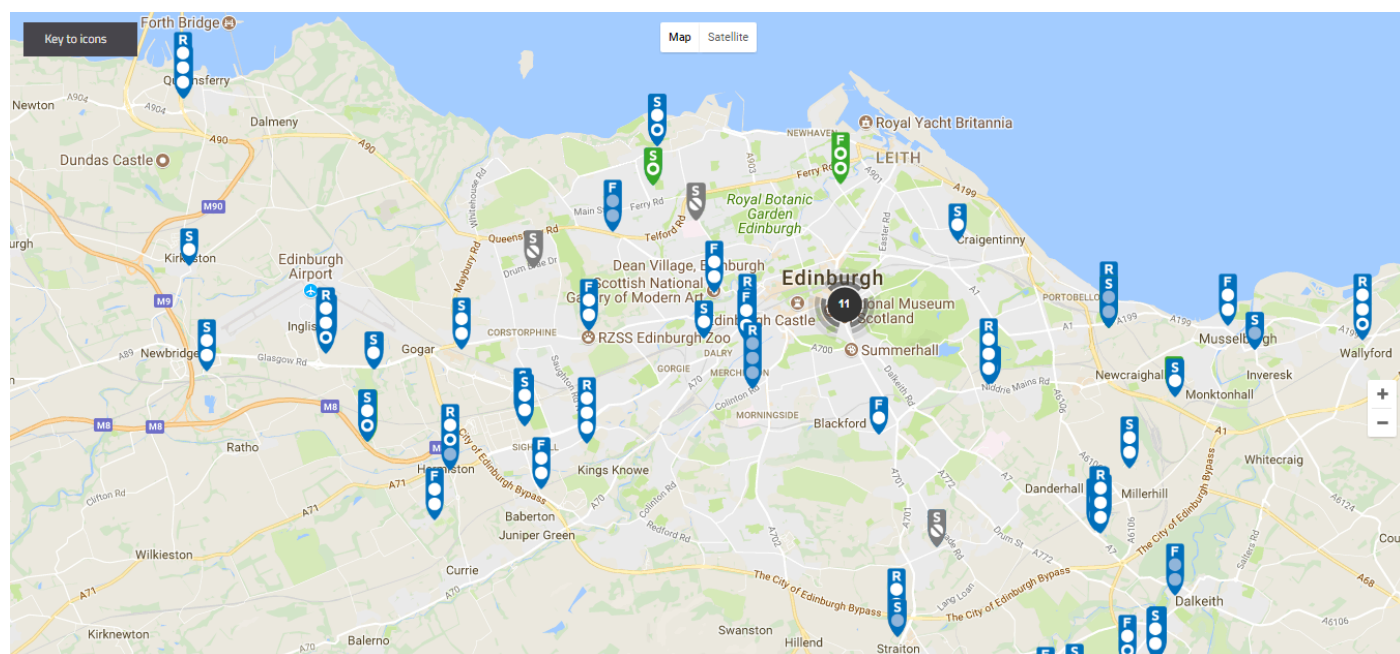


Figure 2: Locations of Charging Points in Edinburgh as of Sept 2017

Source: <http://www.chargeyourcar.org.uk/>

[ChargePlace Scotland](#) (CPS) has been established by the Scottish Government to provide grant funding to Local Authorities and other organisations to install publicly available charge points. CPS offers EV drivers simple and convenient access to chargers across the whole of Scotland. All publicly accessible charge points in Edinburgh (including those owned by the Council) are registered on the CPS network.

Since 2014, data has been compiled for the number of charging sessions and the amount of electricity used at locations across the city. As expected, with additional infrastructure provision and more electric vehicles there has been an increase in usage. Yearly comparisons of power used (kWh) are shown in Fig. 3 below. Data is only accessible from the registered charging locations in the city. Due to there being a number of private unregistered sites, usage is likely to be greater than what is represented in Fig. 3.

[Charge Your Car](#) (CYC) Ltd, is essentially the back-office and public facing arm of CPS. It provides various charger access methods and information for EV drivers. CYC also gathers detailed usage data for each charge point and provides known fault and operational status reports to the owner, or maintenance provider, as appropriate. The location and operational status of each charger (e.g. whether it is currently being used or out of service) is also available to the public through the real-time network map hosted on the CYC website.

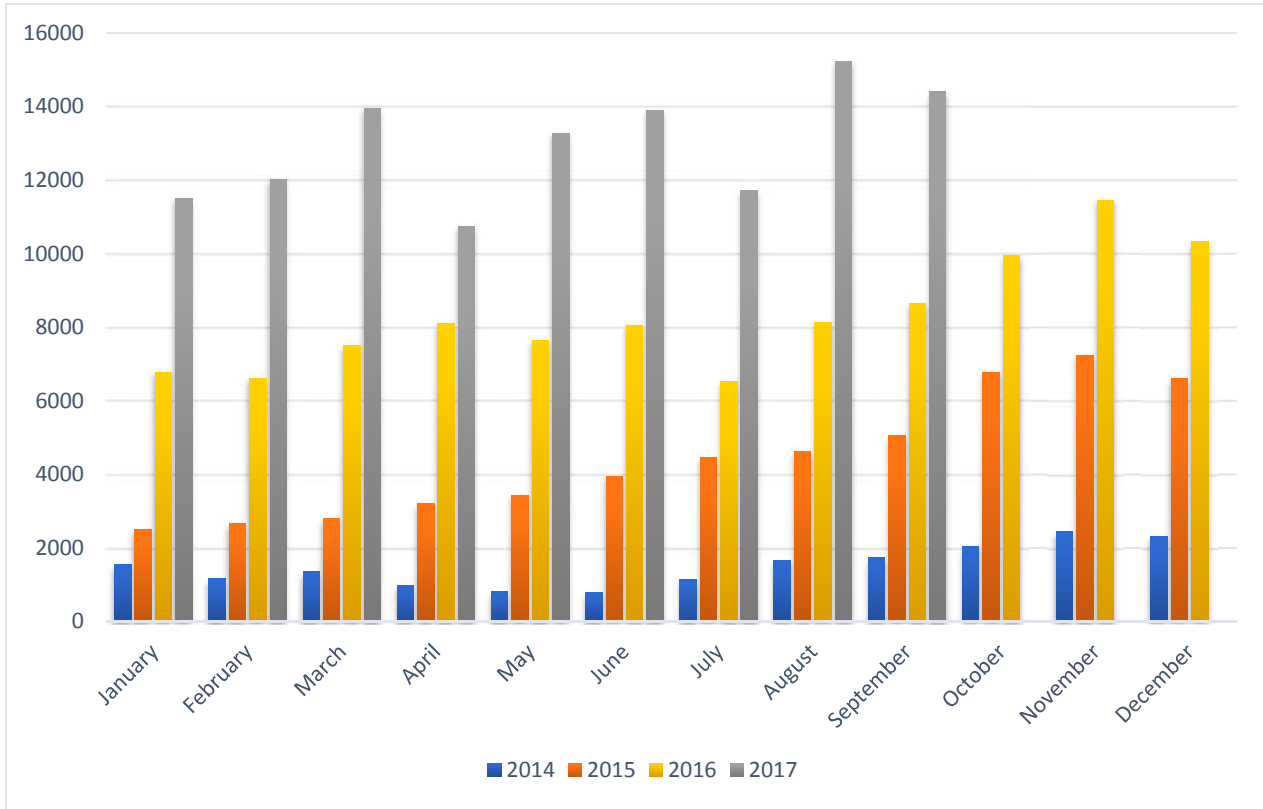


Figure 3: EV Charging Infrastructure: Energy used per Month in kWh

Source: <http://www.chargeyourcar.org.uk/>



Electrified Transport in Edinburgh

4. Strategic Vision and Approach

Strategic Vision

The expansion of EV Infrastructure across the city through the development of strategic charging zones that will link with other future transport infrastructure. This will enable a charging network to grow and integrate with other modes of transport and e-mobility opportunities. Getting the infrastructure in the right place to service a variety of user groups in the city will be the key first step. The Action Plan also looks to maximise the economic, social and environmental benefits and opportunities that the EV agenda will provide.

A key component of the EV Action Plan is to ensure that any future charging points are installed not only in the best location across the city, taking into account need and possible usage, but also to meet other Council objectives for example air quality standards in the city centre. There are three zones envisaged:

ZONE 1: THE CITY CENTRE

This area predominates with commercial vehicles, taxis, buses, fleet and private cars. The focus here would be for rapid charging hubs only which could include a mixture of on-street and off-street locations. Consideration would be given to some of these being for the sole use of the taxi trade, car club vehicles and public-sector fleets.

ZONE 2: THE RESIDENTIAL AREA

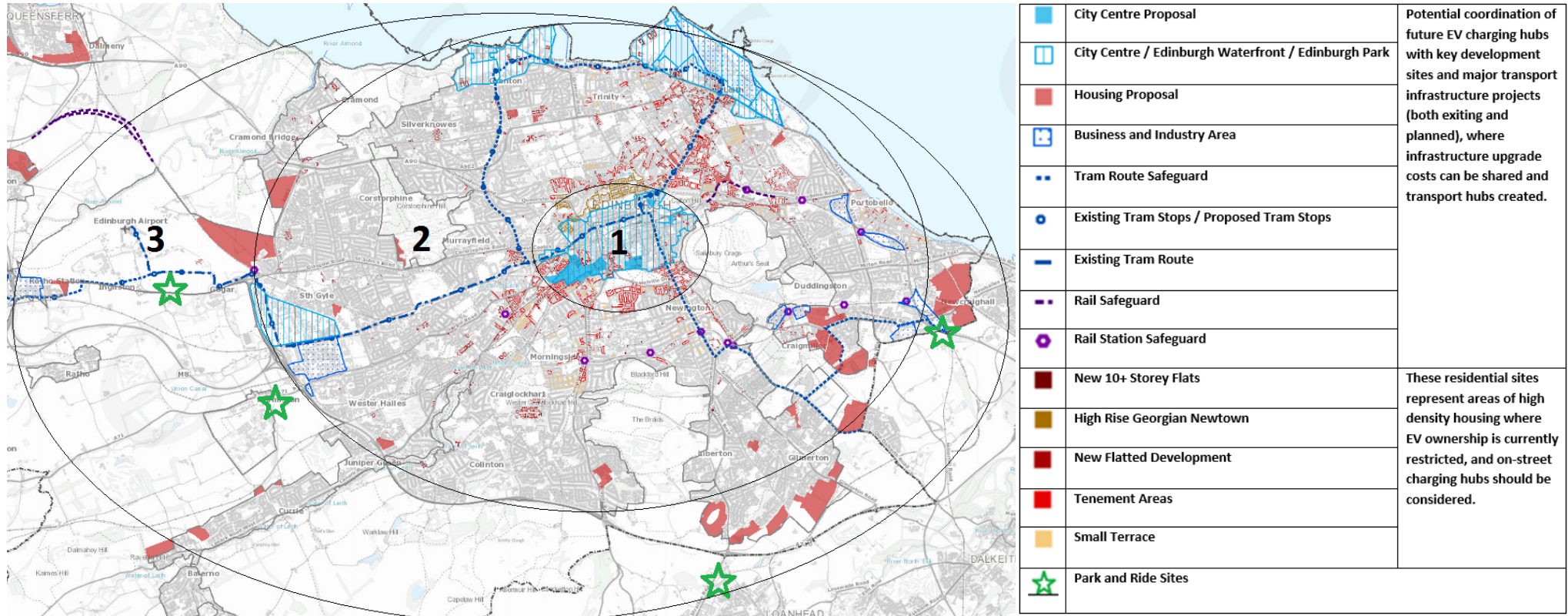
This zone has a high proportion of residents living in tenements which prevents any form of home charging taking place. There is also a mix of properties but currently no on-street EV charging infrastructure available. The most appropriate type of EV chargers for this zone would be fast chargers for on street locations and rapid chargers installed in off-street locations. There is also the potential to partner with Car Clubs to create shared on-street EV charging bays for both residents and Car Club members. Individual residences can also install slow chargers in garages for example.

ZONE 3: THE PERIPHERAL AREAS

For this zone the overall objective would be to create a strategic ring around the periphery of Edinburgh targeting Park and Ride facilities that will encourage commuters to leave their vehicles and choose public transport active travel options to come into the city. A mix of rapid and fast charging hubs will be the preferred model for charging in this zone. Residential areas would also be included. A particular target will be the east and north of the city currently not served by Park and Ride sites.

Figure 4 overleaf provides more information on the zonal approach. This includes a key explaining future infrastructure opportunities as outlined in the Local Development Plan. The Figure also provides some context around constraints, challenges and opportunities. Key users will include residents, commuters, public sector fleets, businesses, Car Clubs and taxi fleets.

Figure 4: Zonal approach to EV charging priorities



Charging hubs – Strategic locations	1. City Centre Zone	2. Residential – non-city centre zone	3. Park and Ride – Peripheral city zone
Key EV users	Taxi (Hackney and Private Hire Cars), Car Clubs and Last Mile Freight (E-cargo bikes), and Public-Sector fleet	Privately owned vehicles – but open to use for taxis, car clubs, businesses etc.	Privately owned vehicles (primarily commuters), but open to use for taxis, car clubs, business etc.
Current restrictions	Opportunities are limited to existing parking/pay and display locations	High density housing (primarily tenement areas) have on-street limitations for charging hubs	Park and Ride sites currently offer good opportunities for expanding existing charging infrastructure
Future development considerations for charging hubs	City Centre LDP proposals will provide opportunities for future charging hubs locations. Introduction of a City Centre low emission zone will be a key enabler for the development of EV charging hubs	Housing proposals within the LDP, Key development sites such as Edinburgh Waterfront and Edinburgh Park – South Gyle offer significant opportunities to future proof opportunities for EV charging hubs	Future expansion opportunities and potential new Park and Ride sites offer excellent opportunities for developing larger scale EV charging hubs

5. Action Plan

This section sets out the key actions in the development of EV Action Plan grouped under five key objectives namely:

- **Developing strategically located EV charging hubs.**
- **Taking a co-ordinated approach across the Council.**
- **Collaboration with Partners.**
- **Trialling new technologies and integrated smart grid systems.**
- **Encouraging wider E-mobility opportunities**

In delivering the actions, it will be important to develop a co-ordinated approach across the Council and with strategic stakeholders (where appropriate) to ensure that the relevant mechanisms are in place to install, manage and maintain the current and future network of Council owned EV charge points. A number of Council service areas will be crucial to this including procurement, parking, planning, licensing, transport and environmental health.

Key Actions

The following actions listed below are mixture of strategic actions to develop the EV Action Plan to enable the roll out of strategically located charging hubs and operational actions that require decisions around the management and maintenance of existing and future EV charging infrastructure. Each of the actions listed below align with the strategic objectives and will require cross sector working across the Council.

Each action has a colour co-ordinated timeframe attached to it with a corresponding level of importance.

Timeframe	1 - 6 months	6 – 12 months	On-going
Level of importance	High	Medium	On-going

ACTION PLAN OBJECTIVES

Objective 1: Development of Strategically Located EV Charging Hubs

The development of strategic charging hubs across the city will be dependent on understanding not just the demand and future growth of EV but also the best locations, how to phase any work and the cost. Issues such as grid constraints could also impact on future installations and be very costly. A first key action is the development of a business case that will assess the above issues and provide a route map to delivering solutions across the three zones. The Council is working with Transport Scotland and has appointed consultants to develop a business case based on the growth in EVs in the city. This study will include an assessment of the location of strategic charging hubs based on the three zones, the grid infrastructure that might be needed and the potential investment required. The study will also assess the potential revenue generation to the Council based on varying charging provision. All of the outcomes will be measured against a number of key dates (2020 and 2023). The study will be completed by March 2018.

Other actions to complement this work include continuing to utilise grant funding from Scottish Government and collaborating with Locality Managers to help identify possible locations for charging infrastructure within their areas.

Marchmont Trial

A proposed EV trial around the Marchmont/Sciennes area has been reported previously to Committee. This would see the installation of a small number of on street charging points following consultation and commencement of all statutory procedures to make the necessary Traffic Regulation Order variations. The project did experience some technical delays and requires further consultation. However, the intention is to progress with the trial which will complement and further develop the outcomes of the proposed Business Case.

Objective 1: Developing strategically located EV charging hubs			
Action Ref	Action	Lead	Timescale
1.1	In partnership with Transport Scotland to commission a Business Case for EVs in Edinburgh that will provide the route map for delivering future infrastructure across the three zones.	Sustainable Development	March 2018
1.2	To continue to use funding through the “ChargePlace Scotland” grant to install a mixture of rapid and fast charging hubs at key strategic on-street and off-street locations.	Sustainable Development	On-going action
1.3	The delivery of the pilot of on-street chargers at Marchmont.	Sustainable Development/Transport and Roads	12-18 month pilot
1.4	To ensure that all future funding secured through the ChargePlace Scotland grant includes provision to replace older charge points.	Sustainable Development	On-going action
1.5	Work with Locality Managers to help identify strategic locations.	Sustainable Development	On-going action

Objective 2: Taking a co-ordinated approach across the Council

The development of the EV Action Plan involves a number of service areas that have different roles and input. In some cases this might relate to purely operational issues but in others there might be a link to strategy or policy. This includes:

- Sustainable Development: lead for the EV programme, development of strategic projects, co-ordination of funding;
- Planning: supplementary guidance, EV installed by developers (ownership), link with Edinburgh Design Guidance, Local Transport Strategy;
- Parking: standards for on-street, enforcement, charging tariffs;
- Transport: management and maintenance of operational EV assets;
- Licensing: specific role with vehicles such as taxis and possible incentives for plug-in vehicles;
- Fleet: use of electric vehicles; link with Green Fleet Policy;
- Procurement: key role in the EV Action Plan for supply, install and maintain;
- Economic Development: low carbon jobs and investment, future innovation opportunities.

An EV Working Group, led by the Sustainable Development Team in Place Development, has been established in the Council with representatives from the above areas. This group has the remit for overseeing the Action Plan through a co-ordinated approach to ensure that there are the robust mechanisms and processes in place to deliver the Action

Plan. The group can also address any constraints or issues. A number of the specific service links are detailed below with corresponding actions.

Planning

The Council has now approved a revised Edinburgh Design Guidance which includes a minimum requirement for EV charging points to ensure that one out of every six spaces should include a fully connected and ready to use EV charging point, in developments where ten or more car parking spaces are proposed. The revised Design Guidance also provides technical guidance to developers and applies to new developments both commercial and residential. This will allow the current level of charging provision in Edinburgh to significantly increase and provide residents and businesses with a wider network of EV charging infrastructure.

Edinburgh Design Guidance

Technical guidance

Typical charging equipment tends to be in the form of charging posts or wall mounted charging units

Charging of an electric vehicle's drive battery can be performed in various ways by different charging equipment. The terms 'charging post', 'charge point' and 'charger' are not, strictly speaking, interchangeable but are used broadly to describe the process.

an installation where possible, AC charging at the above noted power outputs is performed at units which are wall or ground mounted, typically (but not exclusively) with un-tethered cables specific to the vehicle.

'Rapid charging' is a term given to the fastest current method of charging an electric vehicle's battery and is performed by a much larger unit with tethered cables and adapters. Rapid charging can provide significantly higher power and output rates than described above. A typical rate of charge to 80% capacity of an electric vehicle's battery can be performed in around 30 minutes.

Guidance and advice on sourcing electric vehicle charging infrastructure is available from the following sources:

UK Electric Vehicle Supply Equipment Association
British Electrotechnical and Allied Manufacturers' Association

Recent Park installation of underground car park electric vehicle charging.

Charging infrastructure has developed greatly over the last few years. Whereas the first generation of electric vehicles could be found charging at a slow rate from a standard household socket, the current minimum standard is a dedicated 'Type 2' socket/ single phase AC supply offering outputs of up to 7kW per hour. Where a three phase AC supply is available, an otherwise identical higher powered unit can be installed offering up to 22kW per hour. Although not all electric vehicles are currently capable of accepting AC current at 22kW per hour, the trend has been for manufacturers to improve their vehicles AC charging ability. The highest power charge point should always be considered in order to future proof

Source: Code of Practice on Electric Vehicle Charging Equipment Installation (BSI Standards, 2012)

Edinburgh's Technical Guidance for EV charging infrastructure

The new Guidance will also apply to all new Council developments. The costs for this will be incorporated within the overall project costs. This will be a useful support for Council fleet vehicles by providing additional infrastructure across the Council's operational estate.

Strategic Objective 2: Taking a co-ordinated approach across the Council: Planning			
Action Ref	Action	Lead(s)	Timescale
2.1	Edinburgh Design Guidance for new developments to include provision for EV.	Planning	Ongoing
2.2	Raising awareness of EV provisions with developers early in the planning application process to increase the likelihood of them being included in new development proposals.	Planning	May – Nov 2018
2.3	Council will install appropriate EV charging points at all Council refurbishment and new development projects.	Sustainable Development, Corporate Property	Dec – May 2018

Parking Actions

The Council sets the price of parking permits in line with the carbon emissions produced by the vehicle and currently lower emitting cars pay less. In relation to EVs, some issues that will need to be addressed from a parking operations perspective, particularly in on-street locations, include:

- Maximum stay periods. This may be reliant on the charger performance i.e. EVs can be charged in 30 minutes by a rapid charger, so maximum periods will need to reflect this;
- Setting the tariff for using EV only on-street parking bay. This will also involve Corporate Property Energy colleagues.
- Monitoring the use of car parking and enforcement.
- Consideration needs to be given to the identification of EVs to distinguish them from fossil-fuelled vehicles. Options include the use of in-car stickers or the creation of EV-specific number plates (this is currently reserved to the UK Government).
- Parking is at a premium for car owners in urban areas and flatted areas such as tenements and has been noted as a challenge for the uptake of EVs in Scotland. This is linked to the need for residential charging, particularly in the on-street context. This needs careful consideration to ensure that residents are not excluded from the benefits of owning an EV.

Strategic Objective 2: Taking a co-ordinated approach across the Council: Parking			
Action Ref	Action	Lead(s)	Timescale
2.4	To agree a defined set of criteria for on-street designated EV bays. This will include considerations such as; pay and display charges; maximum charging times; standard tariff charges; minimum return times; enforcement, etc.	Parking/ Corporate Property/Sustainable Development	May – Nov 2018
2.5	Parking to agree a defined set of criteria for EVs in relation to on-street designated parking bays.	Parking/Sustainable Development	May – Nov 2018
2.6	To work with Parking to establish a process for assessing locations for on-street EV charging provision.	Parking/Sustainable Development	May – Nov 2018

Operational and Transport Issues

The Council’s current network of accessible EV charging infrastructure has grown significantly over the past 5 years and is recording increased usage month on month. The EV Action Plan aims to develop the network even further with strategic charging hubs across the city encouraging the further uptake of EVs. A number of operational issues such as management and maintenance, asset ownership, procurement and closer collaboration with the DNO² will be addressed by service areas within the Council. This will ensure that robust procedures and processes are in place to support the delivery of the Action Plan objectives and ensure that a reliable network is available.

A key issue to address will be a charging regime for the electricity used. Currently all EV chargers owned by the Council provide free electricity for the first year, which has been a requirement of the ChargePlace Scotland funding. However, this is expected to change. A consultation regarding the introduction of a standard tariff was recently undertaken by Charge Your Car, on behalf of Transport Scotland. Consideration will be given to the setting of a standard EV tariff for Scottish Local Authorities. Any standard tariff introduced could also include a premium which would cover management and maintenance costs.

Currently all EV charging infrastructure installed via the ChargePlace Scotland grant comes with 5 years warranty and maintenance. Once this has expired, the responsibility for management and maintenance falls to the Council which will involve any repairs and an annual electrical inspection. Charge Your Car also provides a service whereby all fault and operational status reports are sent to the maintenance provider as appropriate. All Council charge points are

² District Network Operator: Scottish Power Energy Networks

registered with CYC. However a maintenance regime will need to be established which will also include registering all charge points and ensuring that any older charging units have appropriate inspections and/or warranties put in place.

Going forward as the Council's EV charging estate continues to grow there may be options to explore a concession model for a third party operator to develop and maintain the charging network. This could offer the Council an income stream, keeps control of the network with the Council and incentivises the operator to maintain the network.

Strategic Objective 2: Taking a co-ordinated approach across the Council: Operational and Transport			
Action Ref	Action	Lead(s)	Timescale
2.7	The introduction of a standard tariff model for all EV charging infrastructure (on-street and off-street) owned by the Council.	Sustainable Development, Corporate Property, Transport	Dec – May 2018
2.8	To develop an appropriate maintenance regime for all future and existing EV charging infrastructure owned by the Council.	Sustainable Development, Transport, Roads	Dec – May 2018
2.9	Operational management / asset ownership of all Council owned EV chargers to be identified in order to co-ordinate the maintenance and management of the network.	Sustainable Development, Transport, Corporate Property	Dec – May 2018
2.10	To progress the development of a procurement framework for the supply, installation and maintenance of EV charging infrastructure.	Procurement	May – Nov 2018

Licensing encouraging cleaner vehicles

In terms of the licensing and regulation of taxis and private hire cars, current licensing legislation allows the licensing authority to determine the suitability of these vehicles in terms of type, size and design. The legislation also allows the authority to attach certain conditions to a licence to require a particular vehicle standard provided these conditions are reasonable. As such the licensing authority is in a central position to have a more focussed role with regard to EVs in the taxi trade and can assist in the development of the EV agenda with taxi companies and drivers in Edinburgh.

The Council has now agreed to introduce an age limit in respect of taxis and private hire cars and recently ran a consultation regarding the limits to be set and how to introduce it. The results will be reported to the Regulatory Committee. This is an example of the proactive role that licensing has in encouraging cleaner vehicles across the taxi trade in Edinburgh.

Strategic Objective 2 Taking a co-ordinated approach across the Council: Licensing			
Action Ref	Action	Lead(s)	Timescale
2.11	Licensing to investigate if there is any unmet demand for Taxis and if so what options might exist within current legislation to require any 'new' licensed vehicles to be EVs.	Licensing	Dec – May 2018

2.12	Licensing to introduce an age limit on Taxis and Private Hire Cars based on the results of the consultation and forthcoming recommendations from the Regulatory Committee.	Licensing	Dec – May 2018
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Fleet

The Council is committed to leading by example through the acquisition of lower emission vehicles for its own fleet which has a diverse range of vehicles. For smaller vehicles (cars and light vans), electric or hybrid vehicles can be used for the vast majority of journeys within the city. However, currently there is no single EV technology for larger trucks within the fleet such as refuse vehicles. Further consideration will be given to this.



Electrified Transport in Edinburgh (City of Edinburgh Council Fleet)

The Council's Fleet service is currently in the process of developing a new Green Fleet Policy for the Council which will address future fleet procurement policy. The total number of EVs operated by the Council is 27 which equates to 3% of the total fleet. A new action to increase this to 10% of the fleet by 2020 has been incorporated into the EV Action Plan. Funding through 'Switched on Fleets' will support the purchasing of further vehicles.

Strategic Objective 2: Taking a co-ordinated approach across the Council: Fleet			
Action Ref	Action	Lead(s)	Timescale
2.13	Increase the number of EVs within the Council's fleet to represent 10% (100 vehicles) of the fleet by 2020.	Fleet	Ongoing to 2020
2.14	To develop a new Green Fleet Policy for the Council which incorporates the key objectives set out in the Council's Electric Vehicle Action Plan.	Fleet	Dec – May 2018
2.15	To continue to utilize Transport Scotland's 'Switched on Fleets' funding programme for leasing or purchasing EVs.	Fleet, Sustainable Development	Dec – Mar 2018

Objective 3: Collaboration

Collaboration with partners will be important to encourage public-sector and private developers to provide EV charging infrastructure within commercial, residential and mixed-use developments. The Council already engages with public sector partners through the “Switched on Fleets” and “ChargePlace Scotland” grants. This provides funding for Community Planning Partners in Edinburgh such as the Universities in Edinburgh, Lothian Health, Police and Fire Authorities to procure EVs and install charging infrastructure. The Council administers both funds and works with partners to raise awareness of EVs.

The Edinburgh Car Club

The Enterprise Car Club (ECC) is the city-wide car sharing scheme in Edinburgh and has a contract with the Council. It provides a genuine alternative to car ownership and the Edinburgh fleet is the second largest outside of London. It currently operates 18 EVs out of a fleet of 160. There are opportunities in collaboration with the Car Club to expand its current fleet of EVs by assessing the infrastructure requirements for on street charging. Outlined within the Council’s Parking Standards for Development Management is support for Car Clubs which act to reduce parking pressure and, overall, car use. For new residential developments, the Council currently encourages parking spaces for Car Club vehicles, and a financial contribution towards costs (utilising developers’ contributions under Section 75 Planning Agreements). Car Club vehicles are also used by private businesses as fleet vehicles or instead of a staff member using a private car for business.

Providing dual purpose on-street EV charging infrastructure targeted at future Car Club providers and ECC parking bays with the incorporation of an adjoining parking space offered for general EV use, will help to increase the number of charging locations offered for general use throughout the city and encourage the further adoption of EVs into Car Club fleets



Electrified Transport in Edinburgh (Enterprise Car Club)

Lothian Buses

Lothian Buses recently invested of over £2.7million, acquiring new fully electric Wrightbus Street Air single deck buses which will operate on the Service 1 route. The service runs through Edinburgh’s central air quality

management area, and this investment represents a significant commitment by Lothian Buses to reduce emissions and improve air quality in the area.

The Electric Buses operate on a pure electric powertrain, including an all-electric heating and cooling system, with 300 kWh of total battery energy which allows the buses to run with zero tailpipe emissions. The buses charge overnight at new charging stations installed at the Annandale Street garage. Once plugged in, the vehicles take 3-4 hours to receive a full 75 kW charge and can operate for up to 130 miles on electric power. They are designed with regenerative braking, allowing the energy created when the vehicle is braking to be recovered back to the batteries and stored to power the vehicle extending the range of the bus. Lothian Buses will be adding a further five electric vehicles to the service next year, making it the capital city’s first fully electric route.

Lothian Buses will be a key partner going forward in raising the profile of EVs in Edinburgh and will continue to work with Lothian Buses through the “Switched on Fleets” funding programme to purchase additional EV’s to bolster the companies auxiliary fleet. This will also explore future EV infrastructure opportunities that can add value to both organisations.



Electrified Transport in Edinburgh (Lothian Buses - electric Wrightbus Street Air)

Taxis

To encourage the uptake of EVs by potential users such as taxis (Hackneys and private hire cars) there will need to be the installation of rapid charging hubs at key city centre locations. This specific area presents a number of options for installing both on-street and, to a lesser extent, off-street chargers or the installation of charging hubs. However access to dedicated charging points for taxis in the city centre will be an issue to explore.

Edinburgh’s Hackney fleet is the largest outside of London. The introduction of more EVs into the fleet could have a significant impact on both carbon emissions and air quality considering that taxis will do more mileage per day in the city than other cars. Also, additional support for taxis in terms of EV charging infrastructure will further support the move towards more ‘on demand³’ transport which will help to reduce the need for personal car ownership.

³ On demand transport is "an advanced, user-oriented form of public transport characterised by flexible routing and scheduling of small/medium vehicles operating in shared-ride mode between pick-up and drop-off locations according to passenger’s needs". *European Commission Directorate-General for Energy and Transport*



London Taxi Company (new TX5 plug-in hybrid)

However as well as providing the infrastructure, collaboration will be important with potential users of EVs. Information is already provided to users through ChargePlace Scotland in terms of choice of vehicles, locations of chargers etc. The website also includes up to date maps with locations of charging points.

<http://chargeplacescotland.org/>

The Council can have a role in ensuring that other information is up to date or available through a range of media. A User Guide for EVs in Edinburgh will be a useful means of providing information to residents who might be thinking of buying an EV and/or thinking about installing charging points. This could also be useful for businesses.

Strategic Objective 3: Collaboration with Partners			
Action Ref	Action	Lead(s)	Timescale
3.1	To continue to administer the “Switched on Fleets” and “ChargePlace Scotland” grants in collaboration with partners.	Sustainable Development	Ongoing
3.2	Continue to liaise with the Transport Forum to promote EVs in the city and explore opportunities for installing additional EV charging infrastructure.	Sustainable Development	Ongoing
3.3	To work with the Car Club to identify appropriate locations for installing on-street EV charging infrastructure.	Parking, Sustainable Development	May – Nov 2018
3.4	To explore opportunities to utilise the parking standards in the planning process to support the uptake EVs for Car Clubs.	Planning	May – Nov 2018
3.5	Explore OLEV funding opportunities for dedicated EV charging infrastructure for the taxi trade.	Sustainable Development, Licensing	May – Nov 2018
3.6	Produce an EV User Guide for residents and businesses	Sustainable Development	March 2018

Objective 4: Trial integrated smart grid EV charging systems

Both EVs and EV charging infrastructure are subject to rapid advances in technological innovation. The future of electric mobility and charging systems align very strongly with the transition towards a smart city. EV charging infrastructure can be difficult to implement in an urban context where the cost and disruption of grid connections (for example when installing rapid charging hubs) may be too great. To enable greater uptake of EVs, solutions can be offered to improve the commerciality of installing infrastructure, integrate renewable energy, battery storage and avoid significant grid connection costs.

Edinburgh CAN DO Innovation Challenge Fund

The Council has recently been successful with an application for funding through the CAN DO Innovation Challenge Fund run by Scottish Enterprise. This aims to provide an easy to access, low risk approach to encouraging more innovation in Scotland. It connects Scotland’s public-sector organisations with companies and SMEs to develop innovative solutions to service delivery and societal challenges. The overall scope of the Edinburgh challenge will be the development of an integrated and scalable low carbon EV charging solution incorporating renewable on-site generation, battery storage, bi-directional smart meters, and an innovative software system. The proposal will be developed over two years in two stages. Funding of £0.280m has been awarded.



Strategic Objective 5:			
Action Ref	Action	Lead	Timescale
5.1	Participate in the CAN DO Innovation Challenge Fund and trial a smart grid integrated charging solution in Edinburgh.	Sustainable Development, Economic Development	Ongoing action to 2019

Objective 5: Encourage wider E-mobility opportunities

Aside from EVs there are other e-mobility opportunities that can deliver environmental, economic and social benefits to the city. E-bikes and E-cargo bikes are examples supporting active travel, e-tourism and last mile deliveries of goods at the local level. One of the key features of both e-bikes and e-cargo bikes is that the batteries can be charged at home. As such no on—street or off-street charging infrastructure is required unless a city wide e-bike hire scheme was introduced.

E-bikes

E-bikes are very similar to conventional bikes in appearance and function but they also include a small, battery powered engine. They are not simply a low powered moped or motor bike as they are designed to be cycled in the normal way with the engine providing support on hills and against adverse winds. By law, the engine alone does not have sufficient power to take the bike over 15 mph.

E-cargo bikes

E-cargo bikes can be used by businesses for moving goods within the city without getting ensnared in traffic. They both reduce congestion and make sense on business grounds particularly for close deliveries and deliveries in the city centre. They can typically carry up to 100 kg and tackle hills. Widespread use of cargo bikes could make a significant contribution to reducing CO2 emissions, improving air quality and improving congestion in Edinburgh’s city centre. As with e bikes, there are already pioneer users of cargo bikes in Edinburgh, including some small-scale opportunities for cargo-bike hire. The Action Plan will explore these opportunities further.



Examples of e-cargo bikes and e-bikes

Strategic Objective 6			
Action Ref	Action	Lead	Timescale
6.1	Identify opportunities in collaboration with partners such as SPOKES to encourage the wider roll out and piloting of e-bikes and e-cargo bikes.	Sustainable Development	May – Nov 2018

6. Governance and Monitoring of the Action Plan

An internal EV Working Group has been set up within the Council led by the Sustainable Development Team bringing together officers from Transport, Planning, Parking, Fleet, Licensing, Environmental Health and Procurement. The main purpose of the group has been to enable a more strategic approach within the Council to progress the EV agenda. The working group has been instrumental in helping to set the priorities outlined in the EV Action Plan. Going forward it is proposed that relevant Transport and Environment Locality Managers are also represented on the group.

The EV Action Plan has also been consulted on externally, primarily to members of the Transport Forum and key bodies such as Transport Scotland, SESTran, Lothian Buses and Transport for Edinburgh. The responses from the external consultation were positive and supportive and as a result a number of future partnership opportunities have been identified.

Monitoring Progress

It is proposed that the EV Working Group will be responsible for all future monitoring and reporting on progress of the EV Action Plan. In addition, a key role of the group will be to ensure regular review of technological progress in this agenda ensuring that solutions are up to date. Progress updates will also be reported to the Carbon, Climate and Sustainability Member Officer Working Group.

Reporting

The EV Action Plan covers the period up to 2020 and progress will be reported to the Transport and Environment Committee bi-annually.

Contact

For more information contact:

Michael Kellett

Senior Sustainable Development Officer

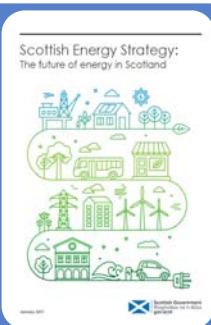
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EV charging unit, Straiton Park and Ride, Edinburgh

APPENDIX 2 – STRATEGIC CONTEXT AND TECHNICAL BACKGROUND



Scottish Energy Strategy

The recently launched consultation on the **Draft Scottish Energy Strategy: The Future of Energy in Scotland**, sets out the Scottish Government’s vision for the future energy system in Scotland, to 2050. One of the key aims within the draft strategy is that by 2050 Scotland has successfully managed a widespread shift to a low carbon transport system and that by 2032 over 40 per-cent of all new cars and vans registered in Scotland will be Ultra Low Emission Vehicles (motor vehicles that emit extremely low levels of motor vehicle emissions compared to other vehicles).



Climate Change Scotland Act 2009

In terms of key legislation, the **Climate Change (Scotland) Act 2009** sets an interim target of a 42 per-cent reduction in greenhouse gas emissions for 2020, on the way to achieving at least an 80 per-cent reduction by 2050. Transport emissions make up just over a quarter of Scotland’s total emissions, with more than two thirds of these emissions coming from road transport. Increased adoption of plug-in vehicles can make a significant contribution to both reducing carbon emissions and improving local air quality, and as such forms a key action supporting this legislation.



Switched on Scotland Phase Two: A Roadmap to Widespread Adoption of Plug-in Vehicles

The Electric Vehicle Action Plan reflects the vision for Scotland outlined in Transport Scotland’s **Switched on Scotland Phase Two: A Roadmap to Widespread Adoption of Plug-in Vehicles**, June 2017. The Roadmap sets out a vision that ‘by 2050 Scottish towns, cities and communities will be free from the damaging effects of petrol and diesel fuelled vehicles’. The strategy document outlines a series of goals and measures including the need for policy frameworks to have plug-in vehicles embedded in all relevant areas of policy. Also, one of the key changes in policy from the Scottish Government set out in Switched On Scotland Phase Two is a move away from installing chargers at x km intervals to now strengthening specific locations with EV charging hubs to facilitate the provision of new mobility services.



Cleaner Air for Scotland

In November 2015, the Scottish Government published **Cleaner Air for Scotland (CAFS)**, its low emission strategy. The document outlines a vision that ‘Scotland’s air quality will be the best in Europe’, and also confirms the commitment to decarbonise transport, clearly making the links between transport, air quality and health. The strategy makes a commitment to continue to deliver the actions contained in the Roadmap in relation to increasing uptake of plug-in vehicles. The Delivering Cleaner Air for Scotland- Development Planning & Development Management Guidance from Environmental Protection Scotland and the Royal Town Planning Institute Scotland January 2017 provides some guidance for developers in regards to operational phase provision of electric vehicle charging points. This guidance document was a requirement noted in the CAFS document.



SEStran Regional Transport Strategy

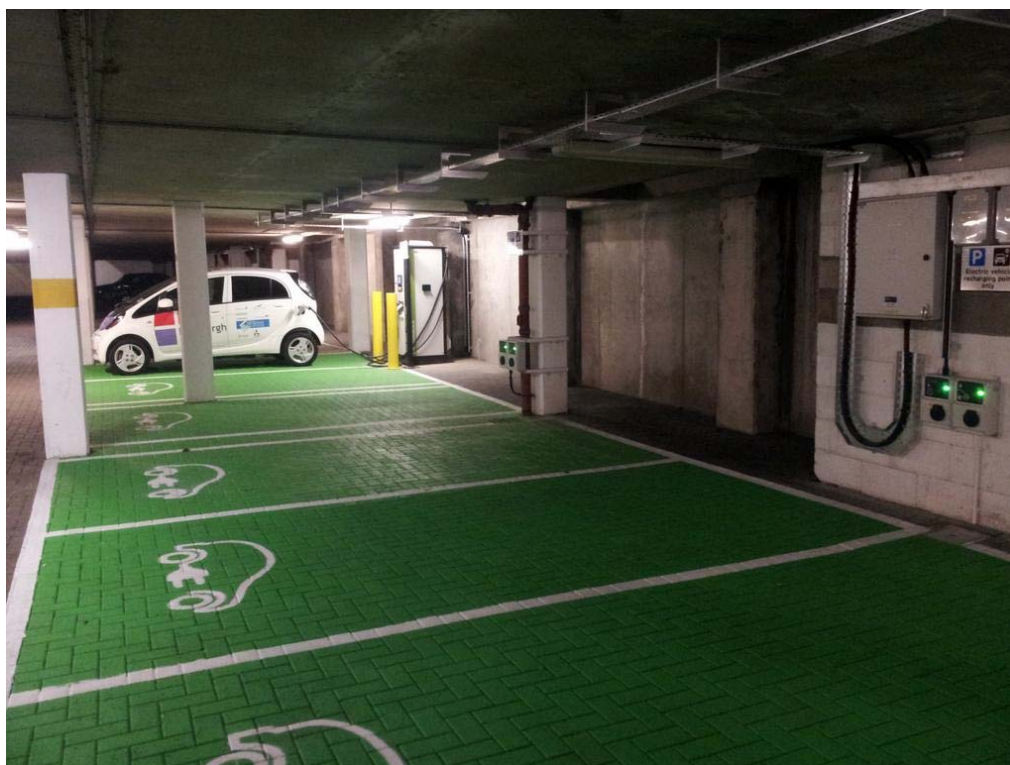
SEStran’s refreshed **Regional Transport Strategy 2015-2025** lists alternative fuels (encouraging use of electric vehicles and alternative fuels) as a priority action that supports a number of objectives outlined within the refreshed strategy.

Introduction to EV technology

Vehicles

The UK has seen a steady growth in demand for EVs, with 2017 being a record year of sales. EVs can be broken down into three types:

- Battery Electric Vehicles (BEVs) – these rely solely on battery power and can travel between 100 and 300 miles on a single charge. Current examples include the Nissan Leaf, BMW i3 and the Tesla S saloon.
- Plug-in Hybrid Electric Vehicles (PHEV) – these employ a conventional petrol or diesel engine alongside an electric motor. They have a relatively short range on electric power (20-40 miles) but the use of conventional engine plus electric motor can return figures in excess of 130 miles per gallon equivalent. Examples include the Mitsubishi Outlander SUV, the newer Toyota Prius PHEV and the BMW i8 sports car.
- Hydrogen Fuel Cell Electric Vehicles (FCEV) – still currently at development stage with limited production due to the difficulties of hydrogen production, storage and refuelling.

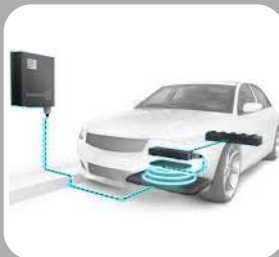


EV Charging Points at Fountainpark, Edinburgh

In the year to June 2017, 45,509 new ULEV's were registered for the first time in the UK, an increase of 27% on one year before and 71% on two years previously. During the year to end of June 2017, ULEVs represented 1.4% of all new registrations, compared with 1.1% over the previous year, and 0.9% over the year before that. Most of the increase in ULEV registrations has been accounted for by vehicles eligible for plug-in car and van grants. New registrations in the year to June 2017 included 39,374 cars and 1,066 vans of models that were eligible for these grants, 19% up on the year to June 2016. The growth in ULEVs is being influenced by new models coming into the market, and increasingly, competitive pricing. The models with the most registrations in the year to June 2017 were the Mitsubishi Outlander with 7,527, followed by the Nissan Leaf with 6,144 and the BMW 330E with 4,702. Source: [Vehicle Licensing Statistics \(DfT\)](#)

Charging Infrastructure

Charging points are primarily defined by the power (in kW) they can produce and therefore what speed they are capable of charging an EV. There are three main EV charging speeds: Slow charging (up to 3kW) which is best suited for 6-8 hours overnight; Fast charging (7-22kW) which can fully recharge some models in 3-4 hours; and rapid charging units (43-50kW) which can provide an 80% charge in around 30 minutes. Rapid chargers also come in two charge point types – AC and DC – depending on whether they use alternating current or direct current.



Slow charging (up to 3kW) is the easiest method of charging electric vehicles as in most cases a standard single-phase 13 Amp three-pin socket is used to draw up to 3kW of power – with a full charge typically taking up to 12 hours. While the first wave of publicly accessible on-street chargers installed across the UK were of this type, these are now being replaced by Fast and Rapid units. Nearly all EV models can be slow charged but this standard is now considered sub-optimal and many manufacturers no longer promote it or supply the appropriate cable as standard.

Source: Zap Map: <https://www.zap-map.com/charge-points/basics/>



Fast charging (7 – 22kW) greatly reduces EV charge times to around less half that of a slow charge by doubling the available current to 32 amps (7kW) and using connectors and cable specifically designed for that purpose – the time for a full charge typically being 3 to 4 hours. Most commercial and many public on-street chargers already use this technology. It is likely that this charge rate will become increasingly used to replace public slow charging points across the UK.

Source: Zap Map: <https://www.zap-map.com/charge-points/basics/>



Rapid AC chargers (up to 43kW) provide a high-power alternating current (AC) supply with power ratings up to 43kW. At this level of power, an electric vehicle can typically be charged to 80% in less than half an hour. The rapid AC option is a relatively new development and only available on one or two EV models in the UK – more common is the rapid DC option described below.

Source: Zap Map: <https://www.zap-map.com/charge-points/basics/>



Rapid DC chargers (up to 50kW) provide a high power direct current (DC) supply with power ratings of up to 50kW. At these charging rates, charging an electric vehicle to 80% typically takes half an hour. The most common type of rapid charging unit, Rapid DC chargers are equipped with a tethered cable with a non-removable connector which is coupled with an appropriate inlet socket which is fitted to some but certainly not all EV models. Although smaller designs are becoming available, these units are relatively large compared to lower power units and require significant local power network capacity, so are more suited to off street provision.

Source: Zap Map: <https://www.zap-map.com/charge-points/basics/>

The current 50kW DC rapid charge speed could soon become outdated with a number of EV charging unit manufacturers developing higher powered options. TESLA already operate their proprietary 120kW ‘Supercharger’ across the UK.

EV ownership in the UK and Scotland

The popularity of electric vehicles throughout the UK has continued to grow over the last few years. There are now approximately 118,000 ULEV's on the road, compared with just 31,000 at the end of 2014 (fig.5). Scotland like the UK is also currently experiencing a similar growth in the uptake of ULEV's. At the end of 2011 there were just 88 EVs licensed in Scotland, at the end of June 2017 the number stood at 5,595 (fig.6). Figure 7 (p.25) shows the percentage of EVs licensed by Scottish Local Authority area and how Edinburgh compares overall. This growing increase in EVs is largely a result of the greater level of choice for drivers, a shift in the public's attitude towards EVs and a constantly improving and expanding public recharging network. The number of new EVs to be launched within the next year or so is set to increase and many of these new models will come with significantly extended battery ranges, further providing confidence for motorists. The UK government's Plug-in Car Grant has also been guaranteed until 2018; as such it is reasonable to expect that the popularity and growth in ULEVs is set to continue.

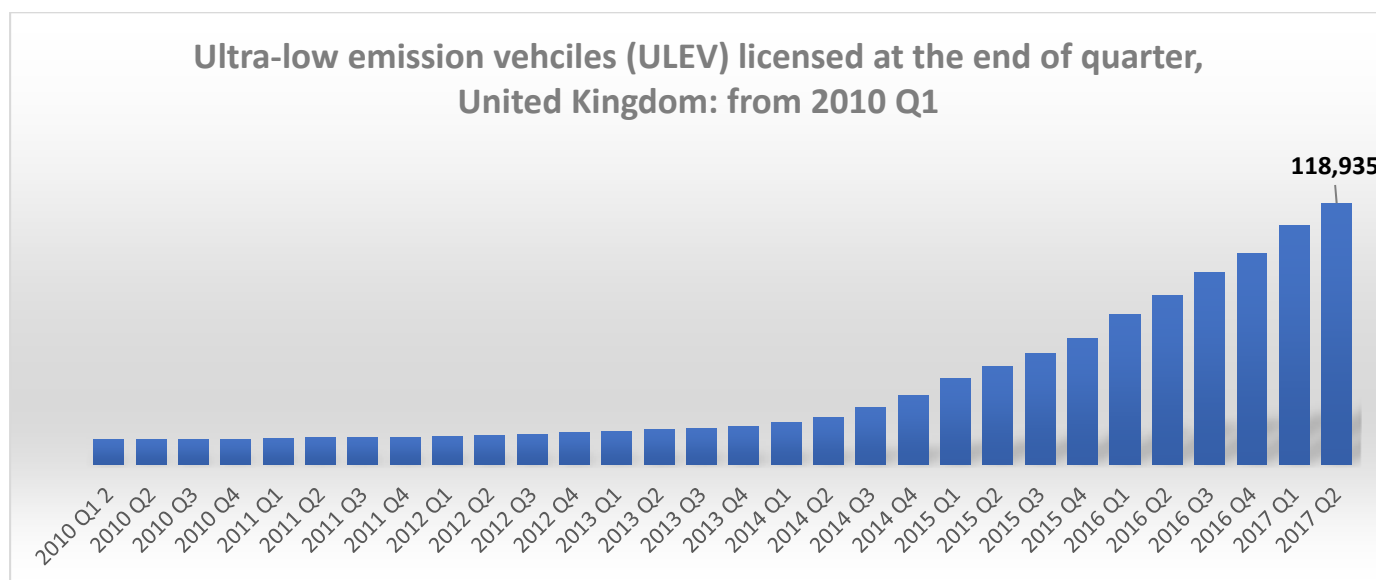


Figure 5: Ultra-low emission vehicles (ULEV) licensed at the end of quarter (UK) 2010-2017

Source: [Vehicle Licensing Statistics \(DfT\)](#)

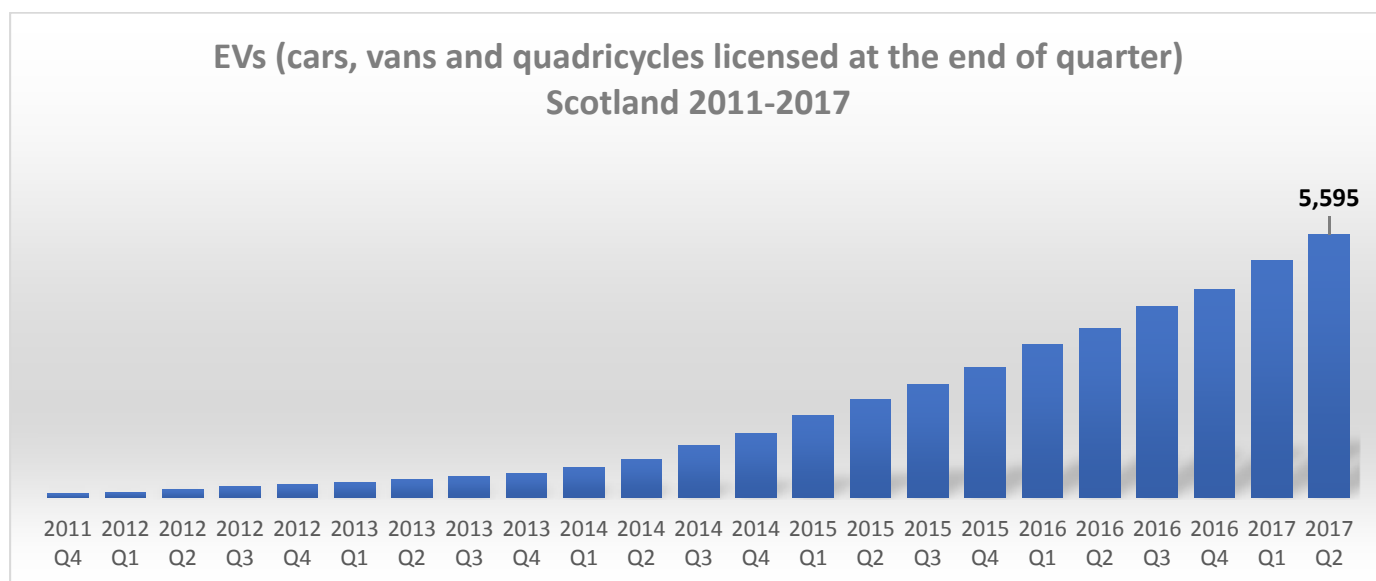


Figure 6: EVs (cars, vans and quadricycles licensed at the end of quarter) Scotland 2011-2017

Source: [Vehicle Licensing Statistics \(DfT\)](#)

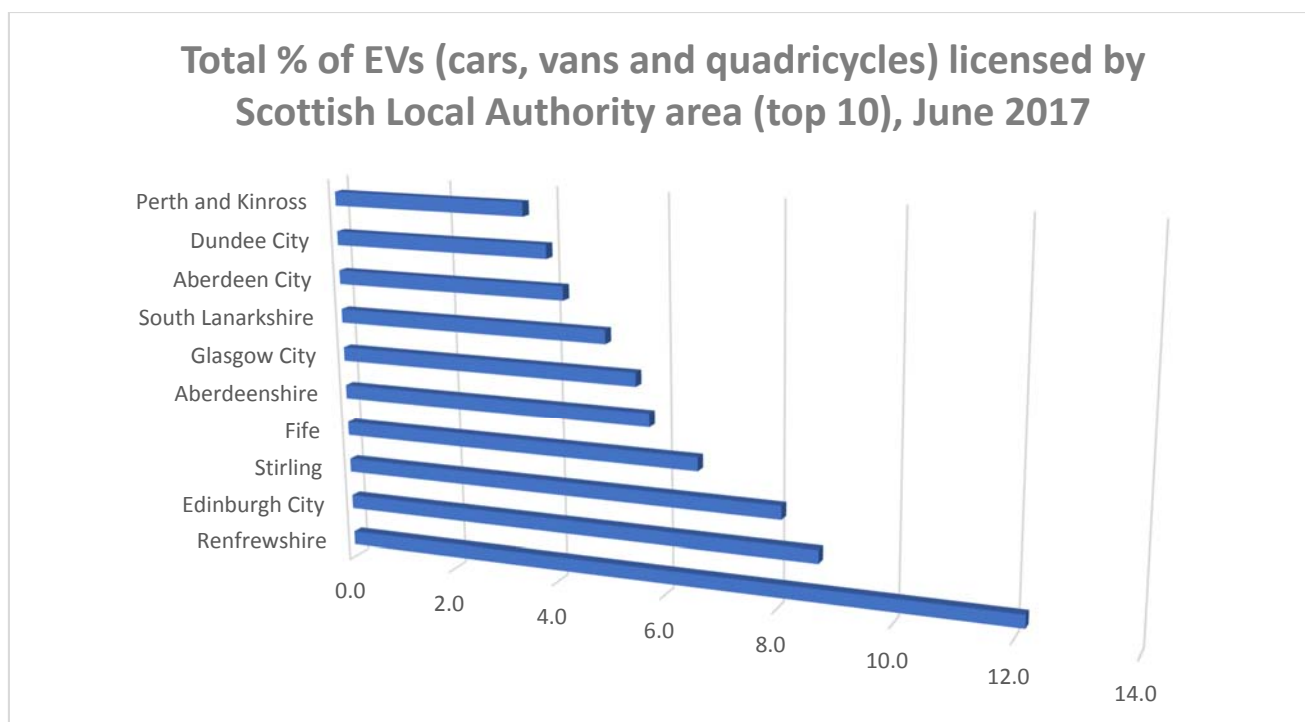


Figure 7: Total % of EVs (cars, vans and quadricycles) licensed by Scottish Local Authority area (top 10), March 2017 (top 10 local authorities)

Source: [Vehicle Licensing Statistics \(DfT\)](#)

Benefits of Electric Vehicles

The growth of the market in EVs has the potential to make a significant contribution across a number of environmental and economic benefits.

Environmental benefits

Reduce carbon emissions

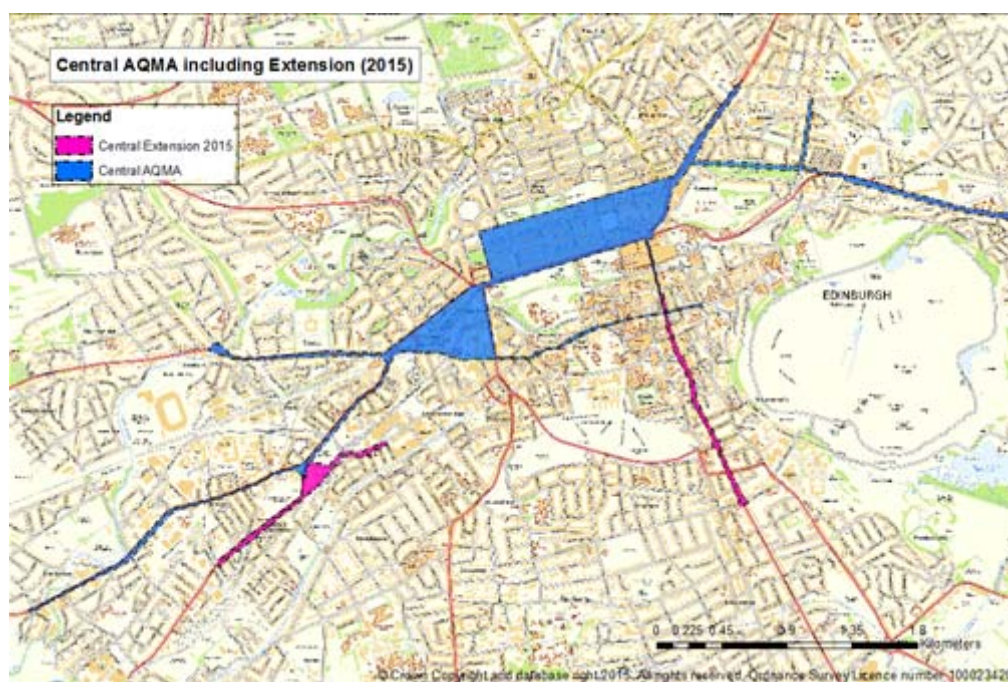
Road transport in Edinburgh is responsible for 26.5% of total carbon emissions⁴. With electric vehicles, CO₂ reductions are dependent on the source of electricity used for charging. The CO₂ produced by an EV is directly related to how the electricity it uses is produced, but even using the current standard UK supply, a pure EV produces up to 40% less CO₂ than a similar petrol or diesel vehicle. In the longer term, increasing generation of electricity from renewables will create carbon-free motoring. Reduced traffic pollution will improve the health and quality of life of people who live in, work in and visit Edinburgh, especially those suffering from respiratory or cardiovascular illnesses that restrict their daily activities.

Improve air quality

Since December 1997 each local authority in the UK has been obliged to carry out continual assessment of air quality in their area by measuring air pollution in an attempt to predict how it will change in coming years. The aim of this work is to ensure that the national air quality objectives (AQO) will be achieved throughout the UK by the relevant deadlines. These objectives have been put in place to protect personal health and the wider environment. If the

⁴ Department for Business, Energy & Industrial Strategy, <https://www.gov.uk/government/statistics/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics-2005-2015>

assessment process identifies an area/areas which may fail to meet the objectives, an Air Quality Management Area (AQMA) must be declared.



Edinburgh's Central Air Quality Management Area

Breaches of AQO in the city's AQMAs are largely due to road traffic. Emissions from the exhaust include, among others, particulates (microscopic particles of matter which are a by-product of combustion), and NO_x and SO_x (nitrogen oxides and sulphur oxides) which directly impact local air quality. Friends of the Earth Scotland recently named Scotland's most polluted streets and branded Edinburgh's St. John's Road the worst in Scotland. A recent survey of the UK's roads by Inrix Roadway Analytics found that four of the UK's worst traffic bottlenecks occur on the Edinburgh bypass and that Edinburgh ranks second in a list of Britain's most congested cities. Although EV's will not help to alleviate congestion they will play an important role in helping to improve air quality and reduce CO₂ emissions.

Direct emissions include smog-forming pollutants (such as nitrogen oxides), other pollutants harmful to human health, and greenhouse gases (GHGs), primarily carbon dioxide. All-electric vehicles produce zero direct emissions, which specifically helps improve air quality in urban areas.

Reduce noise

Traffic noise is a major problem, particularly in a tightly packed city like Edinburgh with high densities of residents living or working close to major roads. EV are near-silent, meaning at low speeds typical of urban driving noise pollution is minimal, as such EV's have the potential to significantly improve the urban soundscape.

Economic benefits

Consumer benefits

The UK Government currently offers up to £4,500 off the price of a new electric car, and up to £8,000 off the price of a new electric van. The official names for these grants are the Plug-in Car Grant and the Plug-in Van Grant. As advised by the manufacturers, most EVs currently available have a range of up to 100 miles. Most electric

commercial vehicles have a range of 60-150 miles depending on the model and usage patterns. Most people in the UK travel far less each day than the range of a 100% electric vehicle. As battery technology improves, so will the range of vehicles. Further economic benefits can be realised by consumers as EVs do not pay road tax and are unaffected by fluctuating fuel prices. In addition to this the lack of complex parts (no gearbox or engine) can make EVs cheaper to maintain.

For businesses and organisations, the potential financial benefits of replacing their grey fleets with electric vehicles are significant. Service, maintenance and repair costs, tax savings and fuel savings associated with electric vehicles can save a business or organisation significant amounts of money. Businesses that already operate electric vehicles can save on average £14,000 on a fleet of 10 cars annually when considering whole life costs.⁵

Energy security - Protect customers from volatile fossil fuel prices

Increased global demand for oil and declining reserves currently subject motorists to volatile (and generally rising) fuel costs. While electricity costs are currently linked to fossil fuel prices, increasing renewable energy generation will help to break this link. A shift away from vehicles run on oil-based fuels to EVs will improve our energy security and reduce the impact of high oil prices on the economy.

Green growth

The emergence of EVs offers significant potential for sustainable economic growth. The automotive Council has already identified the shift to low carbon as a strategic imperative for the UK, with opportunities available across a new value chain for the development, deployment and integration of EVs. This will help to build on existing strengths in the automotive sector, which accounts for 12% of the UK's manufacturing employment, including R&D, and design and engineering excellence.⁶

Challenges / Issues to future expansion of EV's in Edinburgh

There are a number of barriers currently holding back the widespread adoption of EV's that are common to the UK as a whole. Some of the most common barriers holding back the widespread adoption of EVs are listed below:

The idea of **range anxiety** is probably one of the most widespread barriers, and is a misconception that the battery will not have the adequate range to meet the driver requirements. For most EV users, charging will be a case of "topping up" with few users exhausting a vehicle's battery completely as a regular occurrence. The average individual journey length in the UK is 8.6 miles and the average total daily distance travelled is 25 miles, well under the full range of most EVs.

⁵ Go Ultra Low: <https://www.goultralow.com/>

⁶ Office for Low Emission Vehicles: [Making the Connection](#)

Long charging times have been consistently reported as a barrier by EV users, regardless of the ability to charge overnight. Having adequate publicly accessible charging in place will be key to addressing this barrier. A network of 3-7kw chargers will not provide the incentive for potential EV buyers or address the issues faced by EV owners. A network of rapid chargers helps address this issue though by greatly reducing charging times. Current rapid charging units are able to provide an 80% charge in around 30 mins compared to fast chargers (7-22kw) which can take 3-4 hours to fully recharge a vehicle. Significant progress has been made though with charging point numbers increasing from a few hundred in 2011 to 11,750 charge points by October 2016.

Grid connection costs - Bringing a new electrical supply to a site which will host EV charging infrastructure is generally the costliest and most time-consuming part of any installation. Some sites depending on their location and the amount of power required will need new electrical substations built on site, when installing rapid and fast charging hubs these costs will increase substantially. As such integrating renewable energy generation and battery storage systems with the EV chargers will allow for the power requirements on site to be reduced and thus the cost.



Future enablers

Legislation

Putting in place key legislation to support the continued uptake of EVs will provide the much-needed support that the EV market in Edinburgh needs to help address the cities air quality problems and rising CO₂ emissions from road transport. The UK Government recently announced that it will end the sale of all new conventional petrol and diesel cars and vans by 2040 and next year will publish a comprehensive Clean Air Strategy which will address other sources of air pollution and likely provide further support for EV's. The Scottish Government has also committed to phasing out of new petrol and diesel cars and vans by 2032. Many local authorities are moving air quality towards the top of their agenda. Examples of proactive legislation coming into force can be seen across a number of local authorities. The Greater London Authority is banning the use of diesel hackney carriages from 2018 onwards. Oxfordshire County Council is considering introducing a congestion charging system and workplace parking levies as a means of funding a range of local sustainable transport improvements contributing to a reduction in CO₂. Key enabling legislation such as this will strongly support the EV priorities set out at the local level in the Sustainable Energy Action Plan, Air Quality Action Plan and the Local Transport Strategy.

New industrial sector

The newly formed Business, Energy and Industrial Strategy Department has highlighted the EV market as a key growth area for Britain's economy, and is keen to position Britain as world-leading hub for next-generation EVs placing it at the heart of the government's new industrial strategy. This comes on the back of Jaguar Land Rover outlining a "vision" for producing electric cars in the UK in a move that could boost the UK's standing as a leading EV manufacturer and deliver thousands of extra jobs. With this new focus on the EV market coming from the UK Government, cities with an ambition to support this market will be able to avail of considerable new funding

streams. Technological improvements and the falling costs of batteries will be the key enabling measure that allows EVs to compete with internal combustion engine vehicles.

Technological advances

The growth in new sales of electric vehicles is increasing year on year, but with the technological advances that are currently underway and planned in the very near future, the growth in EV ownership is expected to increase further. Battery costs are falling, putting them on a trajectory to make unsubsidised EVs as affordable as their internal combustion engine counterparts. The mileage range of EVs is set to increase significantly. General Motors, Chevrolet Bolt is due for release in 2017 and will be capable of delivering 238 miles on a single charge. The Scottish Government has stated in the Draft Climate Change Plan that they expect EV battery costs to halve and their performance to double incrementally over the period to 2035, with a step-change in market penetration from 2020 onwards.

The UK’s EV chargepoint network is also increasing year on year (fig. 8), with the number of rapid DC/AC connectors now standing at 2174 (January 2017) up from 1800 in 2015. The new Tesla Supercharger is capable of delivering up to 120 kW of power, which equates to about 170 miles of range in as little as 30 minutes. Despite this the UK’s public charging infrastructure is struggling to keep pace with EV uptake. As such the ratio of EVs to chargers has grown from 0.78 to 7.32 in just four years⁷. That means the current car-per-charger ratio is in danger of falling behind European Union targets. The European Parliament has said for EVs to become commercially viable, there has to be at least one charger for every 10 cars on the road.

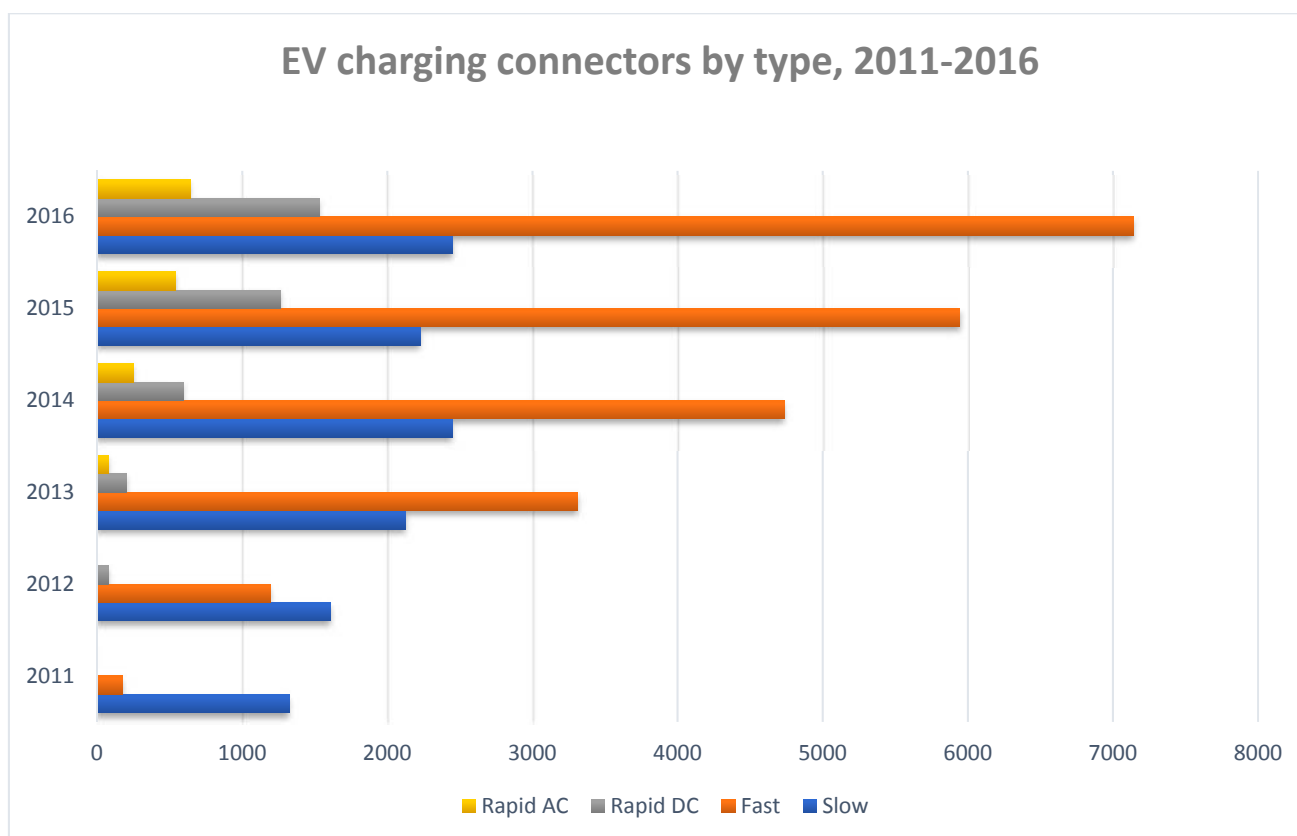


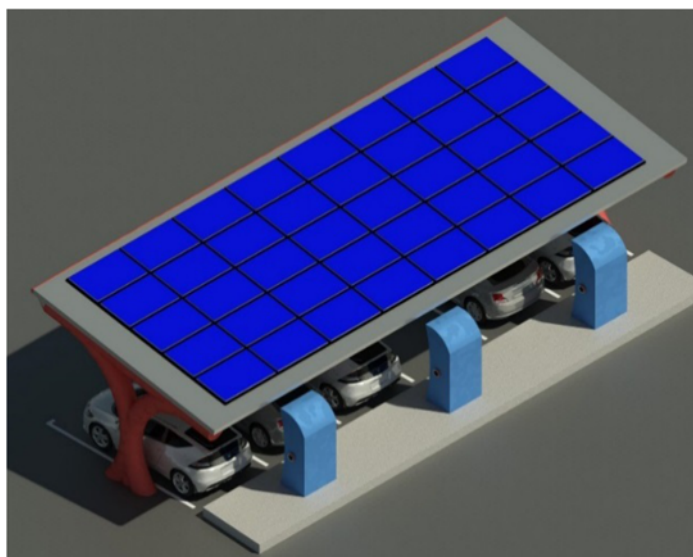
Figure 8: Charging connectors by type (2011-2016)
 Source: Zap Map <https://www.zap-map.com/statistics/>

⁷ Source: Zap Map, <https://www.zap-map.com/>

Smart EV charging solutions - renewable energy generation, battery storage and the smart city transition

Both EVs and EV charging infrastructure are subject to advances in technological innovation that have surpassed expectations in a relatively short space of time. The future of electric mobility and charging systems align very strongly with the transition towards a smart city. Smart cities are seen as representing a next generation of geographically localised energy and infrastructural systems. Smart cities are attracting attention by offering a new environmentally conscious form of urban living. A growing body of research and demonstration projects can attest to the transformative potential of EVs to enhance the smart grid. It could do so namely by regulating energy consumption and eliminating clean energy waste through acting as both a generator during peak load and as storage during off-peak load, through the utilization of both renewable energy generation and battery storage systems on-site. The enhancement of advanced metering and demand response capabilities that Vehicle to Grid (V2G) technology promises implies not only a change to the face of the smart grid but also the promise of cost-savings and revenue creation.

Energy Storage: Installing energy storage (typically Lithium Ion batteries) co-located with EV chargers helps to manage local peak demands, meaning upgrades and investments to the distribution network can be deferred or even avoided, and replace existing inefficient power generation that would otherwise only be needed at times of peak demand. Energy storage can also allow generators to think about maximising the value from the power generated through price arbitrage – storing energy when its value is low, releasing it to the market when demand is high and is more valuable. Other benefits of energy storage include; avoiding the need for renewable energy curtailment; helping grid system operators maintain stable frequency; and provide demand profile smoothing allowing network operators to plan networks more efficiently, delivering lower costs to consumers. On a larger scale, multiple energy storage systems across a distributed, connected and sustainable EV charging network can be used to provide larger scale autonomous grid smart storage and energy trading opportunities.



Bi-directional smart meters – which allow for the efficient control of onsite renewable energy generation and battery storage.

Renewable Generation: Depending on the location of the charging station, renewable energy generation can be co-located to provide a low carbon energy source for transport. If co-located with energy storage solutions, this combination can provide greater benefit by storing excess renewable generation and using it for charging events as required. In order to maximise on space utilisation, solar car-ports are a suitable method with which to enable onsite renewable generation along with a functional and aesthetically pleasing structure.

Vehicle 2 Grid: Utilising vehicle batteries as a power source, vehicle to grid technology allows two-way power flows enabling revenue generation from car storage. The vehicle (perhaps via a software platform) can sell energy and related energy services (e.g. ancillary services) to the grid whilst it's charging. This is a step towards a smart grid where there is dynamic management of Distributed Energy Resources to solve grid challenges either locally or nationally when integrated with other resources.

Smart charging and capacity management (where large parking facilities are available) – vehicles are charged using smart algorithms and giving charge sessions different priorities (i.e. based on how full the battery is upon arrival).