Electric Vehicle Strategy

Surrey Transport Plan

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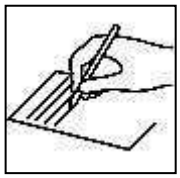

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County Hall
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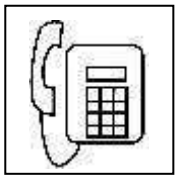

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SMS: 07860 053 465

Online
Email: contact.centre@surreycc.gov.uk
www.surreycc.gov.uk/cleanertravel

Surrey Transport Plan, 2011-2026

Electric Vehicle Strategy
November 2018

Reference note: for the purpose of this document the term Electric Vehicle (EV) is used to refer to all types of plug-in vehicles that can be powered solely by a battery including; Plug-in Hybrid Electric Vehicles (PHEVs), Extended-Range Electric Vehicles (E-REVs) and Battery Electric Vehicles (BEVs). More information on these types of vehicles can be found in Annex 1.

This Version

Version	Date	Author / Owner	Rationale
1.0 Feb 2019	Feb 2019	Transport Strategy Team	Policy Adopted

Previous Version

Versions	Date	Author / Owner	Rationale
0.8	Nov-18	Transport Policy team	Proposed final version, revised based on consultation feedback, presented to Cabinet for approval
0.7	Jun-18	Transport Policy team	Public consultation draft, for publication
0.1 – 0.6	Mar-18	Transport Policy team	Development of Electric Vehicle Strategy working draft – circulated to stakeholders for comment. Senior management sign off to consult approved May 2018.

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Foreword

In July 2018 the Government published Road to Zero[1], an ambitious roadmap towards delivering zero emissions transport across the UK. Within transport, we at Surrey County Council believe that electric vehicles offer an excellent opportunity to help the county on a pathway towards this vision and we are excited about the potential benefits they may have for Surrey residents, businesses and visitors.

It is well-known that petrol and diesel vehicles contribute a significant level of air pollution that can be harmful to both human health and the environment. Technology is constantly evolving to produce more efficient, reliable electric vehicles capable of covering ranges comparable to petrol and diesel fuelled vehicles. A transition to electric vehicles will help to reduce the level of airborne pollutants at the roadside, improving the environment in areas where we all live, work and play.

The County Council has an important role to play in supporting growth in electric vehicles, including through creating a supportive policy environment, enabling the creation of new charging facilities for electric vehicles, promoting their benefits to a wider audience and leading by example to ensure that Surrey County Council's own activities use cleaner technology at the earliest opportunity where it is practical and offers the taxpayer good value for money.
Surrey is an area that is well-suited to adopting electric vehicles and we are keen to help realise this potential through this strategy.
Surrey County Council is pleased to present its first Electric Vehicle Strategy.

Mike Goodman
Cabinet Member for the Environment Transport

Colin Kemp
Cabinet Member for Place and

[1] Department for Transport (2018) Road to Zero.

Executive summary

The UK Government has set a target to ban the sales of new petrol and diesel cars by 2040 and released its Road to Zero strategy in 2018 outlining a pathway towards achieving this. Crucial to the Road to Zero roadmap is a transition from conventional vehicles towards electric vehicles (EVs). Ownership of EVs has grown significantly in recent years, and is expected to grow even more dramatically as technology improves and affordability means that more people can choose to run electric cars. Within Surrey, a transition from conventional vehicles to EVs will reduce exhaust emissions and therefore has the potential to be hugely beneficial in our mission to improve air quality and reduce the harmful effects of air pollutants on public health. Additionally, we believe that the EV revolution has the potential to stimulate growth in Surrey's local economy by providing opportunities for new markets and innovation within our thriving technology and engineering sectors. The charging infrastructure itself could become a key way of attracting visitors to destinations in Surrey, helping to maintain the economic vitality of local areas.

However, we do recognise that there are existing barriers to convenient use of electric vehicles. The absence of a comprehensive charging network means that people have a lack of confidence in how far they can travel using EVs or that existing chargepoints will be unoccupied. While there is an opportunity for a large proportion of EV charging to be done overnight at home, not all households have access to offstreet car parking. There are also technological obstacles, for example, battery sizes are increasing quickly, making low power charging supplies less useful beyond the short term. Owning an electric vehicle may not be attainable or desirable for everyone, creating challenges around how those who rely on other modes might be able to benefit from the technology.

We recognise that in addition to EVs, the past decade has seen the development of a number of other types of alternatively fuelled vehicles such as hydrogen fuel cells, compressed natural gas and even niche innovations with compressed air and liquid nitrogen. This strategy focuses purely on plug-in EVs at present given the increase in EV ownership and relative infancy and low uptake of alternative fuels. Over time, it may be necessary for Surrey County Council ('the council') to address other fuel types and we will continue to monitor the development of new technologies.

This strategy outlines a pathway that enables the council to help support individuals who wish to make the switch from conventional vehicles to EVs in the early stages before a matured commercial market of chargepoints is available. It intends to encourage EV uptake amongst residents, including those without access to off-street parking. It provides a source of information to help coordinate an integrated approach across Surrey and the foundations to ensure that we are able to apply for funding to support a publicly accessible charging network when opportunities become available.

Our strategy will be delivered through a range of actions that seek to make Surrey an even more attractive setting for an established EV environment. We will achieve

this through revised planning guidance that encourages developers to build charging provision into new homes, the development of an on-street charging infrastructure policy, provision of public chargepoints on council land as well as working with partners to support and encourage further provision. In addition to private vehicles, the actions in this strategy also support EV uptake wherever feasible among car clubs, taxis, buses, community transport operators, as well as within our own fleet of council vehicles.

We expect our strategy to complement the growth in EV charging provision in the private sector and help to fill gaps in the existing network. We anticipate this to provide assurance to existing users and encourage the uptake of electric vehicles amongst potential new users. The outcome of this will ultimately benefit air quality as part of our wider sustainable transport approach.

As part of the Local Transport Plan this document is intended to help inform wider decision making at the county level and also guide the development of policy and transport schemes at a local level.

Glossary

The table below provides a glossary of abbreviated terms found in this document.

Term	Description
Alternating current (AC)	A power supply where the electric current waveform switches between positive and negative poles over time. Mains power typically supplies alternating current.
Battery electric vehicle (BEV)	A vehicle propelled solely by an electric motor, powered by energy stored in rechargeable batteries.
Direct current (DC)	A power supply where the electric current waveform maintains a single direction. Batteries in electric vehicles store and deliver power to the motor as direct current.
Distribution Network Operator (DNO)	The owner and operator of the regional electric grid network. Distributes electricity to homes and organisations from the National Grid transmission network.
Electric vehicle (EV)	A vehicle that can be propelled by an electric motor.
Extended range electric vehicle (E-REV)	A vehicle powered by an electric motor, with an additional petrol/diesel generator available to extend range.
Internal combustion engine (ICE)	The conventional type of engine used to drive motor vehicles, typically fuelled by petrol or diesel.
Nitrogen oxides (NO_X)	An umbrella term for various gases containing compounds of nitrogen and oxygen. Some nitrogen oxides react with other compounds in the air to create particles that can be damaging to human health.
Office for Low Emission Vehicles (OLEV)	Part of two government departments, the team works to support the introduction of ultra-low emission vehicles, including electric vehicles.
Particulate matter (PM)	A form of air pollution consisting of fine particles, typically below ten micrometres in diameter, which can cause damage to human health.
Plug-In hybrid electric vehicle (PHEV)	A vehicle that can be powered by both electric and an internal combustion engine.

Term	Description
Scottish and Southern Electricity Networks (SSEN)	A distribution network operator covering Central Southern England, including parts of northwest and southwest Surrey.
Traffic regulation order (TRO)	A legal tool enabling the highway authority (in this case, the council), to govern, restrict or regulate traffic on the public highway.
UK Power Networks (UKPN)	A distribution network operator covering London and South East of England, including the majority of Surrey.
Ultra-Low Emission Vehicles (ULEVs)	Vehicles which use low carbon technologies, emit less than 75g of CO2 per kilometre from the tailpipe / exhaust, or is capable of operating zero tailpipe emission mode for a range of at least ten miles[2]

[2] https://www.smmt.co.uk/industry-topics/technology-innovation/ultra-low-emission-vehicles-ulevs/

1. Introduction

This strategy covers a range of emerging areas where readers might be unfamiliar with the terminology used. A glossary of abbreviations, along with a technical information section (Annex 1) has been included.

This strategy considers a number of benefits and challenges of electric vehicle (EV) technology, however the main driver behind the council supporting a transition from conventional petrol or diesel internal combustion engine (ICE) vehicles to EVs is the beneficial impact this will have on transport-related pollutants, including:

- Reduced greenhouse gas emissions at the vehicle exhaust.
- Reduced emissions of harmful nitrogen oxides (NO_X) emissions.
- Fewer exhaust emissions means improved air quality and therefore better public health.

Our target audience for the strategy is:

- Our residents, visitors and organisations.
- All those involved in provision of transport infrastructure.
- All partner organisations within Surrey.

Both emissions released at the vehicle itself (tail-pipe emissions) and those released in the generation of the fuel should be considered when looking at environmental performance. The council recognises that the environmental sustainability of EV use is therefore partly determined by the power source from which the electricity is derived, given that traditional fossil fuels make up around 47% of the current national electricity generation mix[3].

Studies suggest that the greater efficiency of EVs over conventional vehicles means that an EV powered solely by electricity generated from oil would still use less than two thirds of the energy compared to a petrol vehicle[4]. Furthermore, trends towards the decarbonisation of the energy industry are expected to only improve the environmental performance of EVs further.

In developing this strategy, it has been important to note that EVs are not viewed as a solution to all transport-related health issues. While EVs have significant air quality benefits over conventional petrol and diesel fuelled vehicles, they still create air pollution in the form of small particulates from the wear on brake discs and tyres, which can be

[3] Aggregated annual figures for 2017. Electricity generation mix by quarter and fuel source (GB). July 2018, Ofgem.
[4] European Commission (2014) Wells to wheels report v4.a.

harmful to human health[5,6]. Walking, cycling and travel by public transport remain essential to improving air quality as well as tackling congestion and encouraging physical activity. As such, EVs need to be considered as complementary to a wider sustainable transport approach.

This strategy covers all types of plug-in electric vehicles. More information on the different types of EV are provided in Annex 1.

1.1 Existing charging provision for electric vehicles in Surrey

There are more than 200 publicly accessible chargepoints at over 60 locations in Surrey, ranging in type from 3kW trickle chargepoints to 50kW rapid chargepoints[7] (information on the different types and speeds of chargepoints is provided in Annex 1).

The majority of sites are located in off-street locations such as supermarkets, rail stations, business parks and public car parks. The current provision of chargepoints is available to view on www.zap-map.com.

The council currently operates a small network of publicly-accessible chargepoints, as well as a number of privately-accessible chargepoints on its estate for staff and visitor use.

1.2 Demand for electric vehicles

Beyond the ambition at national level for a transition from conventional vehicles to EVs, research has demonstrated the potential within Surrey for the uptake of EV technology[8]. Based on factors including local demographics, the county was acknowledged as having a high propensity for EV uptake amongst its population compared to the national average (further information is provided in Chapter 3.1).

This demand has subsequently been shown in the number of EV registrations in the county; Figure 1 shows the acceleration in EV registrations in Surrey compared to the neighbouring counties of Hampshire, Kent and West Sussex. To enable the anticipated trends for EV growth in the county, it is important for this document to provide a coherent strategy to support the uptake in these vehicles.

[5] Ki-Hyun, Kabir & Kabir (2015) 'A review on the human health impact of airborne particulate matter'. *Environmental International*. **Vol 74**, pg 136-143.
[6] Timmers & Achten (2016) 'Non-exhaust PM emissions from electric vehicles'. *Atmospheric Environment*. **Vol 134**, pg 10-17.
[7] Source: www.zap-map.com, 2018
[8] Surrey Electric Vehicle Strategy Final Report. Steer Davies Gleave, June 2012.

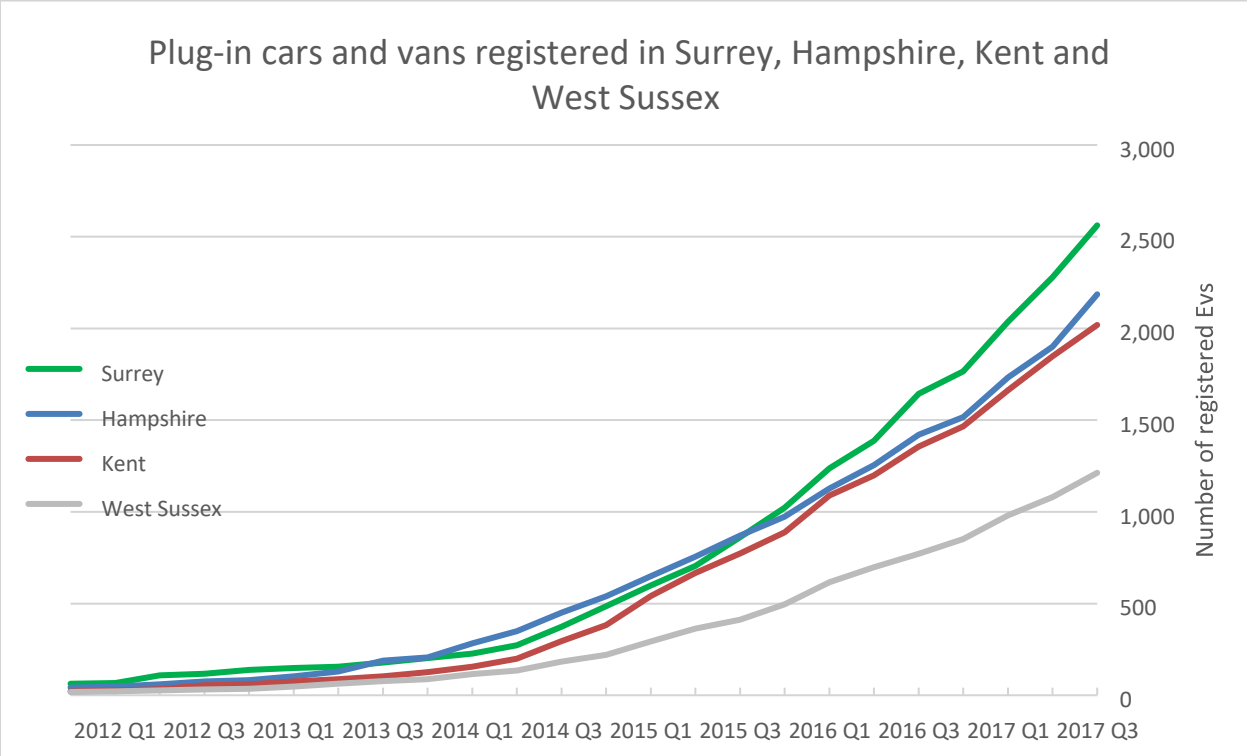


Figure 1: EV registrations from January 2012 to December 2017[9]

1.3 Alignment with other Surrey County Council strategies

This document seeks to complement other strategies that make up the Surrey Transport Plan including:

- Low emission transport strategy (emerging 2018)
- Air quality strategy (2016)*
- Climate change strategy (2012)*
- Travel planning strategy (2011)
- Local bus strategy (2014)

*These strategies will be combined and updated to form Surrey's emerging 'Low emission transport strategy'.

[9] Data source: Vehicle Licensing Statistics, Table VEH0131. Department for Transport, 2018.

2. Aims and objectives

The aim of this strategy is to:

Develop a Surrey-wide approach to encourage the transition from petrol and diesel vehicles to electric vehicles as part of a sustainable, integrated transport system.

Our objectives that will enable us to fulfil this aim are:

a) To encourage use of EVs amongst Surrey residents, businesses and make provision for visitors.
b) To facilitate an increase in publicly available charging infrastructure through:
    - Council-led provision of EV chargepoints.
    - Working with local authority partners and private enterprise to encourage third party provision of EV chargepoints.
c) To act as a coordinator for a strategic Surrey-wide approach to charging provision.
d) To secure appropriate funding and sponsorship when and where it becomes available.
e) To influence high level decision makers to provide support and funding opportunities where needed.
f) To respond flexibly to fast-paced developments within the EV sector.
g) To inform residents and lead by example by using EV technology to reduce the environmental impact of our day-to-day operations.

There are a number of approaches available to the council to help work towards our objectives and the overall aim:

- **As the highway authority:** The council can provide infrastructure to enable EV uptake and consider interventions that make it more appealing to use EVs over conventional vehicles on Surrey roads.

- **As the local authority:** The council can seek to engage, inform and encourage Surrey residents and organisations to switch to a more sustainable mode of

transport. It can produce guidelines and therefore coordinate an integrated approach across the county.

- **As a major employer and purchaser of services:** The council can take a lead to help its own staff and suppliers to use EVs in day-to-day business, to both demonstrate positive behaviour and help normalise the technology.

3. Developing a network of public chargepoints in Surrey

Opportunities and challenges

In general, EVs and the charging infrastructure needed to support them present a series of challenges and opportunities to current and prospective EV owners and land owners. As local authorities, the county, borough and district councils can all play a role in supporting EV growth.

As the highway authority, the council faces specific additional challenges and opportunities associated with use and charging of EVs on-street. Gives an overview of factors which need to be taken into account in developing our county-wide EV Strategy:

General

Opportunities	Challenges
• Encouraging drivers to switch from petrol/diesel to EV will benefit local air quality through reduced exhaust emissions of NO_X. • Increased use of EVs will help 'decarbonise' the economy as energy generation progresses from fossil fuels to renewable sources. • Providing chargepoints may attract EV users to an area and stimulate nearby shops and the local economy[10]. • Increased EV usage will stimulate the EV technology sector both nationally and specifically an industrial sector in Surrey which has a rich science,	• Available power capacity on the local electricity network varies across the county and is typically limited in builtup areas. • Costs of upgrading the local electricity network to unlock spare capacity is often too high to justify new EV chargepoints. • Installing and maintaining chargepoints may create an additional cost to the council, at a time when funding is constrained. • Financial risk to the council of removing of chargepoints if they become damaged, obsolete or a chargepoint supplier folds.

[10] Zap-map (2015) Survey supports the need for a public EV charging network.

technology, engineering and maths (STEM) base. • Demand for chargepoints in Surrey is likely to be higher than other regions due to a relatively large number of existing EV owners and level of affluence.	• EV charging periods requires a dwell time greater than conventional refuelling; potential charging sites must be able to accommodate this (and provide services for EV users during this period). • Certain chargepoint sites can be constrained by planning/heritage restrictions. • Various charging cable types

Highways

Opportunities	**Challenges**
• On-street charging infrastructure at appropriate locations may offer more convenient locations for users to charge than off-street locations. • When installing a chargepoint, access to the electricity network is often easier on-street than off-street. • On-street EV chargepoints in town centre locations may attract more visitors to shopping parades where off-street parking is limited. • On-street charging infrastructure may provide a revenue opportunity for the council at a time when funding is constrained.	• On-street chargepoints require space on the public highway. Some locations may present an obstruction to pedestrians. • Certain types of chargepoint units are not suitable for on-street locations. • On-street parking bays are limited in certain areas. Reserving bays only for EV users may place further pressure on parking and would require resources for the traffic order consultation process. • Limited levels of on-street EV charging infrastructure may attract additional vehicles to areas of greater provision, increasing parking pressure. • Need to be sensitive to the visual impact of chargepoints and ensure the character of local areas is considered.

Table 1: Opportunities and challenges of developing a public charging network

Given that EVs are still a relatively new phenomenon, a broader challenge beyond public chargepoint infrastructure is the level of information and general understanding that people have regarding EVs and the extent to which a lack of accurate information

might make them less inclined to switch from ICE to EV. The council recognises that it is able to contribute towards information provision to help overcome this.

This chapter studies some of the listed opportunities and challenges in more detail, understanding how the council can support the expansion of a public charging network in Surrey and considers how we can work with our partners to deliver infrastructure in areas that are outside of our immediate control as the highways authority.

Action:
Information provision on EV technology:

- We will continue to use our existing online platform to inform and signpost visitors to reputable sources of educational information on EVs.

3.1 Planning a public chargepoint network

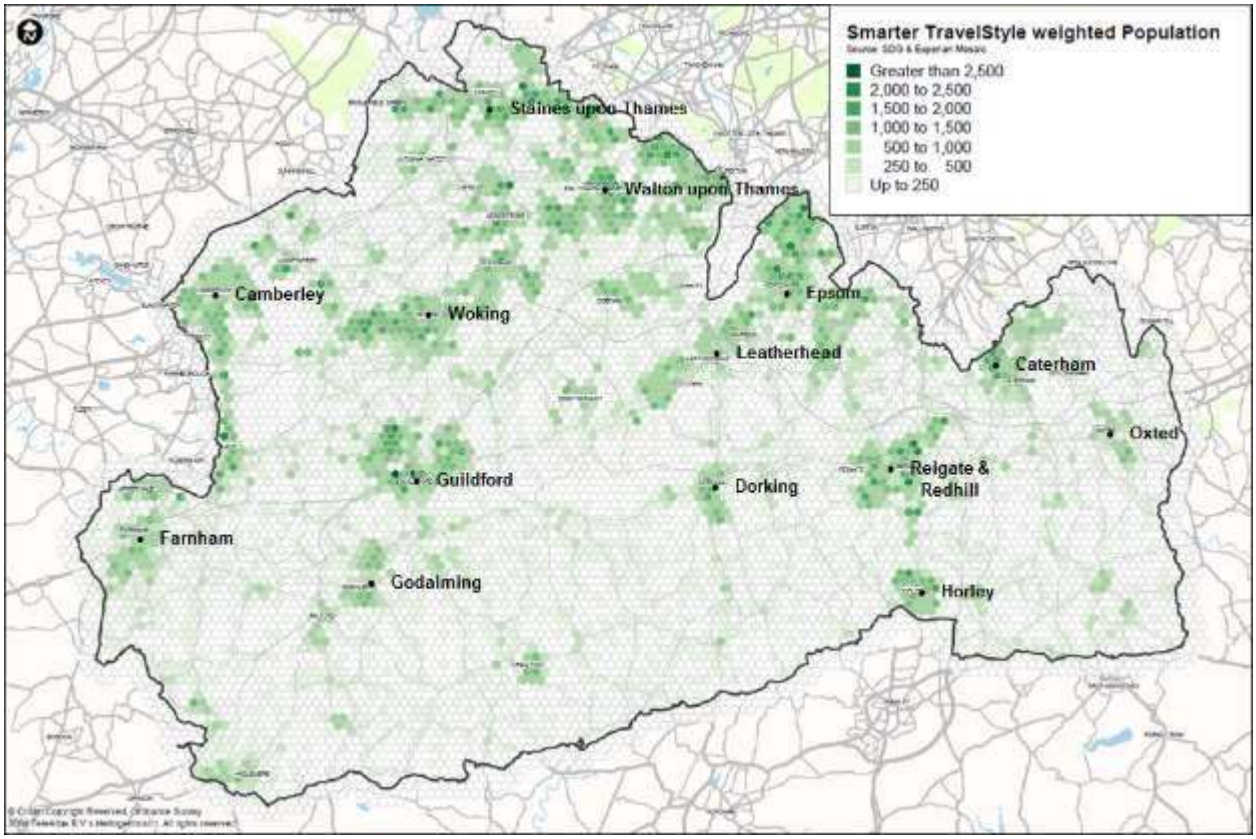


Figure 2: Areas of Surrey where population may be receptive to EV uptake[11]

Location

Analysis carried out in 2012 based on resident population, suggested that Surrey has the potential for a significant EV market. The analysis presented in *Figure 2*, highlighted areas where it was considered EV take up might be particularly popular.

The analysis used characteristics such as affluence of the population, levels of second car ownership and commuting distance as indicators of EV market potential. Other factors that we recognise that are likely to influence an increase in uptake in EVs include a high dependence on the private car for commuting and having off-street parking to allow overnight home charging. This may suggest that the areas highlighted above could be extended to include more suburban/rural fringe areas.

Since 2017, the council has logged enquiries from members of the public where they have expressed an interest in having an EV chargepoint located nearby, which has helped us build an initial picture of where there is demand. Beyond this, further data is required to ensure that chargepoints can be targeted in locations where it is needed.

[11] Source: Surrey Electric Vehicle Strategy Final Report. Steer Davies Gleave, June 2012.

Action:
Informed geographical planning of EV chargepoints

- We will develop an updated spatial plan to help inform the rollout of EV chargepoints across the county.

Charging speed and power supply

Information on the different speeds of chargepoints is given in Annex 1. It is anticipated that a fast chargepoint will eventually become a minimum standard for public chargepoints across the county, as increasing battery sizes in vehicles may mean that trickle chargepoints become less useful as battery sizes increase.

The ability to rollout charging infrastructure is ultimately dependent on the capacity of the local electricity network to support it. A 'thought piece' published by National Grid indicated that over one third of the country's low voltage electricity distribution network would need to be upgraded if EV uptake reached over 40% - simply to support a network of 3.5kW residential 'trickle chargepoints'[12]. National Grid instead considered how a model based on centralised rapid charging hubs, similar to the current 'filling station' model, might be better suited to meet the long term charging needs of the UK.

The council will need to consider the impact of any new charging infrastructure on the local electricity network which will involve liaison with the local Distribution Network Operators (DNO). These discussions will also help to inform the strategic spatial planning work described in the Action above.

Chargepoint installation, ownership and management

The Office for Low Emission Vehicles (OLEV) currently offers funding of up to 75% for the capital costs of procuring and installing on-street residential chargepoints; the remaining 25% cost must be funded independently. The OLEV funding does not cover ongoing maintenance, future removal or replacement costs.

The council currently has no funding allocated to fund chargepoint installations or associated ongoing costs and its current financial position makes it unlikely that a significant budget will become available to do so. Should we make provision for additional chargepoints, their funding and maintenance will need to be appropriately resourced, most likely with no cost to the county council.

The development of a model that allows the council to provide and maintain its new and existing chargepoints is therefore a key early requirement of our strategy.

At a basic level a chargepoint network requires:

- **An owner** – the party that owns the physical chargepoints.

[12] Our energy insights, Forecourt thoughts: Mass fast charging of electric vehicles. National Grid, 2017

- **A manager** – the party responsible for the day-to-day maintenance of chargepoints and handling issues raised by customers.
- **A network operator** – the party responsible for the 'back-office' (or software) system through which people use the chargepoints.

In some instances, external commercial suppliers will fund installation, management and network operation of chargepoints where they are likely to offer a good return on investment, and therefore generate sufficient income from user charges. This is more likely to be the case with rapid chargepoints, rather than trickle or fast chargepoints which are more typical in residential areas.

Table 2 outlines some of the different models available which could be considered for the rollout of a public EV charging network. Depending on the model pursued, the council must ensure that arrangements and funding are in place to cover maintenance and remedial action in the event of accidental damage or vandalism. Even where a chargepoint is provided and fully maintained by a private company, there may be a risk to the council if the company were to cease trading. Any installation will therefore require the council to have contingency arrangements in place to cover the removal or replacement of the chargepoint. For this reason, the council may only seek to provide public chargepoints where it has the opportunity to recoup these costs.

Chargepoints	Chargepoints Owner	Chargepoints Manager	Chargepoints Network operator	Considerations
A	Council	Council	Council	Requires a high level of investment and ongoing expertise. Would be difficult for the council to implement without grant funding but would offer the most flexibility.
B	Council	Council	Supplier	The council would purchase the chargepoints outright and maintain them at own cost. The network is run by a supplier with expertise that customers are familiar with using.
C	Council	Supplier	Supplier	The council would purchase the chargepoint from a supplier but employs them to manage the points. A single point of contact would provide a simplified process for users but less flexibility in types of chargepoints.

Chargepoints	Chargepoints	Chargepoints	Chargepoints	Considerations
	Owner	Manager	Network operator	
D	Supplier	Supplier	Supplier	Would require the council to lease land to a 3rd party for the chargepoint installation. Low of financial risk to the council but potential sites may be limited by the attractiveness of the location and types of chargepoints available.
E	Commercial provision			A public charging network supplied by commercial providers on private land. Zero financial risk to the council but provision may not match the public need.

Table 2: Different models of chargepoint networks

The consideration of most appropriate technologies and types of charging infrastructure will be considered as part of any site selection and feasibility work.

Action:
Funding the installation and maintenance of charging infrastructure

- We will work to develop a business model suitable to the council and other interested local authority partners for deploying and managing a charging network.

3.2 Residential charging

Useful information on purchasing and charging electric vehicles, including charging at home, can be found at: https://www.goultralow.com/

Planning of new developments

To enable EV uptake in residential areas with access to off-street parking, new homes should be planned with capacity to support EV charging. Responsibility for development planning is split between the county, district and borough councils.

In Surrey, the districts and borough councils are the local planning authorities, responsible for setting planning policy and enforcing regulations in relation to the development of new homes and commercial buildings. However, the district and borough councils work with the county council to understand and appropriately mitigate the impact of new developments on the local transport network. The county council therefore provides guidance to help the planning authorities apply consistent positive standards to transport development.

To enable a coordinated approach to the provision of EV charging infrastructure in new developments across the county, the council has produced planning guidance for use by the districts and boroughs when considering planning applications for new residential and commercial developments. For example, the guidance suggests that for developments of flats or apartments, 20% of available parking spaces should be fitted with a fast chargepoint with sufficient power supply made available for a further 20% of spaces to be fitted with additional fast chargepoints. It is expected that this guidance will be reviewed and updated as EV uptake progresses.

In situations where a new development results in a chargepoint on-street on a public road, it shall be a prerequisite that an agreement is in place between the developer and the council to cover the cost of operation, maintenance and eventual removal or replacement of the chargepoint over its lifetime.

Action:
'EV-friendly' planning policy

- The Vehicular and Cycle Parking Guidance will be maintained and reviewed periodically to ensure the guidance to planning authorities is kept up to date with the development of EV technologies and national policy.

Residential on-street charging
The council recognises that off-street home charging is not a possibility for everyone. Just over 41% of homes in the south east of England do not have access to off-street parking[13], meaning that home charging can provide only part of the solution. The council

[13] English Housing Survey, Table DA2202. Ministry for Housing Communities & Local Government, 2015.

will investigate what it can do to support its residents who wish to use an EV but lack off-street parking.

Many areas without off-street parking are typically urban areas with large amounts of Victorian terraced housing. These same streets may have heritage/conservation considerations and be sensitive to street clutter, making it more difficult to provide suitable positions for chargepoints due to accessibility and aesthetics.

Where possible the council will seek to satisfy local residential demand through chargepoints in off-street locations or through car clubs (see Chapter 4.1 on car clubs), rather than on-street charging bays in residential areas. Where this is insufficient and on-street provision appears to be the only viable option, this section outlines some of the key considerations for the council in developing an on-street charging policy:

Types of chargepoints
Details of different types of chargepoint are described in Annex 1. We expect trials of different chargepoint technologies currently being carried out elsewhere (e.g. in Oxfordshire and Hounslow) will demonstrate technologies' effectiveness in different situations.

There are certain circumstances in Surrey that must be taken into account when considering how appropriate a certain technology may be. For example, most street lights in Surrey are located at the back of the pavement, away from the kerb, making street light charging less suitable as we cannot allow charging cables to trail across the pavement when in use, as they would present a trip hazard. Locations where street lights are currently close to the kerb will be replaced under the current council street lighting contract as part of our policy to improve pedestrian accessibility. The conversion of a street light to a chargepoint is also not without cost and would likely result in increased costs of ongoing maintenance.

Parking
Typically, most on-street residential bays are orientated parallel to the kerb. The agreed position of a double-socketed chargepoint should ideally enable it to serve two parking bays.

A dedicated EV chargepoint would generally require a marked parking bay, reserving the space for charging EVs only. To create a dedicated EV bay on the road would require the council to advertise and implement a traffic regulation order (TRO), enabling it to be legally enforced. This could be met with objection from non-EV users in residential areas with high parking pressure and could create conflict if several residents in a neighbourhood compete for the same bay.

It may be necessary to place restricted dwell times on EV bays during certain periods of the day to discourage a single vehicle from using the space for extended periods and preventing other users from accessing the chargepoint. This is particularly the case in relation to fast and rapid chargepoints to ensure a regular turnover of vehicles. Penalties

for overstaying would be administered through the chargepoint payment software. We may wish to consider a system whereby users can make and advanced booking for a time slot.

An alternative approach is to not reserve and mark out bays that are served by chargepoints solely for the use of EVs. This approach has been taken by some local authorities when combined with a sufficient number of cheaper street light trickle chargepoints, however as noted previously, street light conversion is not a viable option for Surrey in most cases. The provision of faster and more expensive stand-alone chargepoints would typically require a marked bay to be economically viable.

The council carries out a review of parking provision in most districts and boroughs every 12-18 months and the introduction of new on-street charging bays could be considered and consulted on through this process. It is anticipated that demand for onstreet EV chargepoints in residential areas is likely to coincide with areas where there are parking controls, due to a shortage of off-street parking. Consultation questionnaires on new residential parking schemes may therefore also look to gauge demand for charging provision.

Positioning of chargepoints
It is likely that we would review requests on a case-by-case basis and only consider installing a chargepoint if a suitable position could be found locally. Requests for onstreet chargepoint provision would likely be considered as part of the wider parking review process.

Considerations are likely to include issues such as:

- Sufficient remaining pavement width to avoid adverse impact on pedestrian accessibility
- Accessibility of the location
- Sensitivity to local street scene
- Location of nearest power supply

Action:
Develop the council's on-street charging policy

- We will monitor and review the outcomes of trials on different charging units in other areas to determine their potential suitability for use on-street in Surrey.
- We will review parking management policy to give consideration to parking arrangements for EVs.
- We will produce guidelines for determining what constitutes a suitable position for an on-street chargepoint.

3.3 Charging on the move

EV battery technology is progressing towards a point where the limitations of local electricity supplies in residential areas may eventually make residential charging impractical as a long term solution for EV charging, particularly as EV ownership increases. Chargepoints in locations where EV users can access them either on the move or at their destination may provide a suitable alternative.

In addition, the ability to charge EVs en route is essential for enabling longer journeys and giving people the confidence to undertake their journey without the need for a lengthy period of charging. Rapid chargepoints are typically preferable for users wishing to charge on the move given the need for a shorter dwell time and are well suited to locations near motorways and major 'A' roads which are utilised for most longer journeys.

It is anticipated that the infrastructure to enable vehicles to charge or 'top up' while on the move will largely be addressed by the commercial sector based on the current model of roadside filling stations and converting these into roadside charging stations to cater for EVs. Some large forecourt operators have already taken steps towards installing rapid charging infrastructure on their sites[14]. However, where the council owns land which is located near to strategically important roads (e.g. motorways and major 'A' roads), these sites could be considered for the installation of rapid chargepoints (see Chapter 5.1 for further information on the use of council land).

Presently, residential and destination charging may offer EV users a more cost effective or convenient option given that, to charge on the move, users would need to set aside around 30 minutes during their journey for an 80% charge based on current rapid charging technology. Therefore, in the short term, it is reasonable to assume that 'charging on the move' will be less common amongst EV users than 'filling up on the move' is among conventional petrol and diesel vehicle users – particularly on the local road network. However, in the medium to long term, charging on the move is likely to become much more prevalent as battery sizes increase.

Action:
Strategic site assessment

- We will review strategically located council owned sites for potential installation of rapid chargepoints for public use.

[14] https://www.motorfuelgroup.com/mfg-announces-partnership-deal-with-chargepoint-services/

3.4 Destination charging

Destination charging is expected to play a key role in provision of charging both now, during the initial transition, and in the future as EV uptake and battery sizes increase. It will be one of the most convenient ways to charge for users and provision at key destinations will be essential. Some examples and their potential dwell times are listed below:

- Workplace car parks (long stay, 6+ hours)
- Railway stations (long stay, 6+ hours)
- Hospitals / NHS Trusts (short-long stay, 1-6+ hours)
- Out of town 'Park and Ride' car parks (short-long stay, 1-6+ hours)
- Town centre car parks (short/medium stay, 1-5 hours)
- Leisure centres (short stay, 1-3 hours)
- Countryside car parks (short stay, 1-3 hours)
- Supermarkets (short stay, 1-2 hours)

It is our ambition to work with landowners to identify suitable locations to contribute to both strategic and local provision. The council has limited ability to directly contribute towards destination charging provision, although we do own land near some town centre locations that could be considered for the installation of chargepoints where appropriate (also see Chapter 5.1 on council land).

By providing chargepoints on council land which can be accessed by the general public, the council may be able to ease barriers to EV uptake in specific parts of the county hampered by a lack of existing chargepoint infrastructure. This may be achieved by providing a number of fast or rapid chargepoints on council land located near key destinations. Realistically, any infrastructure would need to be provided at no financial risk to the county council given current budget constraints, with maintenance and installation costs would be covered by the supplier.

Additionally, as the highways authority, there may be opportunities for the council to provide on-street chargepoints in popular town centre locations. However, this will depend on the development of a policy regarding approval of chargepoints on-street. We are aware there are a number of models for users when accessing chargepoints and paying for usage. Wherever possible we would encourage a consistent user experience that allows universal access (i.e. no mandatory membership).

Action:
Supporting a town centre charging network

- We will work with boroughs, districts and other third parties to provide a network of chargepoints in town centre locations and key destinations.

Action:
On-street chargepoint trials

- We will consider possible locations for a trial of on-street chargepoints at key destinations where parking pressures permit and where characteristics of the area suggest charging to be feasible.

4. Transport services and electric bikes

The use of electric motors extends beyond the private car and is continuing to develop for other modes of transport. As a local transport authority, the council has involvement in a number of transport services that are used by residents and visitors. This chapter explores what the council can do to encourage the uptake of EVs in these other areas.

4.1 Electric bikes

The growth in use of electric bikes within Surrey is viewed positively by the council and aligns with a number of objectives within the Surrey Transport Plan, including both the Low Emissions Transport Strategy and Cycle Strategy, to encourage modal shift from private car to sustainable modes and make cycling more accessible as a general mode. Electric bikes are propelled primarily via pedalling, similar to a traditional bike, however the electric motor provides power assistance (up to 15mph) to make it easier for the user to pedal. By making cycling easier and enabling groups of people with different fitness and ability levels to cycle together, the technology has the potential to make cycling more accessible and attractive to wider range of users.

Electric bike batteries are typically charged using a charger and standard domestic plug, meaning they can be charged at home by most users. However electric bikes do not have a ‘range’ in the same respect as electric cars, as the user can continue to ride using pedal power alone when the battery is empty. Depending on the terrain, level of power assistance and the model of bike/battery most electric bikes will provide power assistance for at least 25 miles – suitable for the majority of regular trips.

In terms of barriers to use, for the reasons outlined above public charging infrastructure is not a requirement of electric bikes although destination charging facilities may serve to further encourage their uptake. Electric bikes are usually more expensive than a standard bike, meaning that the purchase cost might be prohibitive to some. There are also general issues around road safety or perceptions of personal risk surrounding the use of electric bikes which are the same as for those using a standard bike.

Action:
Encouraging the use of electric bikes

- We will implement the Cycling Strategy including ongoing development of cycling routes via the Local Transport Strategies
- We will continue to encourage employers to offer a Cycle to Work salary sacrifice scheme (covering all bikes) to reduce the overall purchase cost and make payment more manageable for potential users.
- We will promote electric bike hire as a ‘Thing to do’ in Surrey via our online platforms with links to hire locations.

4.2 Car clubs

Residents who have an interest in using EVs but don't have the means or inclination to purchase one may only become able to access an EV through a car club.

The car club in Surrey currently operates over twenty vehicles located within six towns across the county and has plans to expand further over the next few years to reach over 1,000 members. Around 25% of existing car club provision is electric including EVs in Guildford and Woking which have proven to be some of the most popular vehicles in the fleet, partly due to their ease of use and low hire cost.

The provision of parking bays for car club use also helps overcome potential objections from non-EV users to the creation of EV only bays. As described in Chapters 1.4 and 3.2, dedicated EV bays can have the result that some parking is effectively reserved for a particular individuals who own an EV, whereas the provision of car club EV parking bays have the benefit that they are available for use by the entire community. The provision of car club vehicles also has potential to reduce parking pressure as some residents can use this as an alternative to private vehicle ownership.

By providing an on-street car club EV bay alongside a chargepoint with two sockets, it becomes possible to create a second adjacent bay for residents with privately owned EVs to use for charging.

Another challenge outlined throughout Chapter 3 is the initial cost of installing a chargepoint, ongoing maintenance and the future risk to the council of needing to fund the removal of the chargepoint if it becomes damaged, obsolete or the chargepoint supplier were to fold. A car club EV chargepoint may provide an opportunity for these risks to be covered within the council's contract with the car club operator if terms feasible for this were agreed (i.e. suitable length of contract). Additionally, the creation of new car club bays can be financed via agreements linked to new developments, through which funding could be set aside to cover future removal of the chargepoint if necessary.

As is the case with regular EV chargepoints, any prospective sites must be assessed against suitability criteria. In addition to this, the site must also be deemed suitable for a car club. More detail will be available in upcoming car club guidance.

Action:
Enable EV use through Surrey's car club

- We will work with the county's car club operator to expand its network of EV provision with a view to making 50% of available vehicles electric by 2025.

4.3 Taxis

Taxis are licensed by district and borough councils. However, by working in partnership, the county council hopes that it can encourage ways in which licensing can move towards more clearly defined licensing standards based on emissions, to encourage a cleaner fleet of taxis to operate on Surrey's roads.

A sub-group of the Surrey Air Alliance (SAA) has recommended that local authorities adopt a Surrey-wide approach to taxi licencing. Existing licensing conditions were looked at, to try and identify a standard that would encourage cleaner vehicles in taxi fleets.

For example, local authorities could choose to include a provision in licensing terms which would require vehicles to be of a cleaner emissions standard by a given deadline; this is similar to the conditions imposed by Woking Borough Council. They could also set an age limit for taxi vehicles, indeed Epsom and Ewell Borough Council have set a limit that vehicles should be no older than 6 years. Through the same approach, borough and district councils could also look to incentivise the use of EVs by taxi operators.

The decision to alter taxi licensing conditions rests with the individual local authorities and is not a function of the county council, but we will endeavour to make ultra-low emission vehicles a focus of our future partnership working with licensing authorities. The council also recognises that we can play a role in enabling chargepoints at key locations to support EV take up within taxi fleets.

Action:
Encourage EV uptake by taxi operators

- We will continue to work with district and borough partners where appropriate through the Surrey Air Alliance to support consistent licensing standards for taxis across the county.
- To support this work we will work in partnership with taxi firms and other stakeholders and review evidence from existing electric taxi schemes to identify key locations where the most advantageous chargepoints can be installed to facilitate the usage of EVs by taxi operators.

4.4 Buses

Bus operators in Surrey periodically upgrade their fleets to ensure they are attractive to existing and potential users and remain economic to operate and maintain. This provides an opportunity where fleets can be considered for replacement with a cleaner and less noisy alternative, such as EV.

Certain factors influence whether a service can feasibly be considered for an electric bus, including:

- Charging facilities at bus stations and depots
- Length and topography of the route
- Commercial viability of the route
- Available funding sources for fleet renewal
- Purchase cost and operating cost

Where electric buses are feasible they will enable the council to improve local air quality by reducing the size of the diesel fleet and their associated exhaust emissions. They are also expected to make bus usage a more attractive option for both existing and prospective users by providing a high quality and more pleasant on-board experience.

To date, we have endeavoured to work with bus operators to identify opportunities for electric buses to operate along Surrey routes. In August 2017, the council and Stagecoach were successful in a bid of £1.74m to the Department for Transport (DfT) to provide nine electric buses on the park and ride service in Guildford for introduction in 2018. The award had the additional benefit of boosting the local economy as the fleet is built by a local company, Alexander Dennis[15].

A marketplace producing large numbers of affordable electric buses is yet to fully emerge, however the example in Guildford demonstrates that opportunities can be found. We will continue to review technological advancements in partnership with bus operators, government and industry to develop a vision for a clean bus fleet that is commercially feasible and sustainable.

The council does not presently have capital funding available to plan or install further electric bus infrastructure and budget pressures have required us to review instances where revenue funding is used to subsidise routes that are not commercially viable. External funding is therefore critical to enable the council to continue to expand a low emission bus fleet, meaning that we must continue to proactively pursue existing opportunities for grant funding from the public and private sector, whilst also pushing for further opportunities to be made available.

[15] https://news.surreycc.gov.uk/2017/08/29/surrey-wins-1-5million-to-bring-electric-buses-to-guildfordpark-and-ride/

An objective of the Local Bus Strategy[16] is to maintain a sustainable network of financially-supported bus services, a key aspect of which surrounds making bus travel more appealing to increase patronage and therefore make services self-sustaining. One of the ways that the council seeks to increase patronage is through a programme of improvements to bus infrastructure through external funding sources (e.g. through Local Enterprise Partnerships (LEPs)). By increasing the number of people travelling by bus the capacity to invest in electric bus fleets also grows, contributing towards joint aims of reducing congestion, reducing emissions and further boosting patronage.

Action:
Bus route assessments

- We will identify routes which might be suitable for operation with electric bus fleets.

Action:
Clean bus fleet funding

- We will continue to work with bus operators to pursue funding to expand the electric bus fleet maximising opportunities through LEP bids.

[16] Surrey Transport Plan: Passenger Transport Strategy, Part 1 – Local Bus. SCC, July 2014.

4.5 Community transport

We also recognise that there are some Surrey residents who are unable to use or do not have access to the local bus network. We are committed to assisting organisations (such as community transport operators and voluntary car schemes) that provide transport services to these individuals in the electrification of their fleets.
Currently, opportunities for funding suitable EVs for community transport use are limited, and there is a scarce range of vehicles available on the market that can be used for this purpose. However, it is expected that the range of vehicles that are available on the market will increase in the next few years.

Action:
Lobby central government for funding

- We will lobby DfT for funding to support EV solutions and support innovation in the community and third sector.

5. Surrey County Council's assets: leading by example

As a major employer and purchaser of services, this chapter explores the steps that the council can take to help support a transition EVs amongst its staff and supplier base.

5.1 Surrey County Council land

Beyond public highway infrastructure, the council is a major landowner across the county including schools and libraries with surrounding land, office buildings with car parks and a limited number of private roads. Some of this land could potentially become suitable sites for the provision of EV charging infrastructure for use by staff, visitors or for wider public use (also see Chapter 3.1 on destination charging).

The rollout of an EV council fleet (Chapter 5.2) will require the availability of chargepoints near to where vehicles are stored. Depending on the trend and pace of new charging station developments, this demand may be met by the commercial sector, however an alternative option may be to install points at council offices and depots. The council could consider making these chargepoints dedicated to council vehicles only to ensure spare capacity, however, given that the council fleet will be mainly charged overnight we could potentially consider making these bays available for staff use during normal working hours.

While recognising that there may be good opportunities to provide chargepoints on council land, there are also considerable challenges. These include the need for an ongoing maintenance budget to ensure the points are in a safe and usable condition. Currently there is no long-term budget identified to manage both new and existing chargepoints and it is therefore important to identify a solution to this problem.

Action:
Funding the installation and maintenance of charging infrastructure

- We will work to identify and secure suitable funding to maintain new and existing charging infrastructure on council land and public highway.

Action:
Providing further infrastructure on council land

- We will continue to work to identify council property suitable for installing a small number of off-street chargepoints at minimal financial risk to the council.

5.2 Surrey County Council vehicles

The council is behind other councils in the south east in terms of using EVs for our dayto-day activities. The council fleet is made up of vehicles that are either leased or owned outright. Fleet turnover for owned vehicles is likely to be slower than those that are leased so as to ensure value for money is achieved over their lifespan.

The current fleet includes a range of vehicles intended to serve varying purposes, meaning that some vehicles would be more suited to switching from conventional fuels to electric than others. Given the current average range limitations of EV batteries, council vehicles which currently travel less than 100 miles per day would have the best potential to switch to electric.

Much of the council's fleet is stored overnight on county-owned premises and therefore any attempts to electrify these vehicles may necessitate the availability of charging infrastructure on council land (See Chapter 5.1).

Ultra-low emission vehicles, including EVs, shall be made a key criterion in the decision making process as the council begins the process of replacing its current fleet of vehicles from 2020 onwards. This will be undertaken as part of the council's procurement process where vehicles become due for renewal, EVs will be included on the list of potential replacement vehicles during the assessment procedure where they are viable, the infrastructure is available to support them and they offer value for money as part of public budgets. There may also be earlier opportunities for an EV transition where staff vehicles are hired on short or long term contracts.

Beyond simply managing the council's own fleet, there may be opportunities to influence external organisations to switch their fleet to EVs. The council employs a number of external contractors and agencies to carry out work on its behalf and the council's purchasing power is strengthened by its partnership agreements with other local authorities.

Action:
Encourage EV adoption when fleet vehicles are refreshed

- We will review the process by which fleet vehicles are replaced to ensure that ultra-low emission vehicles are considered as a preference wherever feasible.

Action:
Encourage EV uptake amongst the council's partners

- We will revise our tendering specifications to make EV fleets a desirable characteristic of a potential supplier, where appropriate, when deciding to award a contract.

Action:
Lobby central government for funding

- We will lobby DfT for funding to support EV solutions and support innovation among local authority fleets.

6. Next steps

This document represents the first iteration of the council's Electric Vehicles Strategy. The strategies that make up the Surrey Transport Plan are periodically updated to ensure they remain fit for purpose.

Given that EV technology is still in its emergence, it is envisaged that this strategy will be revisited in approximately 18 months' time to keep it up to date with the latest developments and review progress against the actions outlined.

6.1 Table of actions

Table 3 summarises the actions acknowledged within the documents and sets out timescales against which we expect them to be undertaken. The first column of the table refers to the chapter where each action can be found within the document.

Table 3

	Policy and measure	Lead team	When	Objectives
3	Information provision on EV technology • We will continue to use our existing online platform to inform and signpost visitors to reputable sources of educational information on EVs.	SCC Transport Policy	Ongoing	a, g
3.1	Informed geographical planning of EV chargepoints • We will develop an updated spatial plan to help inform the rollout of EV chargepoints across the county.	SCC Transport Policy	2019	a, c
3.2	'EV-friendly' planning policy • The Vehicular and Cycle Parking Guidance will be maintained and reviewed periodically to ensure the guidance to planning authorities is kept up to date with the development of EV technologies and national policy.	SCC Transport Development Planning	Ongoing	a, c

	Policy and measure	Lead team	When	Objectives
3.1, 5.1	Funding the installation and maintenance of charging infrastructure • We will work to develop a business model suitable to the council and other interested local authority partners for deploying and managing a charging network. • We will work to identify and secure suitable funding to maintain new and existing charging infrastructure on council land and public highway.	SCC Transport Policy, Procurement Services, Highways, Property Services	2019	a, c, d, e
3.2	Develop the council's on-street charging policy • We will monitor and review the outcomes of trials on different charging units in other areas to determine their potential suitability for use on-street in Surrey. • We will review parking management policy to give consideration to parking arrangements for EVs. • We will produce guidelines for determining what constitutes a suitable position for an on-street chargepoint.	SCC Transport Policy, Highways, Parking	2018	a, b, c, f
3.3	Strategic site assessment • We will review strategically located council owned sites for potential installation of rapid chargepoints for public use.	SCC Property Services	2019	a, b

	Policy and measure	Lead team	When	Objectives
3.4	Supporting a town centre charging network • We will work with boroughs, districts and other third parties to provide a network of chargepoints in town centre locations and key destinations.	SCC Highways, Transport Policy and Property	Ongoing	a, b
3.4	On-street chargepoint trials • We will consider possible locations for a trial of on-street chargepoints at key destinations where parking pressures permit and where characteristics of the area suggest charging to be feasible.	SCC Highways	Ongoing	a, b, f
4.1	Encouraging the use of electric bikes • We will implement the Cycling Strategy including ongoing development of cycling routes via the Local Transport Strategies • We will continue to encourage employers to offer a Cycle to Work salary sacrifice scheme (covering all bikes) to reduce the overall purchase cost and make payment more manageable for potential users. • We will promote electric bike hire as a 'Thing to do' in Surrey via our online platforms with links to hire locations.	SCC Transport Policy	Ongoing	a, f, g

	Policy and measure	Lead team	When	Objectives
4.2	Enable EV use through Surrey's car club • We will work with the county's car club operator to expand its network of EV provision with a view to making 50% of available vehicles electric by 2025.	SCC Transport Development Planning	2021	a, g
4.3	Encourage EV uptake by taxi operators • We will continue to work with district and borough partners where appropriate through the Surrey Air Alliance to support consistent licensing standards for taxis across the county. • To support this work we will work in partnership to identify key locations where chargepoints can be installed to facilitate the usage of EVs by taxi operators.	Local authorities	Ongoing	a, c
4.4	Bus route assessments • We will identify routes which might be suitable for operation with electric bus fleets.	SCC Passenger Transport Projects	2020	f, g
4.5	Clean bus fleet funding • We will continue to work with bus operators to pursue funding to expand the electric bus fleet maximising opportunities through LEP bids.	SCC Passenger Transport Projects, Transport Policy	Ongoing	d, e, f

	Policy and measure	Lead team	When	Objectives
4.5, 5.2	Lobby central government for funding • We will lobby DfT for funding to support EV solutions and support innovation in the community and third sector. • We will lobby DfT for funding to support EV solutions and support innovation among local authority fleets.	SCC Passenger Transport Projects	2018	e
5.1	Providing further infrastructure on council land • We will continue to work to identify council property suitable for installing a small number of off-street chargepoints at minimal financial risk to the council.	SCC Property Services, Procurement Services	Ongoing	a, b, g
5.2	Encourage EV adoption when fleet vehicles are refreshed • We will review the process by which fleet vehicles are replaced to ensure that ultra-low emission vehicles are considered as a preference wherever feasible.	SCC Fleet Managers, Procurement Services	2021	e, g
5.2	Encourage EV uptake amongst council partners • We will revise our tendering specifications to make EV fleets a desirable characteristic of a potential supplier, where appropriate, when deciding to award a contract.	SCC Procurement Services	2020	g

Table 3: Policies and actions of the Surrey Electric Vehicle Strategy

Annex 1. Technical Information

This annex provides technical information on electric vehicles and chargepoints. Information on other types of ultra-low emission vehicles can be found via OLEV.

Types of Plug-in Electric Vehicle

There are three main types of electric vehicle listed below which can be powered solely via the battery and charged by plugging the vehicle into a power supply:

1. **Battery Electric Vehicle (BEV)**: Also known as a ‘full’ or ‘pure’ EV, the vehicle uses batteries to store energy that powers a motor. The batteries are charged by plugging the vehicle into an electrical power source, and BEVs can also be charged by regenerative braking, i.e. storing the kinetic energy created by slowing down the vehicle.
2. **Extended-Range Electric Vehicle (E-REV)**: Powered by batteries, but also fitted with a small petrol/diesel generator that can help extend the range of the vehicle by topping up the batteries while driving.
3. **Plug-in Hybrid Electric Vehicle (PHEV)**: Powered both by electric and a conventional diesel/petrol engine. The diesel/petrol engine provides power when the battery is depleted. The battery can also recharge from the engine and via regenerative braking.

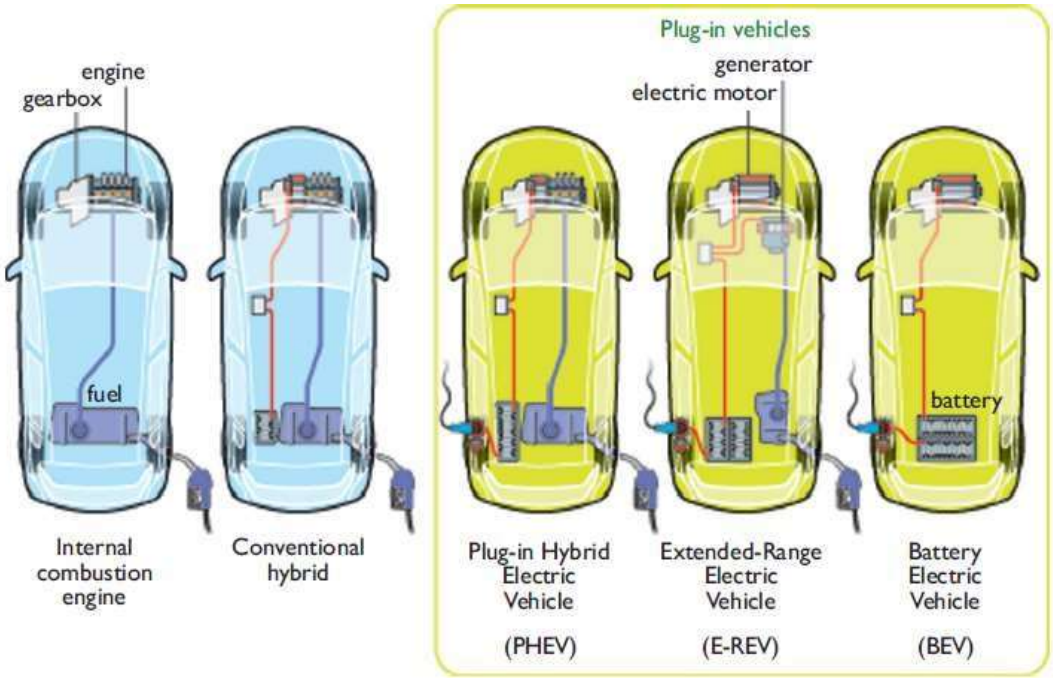


Figure 3: Plug-in electric vehicle types[17]

[17] Source: Making the Connection, The Plug-In Vehicle Infrastructure Strategy. OLEV, 2011.

Chargepoint types

This chapter outlines some of the different types of EV chargepoint units that are available along with associated considerations. Please note that this is not an exhaustive list and we recognise that a number of innovative or bespoke solutions may be available where these types of unit are inappropriate for certain locations.

Figure 4: A domestic wall mounted chargepoint, a floor mounted chargepoint and rapid chargepoint[18]

Trickle (slow) charging (AC charging: 3kW)

Trickle chargepoints can take upwards of 6-10 hours to fully charge a vehicle, depending on the EV. Trickle chargepoints are therefore often found in locations where vehicles can be left to dwell for a long period such as in residential areas and on domestic premises for home charging, and occasionally at workplace locations.

There are a number of trickle charging units available including: domestic power sockets, wall mounted units, floor mounted units and units than can be incorporated into street lights.

Key Considerations:

- Trickle chargepoints only require a small single phase electricity supply and are relatively cheap to install.
- The long dwell time required to use trickle chargepoints make them potentially unsuitable to for areas where there are timed parking restrictions.

[18] Source: Getty images

- Wall mounted charging units are unlikely to be suitable in on-street locations.
- Street light charging units usually need to be positioned at the front of the pavement to avoid creating a trip hazard from cables trailing between the chargepoint and EV. Most street lights in Surrey are located at the rear of the pavement to reduce clutter.
- Trickle chargepoints may be inappropriate for users seeking to fully recharge an EV with a larger battery capacity although may prove useful for 'topping up'.

Fast charging (AC charging: 7-22kW)

A 7kW chargepoint can fully recharge some EV models in 3-4 hours.

Fast chargepoints can currently be found in various locations in the UK, including car parks and residential areas. These chargepoints are suitable for 'topping up' or fully charging vehicles where users have sufficient dwell time to spare.
Fast chargepoints are available in the form of wall mounted and floor mounted units.

Key Considerations:

- OLEV grant funding currently available to help fund residential installation.
- For those looking to recharge whilst making long distance journeys, fast chargepoints may be less useful for users due to the need for a long dwell time.
- Wall mounted charging units are unlikely to be suitable in on-street locations.
- A single phase power supply can be sufficient to provide a 7kW fast chargepoint, whilst the availability of a 3-phase power supply is needed for 11kW and 22kW fast chargepoints.
- The speed at which a fast chargepoint can recharge a vehicle is limited by the vehicle's on-board charging unit which converts line current from AC to DC for storage in the vehicle battery. For example, a vehicle with a 3.3kW on board charger using a 7kW fast chargepoint will only be able to draw a maximum of 3.3kW per hour).

Rapid charging (AC and DC charging: 43kW+)

A 50kW chargepoint will provide an 80% charge for most EVs in approximately 30mins.

Typically in the UK, although not exclusively, rapid chargepoints are located near busy 'A' roads or motorways and trunk roads (i.e. the Strategic Route Network). These chargepoints enable longer journeys and make EVs an option for users that are unable to charge at home.
Rapid chargepoints usually consist of large floor mounted units with an associated feeder pillar or cabinet.

Key Considerations:

- Rapid chargepoints have a high power demand and can only be considered in locations where there is significant spare capacity available on the local electricity distribution network.
- Rapid chargepoints are usually significantly more costly to install than fast chargepoints, and therefore potential locations are often only viable if they are expected to guarantee a high number of users each day.
- Rapid chargepoints are not fully compatible with all types of plug-in EV. Most PHEVs are either incapable of charging using rapid chargepoints or are restricted at the rate they can draw power from one.
- The charging time for an EV using a DC rapid chargepoint is not limited by the size of the vehicle's on-board charger.
- Requires a significant amount of space due to size of the unit and feeder pillar.
- Installation typically requires planning permission.

Inductive charging

In the long term, it is possible that induction charging technology within the carriageway may offer an alternative to roadside charging stations in the future. However, this technology is currently in its early developmental stage and for the majority of research and trials to date have been conducted on the Strategic Route Network rather than local roads: one such example is a Highways England study on wireless power transfer[19] We will continue to monitor any developments and trials of the technology.

[19] Feasibility study - powering electric vehicles on England's major roads. Highways England, 2015

Chargepoint connectors

The latest chargepoints in the UK all now use the latest 'Type 2' universal socket, however earlier chargepoints sometime used different types which are now being phased out[20]. Table 4 displays the different types of EV chargepoint connections. The type of chargepoint often determines whether a cable is permanently tethered to the unit. Portable charging cables with different connectors are available for use on untethered chargepoints, enabling EVs that have a particular socket to use chargepoints with a different type.

Slow / trickle chargepoints

3-Pin (3kW AC)

Type 1 (3kW AC)

Type 2 (3kW AC)

Commando (3kW AC)

Slow public chargepoints are typcially not equipped with tethered cables, meaning that any EV can use the chargepoint if they carry the correct cable. The 3-Pin variant shown above is usually only associated with domestic home charging.

Fast chargepoints

Type 1 (7kW AC)

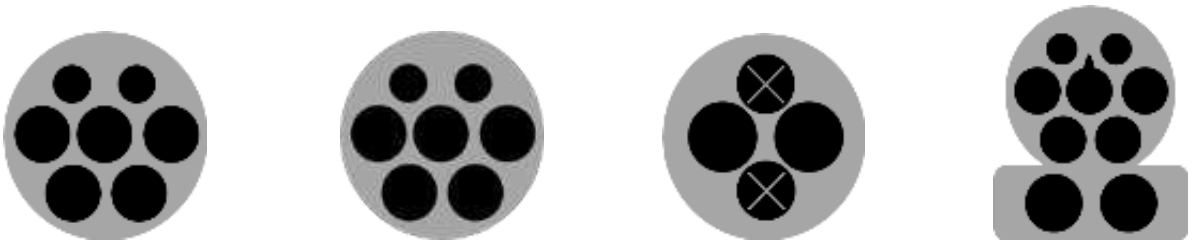
Type 2 (7-22kW AC)

Commando (7-22kW AC)

Fast public chargepoints are typcially not equipped with tethered cables, meaning that any EV can use the chargepoint if they carry the correct cable.

[20] Charging Electric Vehicles at Home and on the Road (goultralow.com)

Rapid chargepoints



Type 2 (43kW AC) CHAdeMO (50kW DC) CCS (50kW DC) Tesla Type – 2 (120kW DC)

Rapid public chargepoints have tethered cables, meaning that EV owners can only use the chargepoint if their EV is compatible with the associated cable connector. However, many rapid chargepoints are equipped with more than one cable and connector type to cater for different EVs.

Annex 2. List of relevant policies and guidance / references

Surrey County Council

Document	Details
Surrey Transport Plan (LTP3)	Provides county transport policy direction, with the aim to provide for effective, safe, reliable, sustainable transport.
Climate Change Strategy (2011)	To be superseded by combined AQ/CC strategy (2018)
Air Quality Strategy (2011)	To be superseded by combined AQ/CC strategy (2018)
Low Emissions Transport Strategy (Draft)	To be published in 2018 with input from borough and district councils, combining and replacing the Air Quality and Climate Change strategies.
Local Transport Strategies and Forward Programmes (2014 / 2018)	Support provision for the uptake of Electric Vehicles in each district and borough in Surrey; updates ongoing.
Vehicle and Cycle Parking Guidance (January 2018)	Provides guidance on EV standards to developers of new housing in Surrey

UK Government

Document	Details
The Road to Zero (Department for Transport, July 2018)	UK Government strategy to delivering zero emissions transport
Automated and Electric Vehicles Bill 2017-19, (Part 2)	Bill to make provision regarding automated vehicles and electric vehicles.
Making the Connection, the Plug-In Vehicle Infrastructure Strategy (OLEV, June 2011)	The UK Government policy paper to develop a vision and remove barriers to EV uptake.