Fife Council Electric Vehicle Strategy

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Contents

1. Introduction

Globally, we are facing a climate emergency, and the UK is committed to reducing Greenhouse Gas emissions to net zero by 2050 in response to recommendations from the Committee on Climate Change. COP26 hosted in Glasgow during November 2021 brought the challenge into sharp focus with the science underpinning projections of future impacts becoming ever starker and pressing.

In 2020, the Scottish Government pledged, along with the rest of the UK, to phase out new petrol and diesel cars and vans by 2030. In the context of a global climate emergency, this commitment to transition to Electric Vehicles (EVs) places EVs central to the strategy to tackle climate change in Scotland, with outcomes as a result of this transition having a positive impact on noise pollution, air quality and health, in addition to a reduction in greenhouse gas emissions.

In support of the EV transition, the public sector in Scotland has led the provision of charging infrastructure. Since 2013, Transport Scotland have invested in a national base network of charge points named ChargePlace Scotland, with the aim of making EV ownership accessible for all. In January 2022, the Scottish Government published its draft vision for Scotland's Public Electric Vehicle Charging Network, with planned launch of a new £60 million fund for Local Authorities over four years but with the anticipation that half of the funding will be from the private sector.

Fife Council is committed to reducing carbon emissions and improving air quality in alignment with the Scottish and UK Government's plans to phase-out the sale of new petrol and diesel cars and vans. Fife Council's 'Climate Fife: Sustainable Energy and Climate Action Plan (2020-2030)', sets out the Council's vision and ambitions to achieve net zero carbon emissions by 2045. The plan contains a wide range of actions and initiatives to achieve this ambition. A key part of the plan involves a focus on the decarbonisation of the Council's vehicle fleet and increasing the uptake of Electric Vehicles (EVs). To support the plan, the Council has commissioned the development of this EV Study, with a focus on future charging infrastructure and decarbonising the Council's fleet of vehicles. This is also reflected in the Local Transport Strategy for Fife 2023-2033, specifically Objective 10: Provide leadership in working with others to reduce Fife's transport emissions by 56% by 2030, compared to a 1990 baseline.

In many ways the transition to EVs will be influenced by factors outside the control of Fife Council and partners, and in some cases the UK Government. Overcoming multifaceted challenges regarding the global supply of batteries and vehicles, and the interlinked issue of EVs being comparatively more expensive than Internal Combustion Engines, will require a cross-sector effort by both public and private sector organisations. Fife Council can however take strategic actions to ensure the local environment is fit for the EV future alongside wider cross sector working.

This report has been developed in a systematic manner, with a series of distinct, but related, stages as shown in Table 1.1.

Table 1.1. Key stages of the study

Stage	Description
Strategy and Policy Review	Review of both national and local policy document on the reduction carbon emissions generally and the transition from petrol vehicles specifically and how this relates to Fife.
Technology Review	A review of the current and future technology trends around electric vehicles, electric car batteries and charging infrastructure and how this will impact the strategy.
Baseline Analysis	Review of existing EV charging infrastructure and demand within Fife and future potential sites suitable for installing charging infrastructure.
Delivering an Accessible and Equitable Network	Discussion around the importance of accessibility and the need for a *Just Transition* into electric vehicle usage within Fife EV strategy.
Stakeholder Engagement	Details and outputs from stakeholder workshops conducted as part of Fife's EV Strategy.
Geospatial Model	The outputs from the baseline evidence were used to help identify suitable sites and assess them in the model.
Strategy and Recommendations	A table highlighting the different elements of the EV strategy for Fife and whether they should be considered short, medium, or long-term.
Site Assessment	Identifies the most suitable sites through the outputs of the Geospatial model, qualitative assessments (e.g. security of each location) and connection costs to power network.
Commercial Approach	An overview of the potential approaches to commercial investment in Fife EV infrastructure and their level of appropriateness.

2. Strategy and Policy Review

There are many policies and strategies at a UK, Scotland, regional and local level that are creating an increasingly supportive framework for the transition to EV as outlined in the following sections. This is a rapidly developing area, with policies and regulations continually changing to meet the climate change challenge. Selected key examples are summarised in this section, setting out the policy and legislative foundation for this study. Although Scotland has a devolved Government, the UK has taken a consistent approach to climate change and therefore the policies referred to below will affect Scotland and Fife.

2.1 Recent UK and International EV Developments

The section outlines the latest international and UK developments in the field of climate change, carbon reduction and transportation, which will ultimately impact Scotland and Fife. The prevailing strategy of the UK government up to November 2020 regarding emissions was to commit to reducing greenhouse gas emissions by at least 80% of 1990 levels by 2050 through the Climate Change Act 2008[1]. It is now net-zero by 2050, and the 6th carbon budget requires a 78% reduction by 2035. The inclusion of shipping and aviation will also mean a focus on domestic emissions such as transport. The UK's transport sector has made the least contribution to a reduction in emissions to date (~5%), making it a prime target for future regulation.

The European Union's Directive for Alternative Fuels Infrastructure requires Governments to adopt national policy frameworks for infrastructure roll-out. The UK Government has also committed to achieving these goals as a minimum following its departure from the EU. Grams of CO2 per km driven is the primary measure used by the EU to enforce improvements in new car and van fleet emissions. EU regulations enable fines on vehicle manufacturers based on their average new car sales emissions.

In 2020, the maximum CO2 emissions from new car and van sales was 95g and 147g CO2/km respectively. From 2021 these targets have been converted to the worldwide harmonised light vehicle test procedure CO2 emissions targets following the change in the vehicle CO2 test procedure. The 2021 actual emissions will represent the new baseline. Manufacturers will then have to meet a 15% reduction for cars and vans by 2025, and a 37.5% reduction for cars and a 31% reduction for vans by 2030, both against this 2021 baseline.

The UK Government's ultimate vision is that every new car and van sold in the UK will be either PHEV (Plug-In Hybrid) or BEV (Battery Electric Vehicle) by 2030, and all new cars and vans will be fully zero emission at the tailpipe from 2035. For Heavy Goods Vehicles (HGVs) all new medium sized trucks up to and including 26 tonnes will be zero emissions from 2035, with the heaviest, above 26 tonnes by 2040. The UK's current objectives are set out in "Decarbonising Transport – A Better Greener Britain"[2].

To this end, the UK's Committee on Climate Change targeted the Ultra-Low Emission Vehicle (ULEV) market to reach 9% share of new vehicle sales by 2020 and 60% by 2030. The UK did indeed exceed its 2020 target, with Battery Electric Vehicles (BEVs) and Plug-In Hybrid Electric Vehicles (PHEVs) totalling 10.7% market share in December 2020[3].

For the first time, Ministers, and representatives from some of the world's largest and most progressive car markets have come together to form a new Zero Emission Vehicle Transition Council. Hosted by the COP26 President, Alok Sharma, the Council met to discuss how to accelerate the pace of the global transition to zero emission vehicles. These Ministers and representatives have agreed to collectively address some of the

[1] https://www.legislation.gov.uk/ukpga/2008/27/contents
[2] Decarbonising Transport – A Better, Greener Britain (publishing.service.gov.uk)
[3] UK New Car Registrations (SMMT): December 2020: The Future Is Clearly Electric! - Ezoomed

key challenges in the transition to EVs, enabling the transition to be faster, cheaper, and easier for all. The Council was made up of Ministers and representatives from California, Canada, Denmark, European Commission, France, India, Italy, Japan, Mexico, Netherlands, Norway, Spain, South Korea and Sweden, and the United Kingdom.

Following the Council meeting, a joint statement was released stating that road emissions currently account for over 10% of global greenhouse gas emissions, and emissions are continuing to rise. Therefore, the rapid transition to zero emissions vehicles is vital to meeting the goals of the climate Paris Agreement. The globe is currently not on track and consequently the pace of the transition needs to dramatically increase. A fleet of fully zero emission road vehicles will remove the source of 91% of today's domestic transport GHG emissions[4]. Furthermore, this transition will generate job and growth opportunities, improve air quality, improve public health, boost energy security, and assist in balancing electricity grids during the transition to clean power.

The joint statement stressed the importance of the roles of cities and regions in helping to determine the pace of the global transitions to zero emissions vehicles. The Zero Emissions Vehicle Transition Council stated its aims to act as a forum to coordinate global efforts to overcome strategic, political, and technical barriers, accelerate the production of zero emission vehicles, and increase economies of scale. Specific opportunity areas for collaboration include aligning the future of the road transport sector with the Paris Agreement goals, ensuring the transition to zero emissions vehicles is global, ensuring the lifecycles associated with zero emissions vehicles is sustainable and inclusive, and coordination innovation efforts. The final and most relevant to this study is ensuring that enabling infrastructure is in place, including EV charge points.

The process of national EV developments is ongoing with a recent consultation on "Future of transport regulatory review: zero emission vehicles"[5]. This consultation aimed to address transport regulation, particularly with regard to those areas that are potentially outdated and not designed with new technologies or business models in mind.

2.2 Key Scottish Strategy and Policy

The following strategies and policies in Scotland contribute towards the foundation for EV growth and promotion in Fife:

- A Network fit for the Future: Draft Vision for Scotland's Public Electric Vehicle Charging Network (2022) The following are key applicable extracts:
  - People have access to a well-designed and comprehensive public network of charge points.
  - The public electric vehicle network works for everyone regardless of age, health, income, or other needs.
  - Scotland has attracted private sector investment to grow the public electric charging network, ensuring it meets the needs of all people.
  - The public charging network is powered by clean, renewable energy and drivers benefit from advancements in energy storage, smart tariffs, and network design.
  - People's first choice wherever possible is active and public transport with the location of electric vehicle charging points supporting those choices.
- National Transport Strategy Delivery Plan 2020 – 2022 (2020)
  - The Scottish Government will continue to support consumers access the benefits of electric vehicles through our Low Carbon Transport Loan (LCTL), which has now been extended to include used electric vehicles.

[4] Decarbonising Transport – A Better, Greener Britain (publishing.service.gov.uk)
[5] Future of transport regulatory review: zero emission vehicles - GOV.UK (www.gov.uk)

  - Provide financial support to households through the Domestic ChargePoint Programme operated by the Energy Savings Trust, including providing £0.5 million this year to support 1600 installations.
  - Support innovative approaches in the design of electric vehicle charge points, including through 'Can Do Scotland' to ensure everyone, including those with mobility issues or other disabilities can access EV charging.

- Update to the Climate Change Plan 2018 – 2032 (2020):
  - Develop new financing and delivery models for electric vehicle charging infrastructure and work with the Scottish Futures Trust to do so.
- Scottish Building Regulations – Proposed Changes to Energy Standards and associated topics (2021)
  - Availability and convenience of EV charging infrastructure is frequently cited as a negative factor impacting an individual's decision to purchase an EV.
  - To overcome this barrier, growth in EV uptake will need to be matched with growth in reliable and convenient charging infrastructure that puts consumer needs first.
  - Scotland currently benefits from having around 43 publicly available EV charge points per 100,000 population and there are more rapid EV charge points per 100,000 in Scotland than anywhere else in the UK (and in overall charge points Scotland is second only to London).
  - The Committee on Climate Change has estimated that there will need to be an overall investment of £280 million in Scotland (up to 2030) in public EV charging infrastructure, in addition to investment in EV charge points in homes and at workplaces.
- Scottish Power Charge Project (2019-2022) – a project to merge transport and the electricity network to create an over-arching map of where EV charging points will be required and where they can best be accommodated by the electricity grid.
- Strategic Transport Projects Review 2 (STPR2) (2022): Recommendation 28 is applicable to inform the growth of EVs.
  - Transport Scotland will intervene to support a Just Transition to ensure there is provision of a charging network across Scotland.
  - Recommendation of a national framework for zero emission vehicles to ensure an accelerated transition through targeted investment.
  - Enhance collaboration between public and private sector to co-ordinate investment in the development of the charging network.
- National Transport Strategy (NTS2) Second Delivery Plan – 2022-2023 (2022)
  - The Scottish Government will continue to support low income communities with a £1.75m grant via the Energy Saving Trust to fund EV car clubs.
  - Hold the inaugural meeting of the EV Infrastructure Forum to create a source of direction for infrastructure projects.
  - A £60m fund to support new infrastructure and pilots for the future of public EV charging.

2.3 Regional

- The South East of Scotland Transport Partnership (SEStran) 2035 Regional Transport Strategy (2022) – This strategy sets out policies to improve transport in the region to 2035. The policies this strategy highlights are designed to achieve decarbonisation of public body vehicle fleets, enhance the roll out of EV charging infrastructure for all areas, support a suitable taxation on all types of private vehicle, and ensure that there is not an uptake in private car ownership due to the lower associated costs of running an EV.

2.4 Local - Fife

The following existing local strategies and policies help to set the foundation for EV growth and promotion in the Fife Council area:

- Declared Climate Emergency (2019) – Fife Council declared a climate emergency in September 2019 with a target of net-zero emissions by 2045. This declaration directs the future planning of the Council to consider climate activities at every stage and a key priority in the Plan for Fife, 2017-2027.
- Climate Fife: Sustainable Energy and Climate Action Plan (2020-2030) and the recently published Climate Fife 2024 Strategy and Action Plan – Fife Council climate action plan contains a wide range of actions and initiatives that the council hopes to put in place and achieve results with. There is a focus on the decarbonisation of the Council's vehicle fleet, increasing the uptake of ULEV, making public transport more popular, reducing the need to travel, and promoting active travel measures.
- Air Quality Strategy for Fife 2021-2025 – This report highlights that at the time of writing Fife Council had two active Air Quality Management Areas (AQMAs). Both AQMAs (as of December 2023) have now been fully revoked but monitoring is continuing in both areas and measures continue to be implemented in order to maintain air quality improvements. Such improvements include expanding the electric charging network across Fife to make it easier for people to move away from conventional vehicles and into EVs.
- Fife Local Transport Strategy (2023 – 2033) - sets out a framework for taking forward transport policy and infrastructure within Fife. Specifically Objective 10: Provide leadership in working with others to reduce Fife's transport emissions by 56% by 20230, compared to a 1990 baseline and Action 43: Develop a Public EV Charging Strategy & Expansion Plan, to enable the private sector and community groups to install and operate electric vehicle charge points.
- FIFEplan Supplementary Guidance (2018) – Policy 11 in this document sets out that the Council may require new housing developments to have EV charging infrastructure to be included when the development is built at a ratio of 1 charger per 50 car parking spaces.
- eFife Website – eFife provides residents and businesses with access to the information that they need to be able to make the switch to an EV including the benefits of having an EV and what funding is available to ensure that those who want to switch can afford to.
- Fife Economic Strategy 2017-2027 (2017) – Outlines the investment priorities in Fife over the active period with key investment in transport connectivity and decarbonisation of transport. The implementation of EV charging infrastructure to encourage EV uptake will help meet this decarbonisation.
- Ore Valley Housing Association – Ore Valley Housing Association has entered into partnership with Enterprise Car Club, funded by Transport Scotland and delivered through the Energy Saving Trust, to make zero emission vehicles available to Ore Valley tenants and local residents. It's part of a wider initiative to engage communities in more sustainable electric vehicles and shared mobility.
- Greener Kirkcaldy – Local initiative the highlights that changing travel habits can help reduce the climate impact and suggests EVs as part of the changes people can make.

2.5 Key UK Strategy and Policy

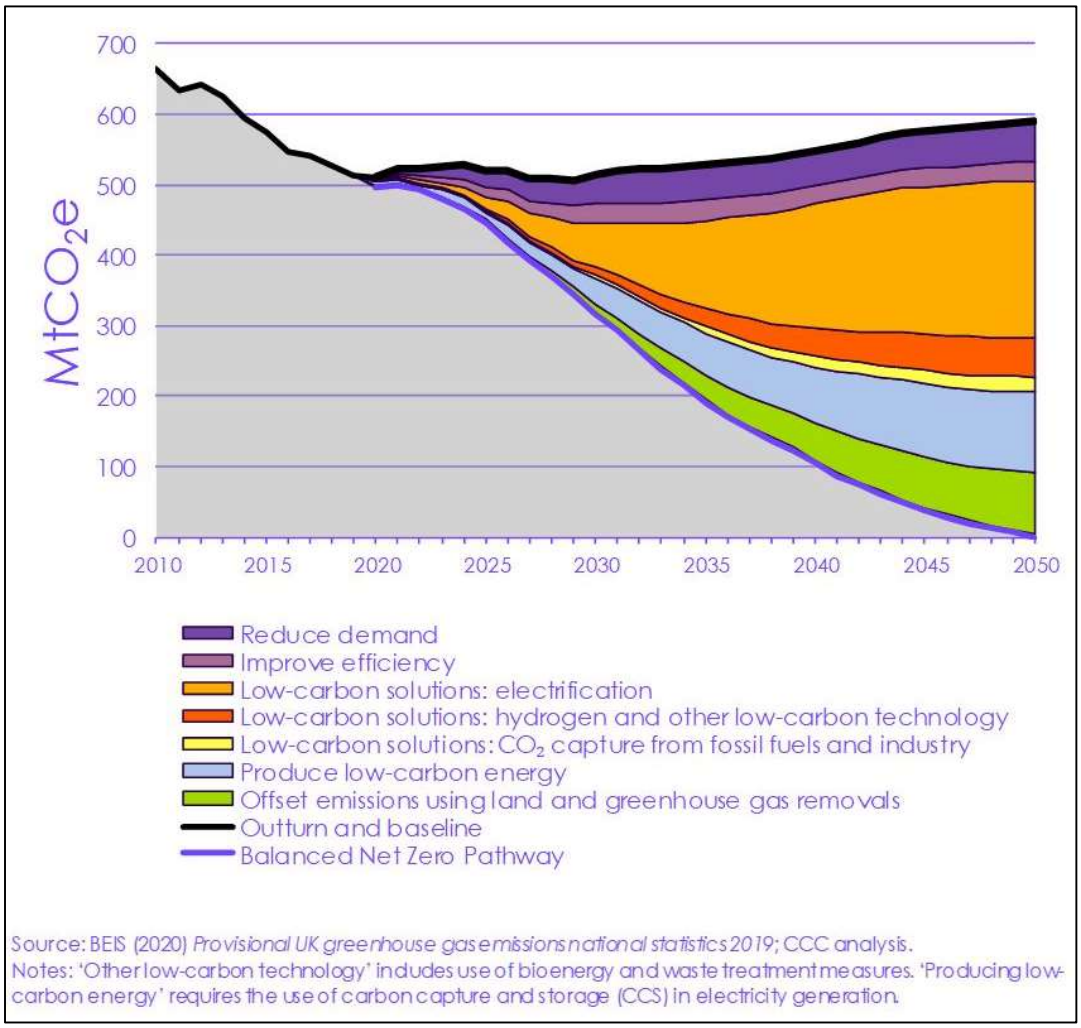
The following key UK strategies and policies are also applicable to Scotland and therefore Fife:

- End of sales of new petrol and diesel cars by 2030 (2020) – Step 1 will see the phase-out date for the sale of new petrol and diesel cars and vans brought forward to 2030. Step 2 will see all new cars and vans be fully zero emission at the tailpipe from 2035 (ending the sale of Plug-in Hybrid electric vehicles).
- Department for Transport (DfT) Decarbonising Transport: A Better, Greener Britain (2021) – Presents the path to net zero transport in the UK by 2050, the wider benefits it can deliver, and the principles that underpin the approach to delivering it. In addition, this strategy outlines the commitments and actions needed to decarbonise transport.
    - All non-zero emission HGVs (>above 26t) are expected to be phased out by 2040, with lighter HGVs (from 3.5t up to and including 26t) being phased out by 2035.

- The sale of new petrol and diesel cars and vans (under 3.5t) will be phased out by 2030, and all new cars and vans will be fully zero emission at the tailpipe from 2035.
- Consultations are being undertaken to determine a phase out date for the sale of new non-zero emission buses, as well as plans to determine a phase out date for the sale of new-zero emission coaches.

- Climate Change Commission's (CCC's) Sixth Carbon Budget (2020) – Sets the limit on allowed UK territorial greenhouse gas emissions over the period 2033 to 2037. It is the CCC's duty under the Climate Change Act to advise on it by the end of 2020, following which it must be legislated by the middle of 2021. A chapter in the associated Methodology Report focusses on surface transport and recommends a swift and sharp increase in EV infrastructure to facilitate EV take up.
  - Reduced demand – Around 10% of the emissions saving in the Balanced Pathway in 2035 comes from changes that reduce demand for carbon-intensive activity. Particularly important in these scenarios are slower growth in flights and reductions in travel demand. Reduced demand can result from reduced miles travelled and modal shift to lower-carbon modes. While changes are needed, these can happen over time and overall can be positive for health and well-being.
  - Surface transport is currently the UK's highest emitting sector. In the CCC's Sixth Carbon Budget Balanced Pathway, options to reduce emissions, including take-up of zero-emission technologies and reduction in travel demand, combine to reduce surface transport emissions by around 70% to 32 Mt CO2e by 2035 and to approximately 1 Mt CO2e by 2050 (See illustration in Figure 2-1).

Figure 2-1. Sources of abatement in the Balanced Net Zero Pathway for the surface Transport sector (UK CC)



Source: BEIS (2020) *Provisional UK greenhouse gas emissions national statistics 2019*; CCC analysis.
Notes: 'Other low-carbon technology' includes use of bioenergy and waste treatment measures. 'Producing low-carbon energy' requires the use of carbon capture and storage (CCS) in electricity generation.

- DfT's Future Mobility: Urban Strategy (2019) – Sets out the Government's strategy for tackling the challenges of urban mobility, including through a £400m funding package for EV charging points.
- Committee on Climate Change (2019) – In June 2019, the Government passed new laws to support a target of net zero emissions by 2050 in response to recommendations from the Committee on Climate Change.
- Automated and Electric Vehicles Act (2018) – Promotes the development and deployment of autonomous and electric vehicles, through large-scale investment in electric charging points and new rules ensuring vehicle compatibility, payment standardisation and guaranteeing reliability.
- Air Quality Plan for Nitrogen Dioxide (NO2) in the UK (2017) – Sets out how the UK aims to reduce roadside nitrogen dioxide (NO2) through a requirement for development of local plans for interventions in targeted areas where the problem is most severe.
- Clean Growth Strategy (2017) – Outlines how the government intends to implement its industrial strategy, focussing on clean growth and lower carbon emissions. It notes that the low carbon economy is predicted to grow 11% a year from 2015-2030, with transport a key sector in delivering this growth.
- UK Industrial Strategy: Building a Britain fit for the future (2017) – Sets out how the Government plans to build 'a Britain fit for the future' through helping businesses create better higher-paying jobs with

investment in the skills, industries, and infrastructure of the future. A key 'grand challenge' is decarbonising the economy to enable clean growth and capitalising on the opportunities to develop world leading skills and businesses in the field of future mobility.

- Climate Change Act (2008) – Commits the UK to reducing emissions by at least 80% by 2050. This has since been amended to include a target of net zero emissions by 2050 (2050 Target Amendment – Order 2019). Although this has since been superseded in certain aspects, it provides important background context.

2.6 Legislation

Various pieces of legislation are being enshrined in UK law to ensure the transition to zero emission vehicles is conducted in a coordinated way and the future infrastructure network offers a high-quality experience, as noted below:

- Electric Vehicles (Smart Charge Points) Regulations 2021 - The regulations ensure charge points have smart functionality, allowing the charging of an electric vehicle when there is less demand on the grid, or when more renewable electricity is available. The regulations also ensure that charge points meet certain device-level requirements, enabling a minimum level of access, security, and information for consumers. The regulations are due to come into force in November 2024.

- The Automated and Electric Vehicles Act 2018 gives the Government powers, through secondary legislation, to ensure that all EV charge points sold or installed in the UK will have smart functionality. Promotes the development and deployment of autonomous and electric vehicles, through large-scale investment in electric charging points and new rules ensuring vehicle compatibility, payment standardisation and guaranteeing reliability.

- Alternative Fuels Infrastructure Regulations 2017 - requires the Government to adopt national policy frameworks for alternative fuels infrastructure roll-out. Additionally, at the very least, the UK Government has committed to achieving these goals following its departure from the EU.

2.7 Summary

This strategy and policy review has shown that there is support for Fife Council's transition to EVs at all spatial levels, and an increasingly supportive and proactive policy and legislative framework is emerging. Specific aspects of the policies and strategies have also informed later sections of this document covering the evidence base and option development.

3. Technology Review

This chapter provides an overview of the various EV and charging technologies available, as well as current trends in the development of this technology. This seeks to highlight how expected future changes in technology could influence user behaviour and therefore potentially need consideration within Fifes wider EV strategy. Note that the precise details of the existing ownership and infrastructure trends within Fife is outlined in Section 4.

3.1 Electric Vehicle Overview

CO2 is the primary greenhouse gas emitted through human activities, which traps heat in the atmosphere causing global climate change. The transport sector currently generates the highest proportion of CO2 emissions in the UK accounting for 27% of greenhouse gas emissions, due to the increasing miles driven by ICE vehicles that burn carbon-based fuels and consequently emit CO2 from their exhausts. The transport sector has made the lowest contribution to UK greenhouse gas emission reduction, only achieving a 4.6% from 1990 to 2019, making it a prime target for future regulation. The UK Government has just published a Green Paper on a New Road Vehicle CO2 Emissions Regulatory Framework for the United Kingdom. The key aspect is that this is another round of consultations.

In addition to carbon dioxide (CO2), ICE vehicles produce methane (CH4) and nitrous oxide (N2O). The emissions of these gases are small in comparison to CO2 however, the impact of these emissions is important because they have a higher global warming potential than CO2. Nitrous oxide is released naturally from soils and water bodies as part of microbial processes. The two major man-made sources are from agriculture and manufacturing. It is also released from power stations and road transport.

An important note is that fine particle emissions (PM 2.5) also originate from brakes and tyres. EVs have the benefit of regenerative braking to increase engine efficiency and reduce particulate emissions from braking compared to ICEs, but tyre wear will be similar to or slightly higher due to increased vehicle weight. There is an environmental impact of vehicle manufacture, as in all vehicles, however this is increased in EVs due to battery manufacture. This is why reducing total vehicle use is the best long-term option for clean air.

EVs are an alternative to ICE vehicles allowing electricity stored on board to power the wheels rather than carbon-based fuels, so they generate zero exhaust emissions whilst driving. EVs can refer to a number of different vehicle types, which are:

- Battery Electric Vehicle (BEV) has no ICE and must be plugged in to charge.
- Plug in Hybrid Electric Vehicle (PHEV) is both a BEV and an ICE with the battery being charged by a plug.
- Hybrid Electric Vehicle (HEV) does not plug in and uses the ICE to generate electricity to drive the vehicle.
- Fuel Cell Electric Vehicle (FCEV) uses on board hydrogen to generate power for the wheels. A hydrogen fuel car is an electric vehicle.
- These descriptions will be expanded upon later, but the term EV will only refer to battery unless hydrogen is included, and it will be referred to as FCEV.

3.2 Electric Vehicle Technologies

EVs use onboard electricity to provide power to the wheels and by doing so are much more efficient. In the UK, in spite of the increased electricity requirement, EVs have a lower operating carbon footprint than ICE vehicles and given the UK's progress towards and remaining plans for greener electricity generation, these benefits will increase further in the future. EVs also produce less noise pollution and encourage a smoother driving style than ICEs, which increases driving efficiency by reducing the power required per kilometre driven and causing lower particulate emissions from brake and tyre wear.

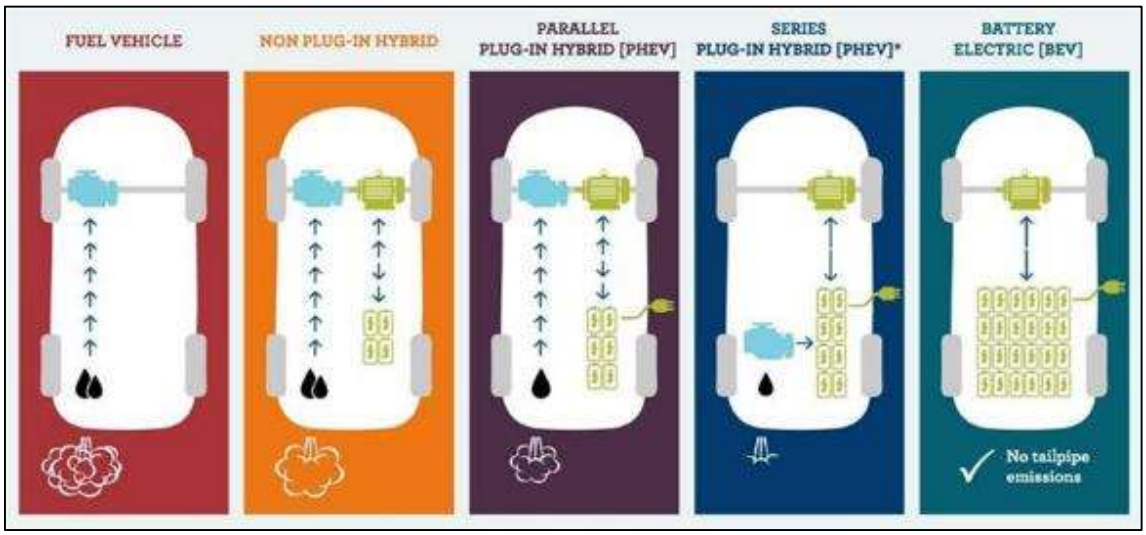
3.2.1 Electric Vehicle Terminology

UK policy is technology neutral, encouraging the development and uptake of all forms of transport to reduce urban air pollution and greenhouse gas emissions. Ultra-Low Emission Vehicles (ULEVs) is the vehicle definition currently targeted for road transport emissions reduction – however, there are many acronyms used to refer to vehicles that are capable of emitting lower emissions than pure ICE vehicles.

Only those electric vehicles that plug into an electricity supply to recharge the battery are relevant to the EV recharging infrastructure discussed in this 'EV Charging Infrastructure Strategy'. The specific vehicles that require EV charging points are Plug-In Vehicles, or PIVs, incorporating BEVs and PHEVs. By 2030, sale of new HEVs (the only EVs that do not plug-in) will have been banned, so the simplified term 'EV' will by then refer only to BEVs and PHEVs. For simplicity, this document refers to EVs rather than PIVs, though charging infrastructure is only required for PIVs rather than for all EVs.

Figure 3-1 below shows different types of electric vehicles, with only the three to the furthest right being of relevance in terms of EV charging infrastructure.

Figure 3-1. Types of Electric Vehicle



A brief explanation of each of these terms for different types of electric vehicles is provided below.

- **Electric Vehicles (EVs)** – EVs are vehicles driven by an electric motor, powered from a battery, which must be plugged into an electricity source to recharge. Full EVs have no combustion engine, and therefore zero tailpipe emissions, producing 0 grams CO2/km when driven – these pure EVs are sometimes referred to as BEVs.
- **Plug-In Vehicles (PIVs)** – A collective term used to cover all vehicles that can be plugged into an external electrical outlet to recharge their battery. PIVs form a subset of ULEVs, which includes both BEVs and PHEVs as well as FCEV. All PIVs require recharging infrastructure to recharge their batteries, so understanding this category's needs is key when planning charging networks. The batteries are much smaller than in a BEV. Statistics for total licensed PIVs by Local Authority are published quarterly. However, UK targets do not focus on PIVs but rather on ULEVs, a more relative term that can be redefined as emission standards improve.
- **Hybrid Electric Vehicles (HEVs)** – Hybrids use more than one form of on-board energy to achieve propulsion, usually a petrol or diesel engine plus electric motors and a battery. Some hybrid vehicles use the electric motor to make more efficient use of petroleum fuel, but the motor cannot power the vehicle alone. The controversial 'self- charging hybrid' falls into this category. Consultation/ lobbying is ongoing

to as to whether these vehicles will be banned post 2030. This is an important point as a favourite of mini-cab and private hire drivers is the Toyota Prius hybrid. Hybrids that use a series drivetrain only receive mechanical power from the electric motor, which is run via a battery charged by a fuel-powered generator. The Nissan e-power is an example of this.

- **Plug-in Hybrid Electric Vehicles (PHEVs)** – Plug-in hybrids combine a plug-in battery and an electric motor with an ICE, either of which can be used to drive the wheels. The means of propulsion therefore dictates the amount of tailpipe emissions produced. All PHEVs plug-in to recharge their battery. In hybrids with parallel drivetrains, the electric motor and internal combustion engine can provide mechanical power simultaneously or separately.

In addition to the main terms listed above, for clarity a number of additional EV-related terms are defined below.

- **Ultra-Low Emission Vehicles (ULEVs)** – This term is used in the UK to refer to any motor vehicle emitting extremely low levels of emissions, currently set at 75g CO2/km driven or less. UK targets are set for ULEV uptake and statistics are reported quarterly at Local Authority level.
- **Alternative Fuel Vehicles (AFVs)** – These are vehicles that run on substances other than solely conventional petroleum gas or diesel. Alternative fuels include electric, solar, biodiesel, ethanol, propane, compressed air, hydrogen, liquid natural gas, and liquid petroleum. All types of EVs are AFVs. Because this term focuses on the way a vehicle is propelled rather than its emission levels, there is no guarantee that an AFV is necessarily less polluting than a conventional ICE.
- **Fuel Cell Electric Vehicles (FCEVs)** – These are vehicles that use a fuel cell, instead in combination with a battery, to power an electric motor. The fuel cells generate electricity to power the motor, generally using oxygen from the air along with compressed hydrogen. Hydrogen must be stored and transported from the production site to the refuelling station, making it a costly infrastructure solution. While FCEVs are not considered within this study, they have been included in this section to complete the EV offering. If FCEV do come into wider usage in the future, they will require a whole new dedicated infrastructure. Over the last 10 years, only 263 FCEVs models have been registered in the UK.

3.2.2 EV Technology Roadmaps by Vehicle Type

The UK Automotive Council has developed long-term technology roadmaps for electric passenger car, bus, and commercial vehicle technology, representing the vision of vehicle manufacturers to 2040. These roadmaps show electric drivetrain technology as a focus area for passenger cars and light vans to 2050, given the drivers towards reducing emissions. Ignoring early teething issues in terms of specific vehicle types being brought to market, it is likely that charging infrastructure will be required for the majority of vehicles in the overall fleet for the next several decades. The roadmap nuances across the different vehicle types are described in more detail in **Appendix A.**

3.3 Electric Vehicle Availability

Since only vehicles that plug-in to charge the battery are relevant to recharging infrastructure, this section provides a summary of current plug-in car availability in the UK. There are now over 200 plug-in car models available on the UK market (as of December 2021):

The question of PHEV longevity is focused on the additional cost, average price (£10,000 more than the average BEV) and the complexity of manufacture.

The recent dominance of PHEVs in the UK market is similar to most European countries – however, other countries such as Norway and the Netherlands have seen the opposite due to their more favourable BEV incentive schemes. The table below shows that BEV in 2019 caught up with PHEV and in 2020 and 2021 significantly outsold PHEV.

Table 3.1. BEV and PHEV Sales Over Time

Year	BEV	PHEV
2013	2,512	1,072
2014	6,697	7,821
2015	9,934	18,254
2016	10,264	26,643
2017	13,597	33,666
2018	15,474	44,437
2019	37,850	34,734
2020	108,205	66,877
2021	190,727	114,554
Total	**395,260**	**348,058**

The second-hand EV market is still very small, making up less than 0.2% of auction sales in 2018, and most independent second-hand dealerships leave this limited EV market to the franchised dealers. Second-hand dealers report the usual concerns about lack of recharging infrastructure alongside poor real range and value for money as reasons for this. However, the Go Ultra Low campaign supported by Energy Savings Trust and others has sought to dispel these myths and continuing regional awareness raising activities are required to get the message out. One likely influence to boost sales of EVs is the future adoption of clean area zone charges, being considered for several of the UK's larger cities.

3.3.1 Battery Capacity

Analysis of the BEV vehicles on the market shows how battery capacity is growing. As a datum the first Nissan Leaf was 24kWh then it moved to 30kWh. It is now available as 40kWh or 62kWh. There will however be a legacy of lower capacity batteries within the fleet from earlier models sold in previous years.

The average battery capacity for currently available BEV's is 70kWh, resulting in an approximate vehicle range of 235 miles.

3.3.2 Battery Charging Capabilities and Constraints

EV charging technology is evolving rapidly. Prior to 2016, most EVs charged at 3kW AC (called trickle charging), which was adequate to fully recharge most batteries (typically up to 24 kWh) overnight. Then with the development of vehicles with 7kW on-board chargers came fast 7kW AC charging, and with the introduction of higher capacity batteries, the 22kW AC fast charging technology has since come to market. A detailed overview of the current battery charging capabilities and the PIV supply constraints can be found in **Appendix B.**

3.4 Electric Vehicle Charging Technology

Although 'electric vehicle charging points' are often discussed as the technology that is required to allow EVs to recharge, there is a lot of other technology involved in the process. This section explains the need for recharging infrastructure, and summarises the technologies used in the UK.

3.4.1 The Need for Recharging Infrastructure

Connecting the vehicle to an external electricity supply, most commonly the electrical grid (the electricity transmission network) or an electrical storage facility is a necessity. Electric Vehicle Supply Equipment

(EVSE) is the collective term used to refer to all equipment used to deliver energy from the grid to a PIV. EVSE includes plugs, sockets, conductors, power outlets and devices that allow communication between the recharging apparatus and the vehicle.

All PIVs require some form of EVSE to recharge their batteries, situated at suitable locations, over a suitable duration and at appropriate times of day or night to meet users' requirements. In a departure from the driver's expectation, built up from years of filling with diesel/petrol, the vehicle dictates how power is drawn from the grid and therefore can control the speed of recharge. Thus, charging speed is a consequence of the interaction between both the vehicle and the EVSE equipment. Consumer preferences and habits also have a role to play in recharging behaviour, and many consumers still consider current recharging durations as a limitation of PIV. However, different recharging equipment types are now available to suit different use cases. Consumer preferences have not yet been established, which is a challenge when planning a service such as a charging network.

There is much debate about who should provide recharging infrastructure, how many, of what type and where, and several different solutions have now been implemented by public and private organisations in the UK and across Europe. There are many stakeholders interested in recharging infrastructure, for many different reasons, making it a complicated marketplace with often conflicting objectives.

There are two clear types of market operators – the first group believes that every house should have a domestic or on-street charger, while the second group believes that rapid charge hubs in central locations are the way forward. The answer is that both are correct up to a point. What no one yet knows is the likely split between home, workplace, destination, and in-transit charging that UK EV users will seek over the next decade or more.

3.4.2 Charge Points

The most well-known element of EVSE is the charge point – also called a charging post, charging point or charging station. There are many specifications of charge point in the marketplace, differentiated by power output, communication protocol, type, and number of charging outlets. They can typically be installed mounted onto a wall or as free-standing units installed in the ground. Most ground mounted charge points can be installed with retention sockets to ease swap out for future maintenance, repair, or replacement. Table 3.2 provides a summary of the different types of charge point currently available in the marketplace.

Table 3.2. Charging Point Types

Common Charge Point Types	Power Output (kW)	Current / Supply Type	Socket / Plugs	Charging Duration (40kW battery)	Use Cases
Trickle	<7	AC	Type 2 Socket	13 hours	Destinations
Fast	7-22	AC	Type 2 Socket	2 to 5 hours	Destinations
Rapid	43-50	AC & DC	AC - Type 2 & DC – CCS & CHAdeMO	80% in 20-40 mins	On-route

Charge point design is evolving rapidly. In the early days of charge point installation, only single outlet 3kW AC trickle charge points were available. This suited early EVs, which were only capable of drawing a 3kW power supply and at the time had relatively small batteries. The earliest charge points provided a standard domestic socket for a 3-pin plug but concerns over long plug-in times led to development of the now

globally recognised Type 2 socket. Then with the emergence of vehicles with 7kW on-board chargers came fast 7kW AC single-phase charge points, with three-phase 22kW alternatives, multiple outlets, and power sharing capabilities.

This was followed by the development of rapid chargers rated at 50kW, which were initially only suited to a few PIV models, but now have multi-standard variants widening their use to most rapid charge-enabled vehicles. In parallel, Tesla developed its own bespoke Supercharger technology supplying their vehicles at 120kW.

Tesla superchargers were the first examples of high-power chargers to appear, but they could only be used by Tesla vehicles. Recently Tesla has opened up access to its supercharger network to some non-tesla vehicles. The wider roll-out of 150kW+ charge points for public use is now beginning, but the few vehicles designed to draw such high-power are typically high-priced executive models. To combat this business model limitation, high-power charge points are designed to be backwards compatible, so they can also deliver, for example, 50kW DC charges to rapid chargeable vehicles.

3.4.3 Further Charging Considerations

Further technical details on the current charging landscape in terms of charging types, estimates of miles per kWh, charging connectors and charging protocols are outlined in **Appendix C.**

There are also a number of future charging technological advances to be aware of, notably smart charging and vehicle to all charging, more details on these are again provided in **Appendix C.**

3.5 Emerging Wireless/ Induction Charging Technology

It is clear that the EV industry has seen substantial technological development in recent years. Another advancement already on trial is induction, or wireless, EV charging. Induction charging is fairly simple – electricity is transferred through an air gap from one magnetic coil in a transmitter pad to a second magnetic coil fitted to a receiver pad on the vehicle. Further information on induction charging and current trials underway at the time of writing using this technology is detailed in **Appendix D.**

3.6 Summary

This section summarises the current and future technology trends relating to EV availability and charging infrastructure.

EV Trends

- There must be a kickstarted uptake of EVs due to the increasing GHG emissions and new legislation - there must be the infrastructure in place to facilitate this.
- Plug-in Hybrid (PHEV) and Battery Electric (BEV) vehicles are the only EVs dependent on charging infrastructure - all of which are being encouraged by central government.
- For successful uptake, EVs must become more widely available and affordable - key manufacturers such as Nissan, Renault and Citroen offer EV vans and have recently been joined by new models from LDV and Mercedes, with Ford, Volkswagen and LEVC announcing models coming soon to the UK - there are currently 117 plug-in car models available in the UK.

EV Availability

- Rapid evolution of charging technology - prior to 2016, most EVs charge at 3kW, however in 2021 150kW+ public chargers are becoming more apparent, with 300+ kW chargers becoming increasingly common in EV forecourts.

- The lack of EV production capacity is a global issue, originating in vehicle production plants and battery production facilities across the world. At present, the UK government does not hold an incentive-base allure for the limited supply, however the recent announcement of Britishvolt building a battery facility in the UK, plus the approval of formal planning permission for Envision AESC in Sunderland, will help address the shortage. AMTE Power, a battery cell manufacturer, has also selected Dundee as its preferred site for its first Megafactory. The Faraday Institute has forecast a need for at least 7 Gigafactories to be built in the UK to meet demands and reduce the potential cost of importing to meet future needs.

EV Charging Technology

- Trickle, fast, rapid, and high-power chargers suit different locations and charging behaviours; trickle and fast chargers suit destination charging patterns, where the driver looks to recharge at a location, they will be leaving the car at for a considerable amount of time. Rapid and high-power chargers however, suit on-route charging due to their high-speed capabilities, perfect for journey stop-offs.
- Practicing smart charging is key in enabling a sustainable recharging market: energy cost reduction, increasing flexibility, demand response, and integrating barriers and renewable energy sources are some of the features of smart charging.
- Vehicle to Everything (V2X) is emerging as a potential key tool within managing energy needs and consumption across networks and individually. The technology works and is proven though commercial use cases and business models are still evolving.

Wireless/Induction Charging

- Various national companies and national governments across the world are trialling methods of wireless charging, attempting to iron out the questions raised on the topic such as retrofitting costs, whether infrastructure should be built if supply is not sufficient and vice versa, and the international standards needed for wireless charging to go global.

4. Electric Vehicle Charging Baseline

4.1 Scotland and Wider UK Context and Current Situation

Buying and driving an EV can feel intimidating for many people and there is a general lack of awareness about the benefits and practicalities of driving an EV. There are however some real-world barriers and constraints to transitioning the private car fleet to EVs that have been considered which are explained below:

- **Range of vehicles** – One common perceived barrier to driving an EV is the real-world range of vehicles before recharging is needed. However, new buyers of EV are experiencing much greater range than early adopters, and typical ranges have gone from less than 100 miles to 200+ miles. 200+ miles electric range is more than adequate for the vast majority of UK drivers' daily driving requirements which are below 20 miles per day, meaning daily charging is unnecessary. Even company car users whose annual mileage is quoted as 17,500 miles typically don't exceed 70 miles daily so electric range should be adequate for most daily mileage requirements.
- **Choice of vehicles is expanding** – There are now over 200 plug-in car models available on the UK market, including more than 60 plug-in hybrids (PHEV), more than 140 full battery electric models (BEV).
- **Price of vehicles** – EV prices generally remain high, although a number of models have come to the market in 2021 priced under £40K with battery capacities up to 60 kW. The second-hand EV market is still small though and many independent second-hand dealerships leave this limited market to franchised dealers. Due to the falling price of batteries and increasing maturity of vehicle production techniques it is estimated that price parity between EV and petrol/diesel vehicles will occur in the mid to late 2020s.
- **Charging of vehicles** – One of the most often cited barriers is the lack of charging infrastructure. Currently, there is a range of charging infrastructure types and connectors which differ across vehicle manufacturers and models; however, all manufacturers (with the exception of Tesla) are working towards the Open Smart Charging Protocol meaning charging types and connectors will become standardised in the coming years. As noted previously, ChargePlace Scotland is a national network of change points, which has continued to expand across the country providing a base charging network for all.
- **EV charging technology is evolving rapidly** – Prior to 2016, most technology charged at 3kW alternating current (called trickle charging), which was adequate to fully recharge most batteries (typically up to 24kWh) overnight. With the development of vehicles came fast 7kW alternating current charging, and with the introduction of higher capacity batteries, direct current fast, rapid, and ultra-rapid charging technology has since become available that (providing the vehicle is compatible) recharges vehicles much quicker. Scotland's public charge point network is the most comprehensive in the UK outside of London. There are 49 public charge points per 100,000 people, and 12.5 public rapid charge points per 100,000 (highest in the UK)[6].
- **Supply of vehicles** – Consumers currently report long waiting times for EV purchases, and there have been instances of models being removed from sale for periods in the UK due to an excess of demand over supply. This constrained supply also affects the price of EVs and has consequential impacts on low utilisation of charge points, leading to challenges for sustaining and planning a cohesive public charging network. The lack of production capacity is a global issue, originating in vehicle production plants and battery production facilities across the world. Investment in manufacturing facilities for batteries and vehicles is gathering pace with significant recent announcements in the UK[7], however further expansion of capacity is needed in the coming years. Despite this, the Draft Vision for Scotland's Public Electric Vehicle Charging Network (January 2022) states that 21.4% of new car sales in Scotland were electric in December 2021, suggesting that there is an increased uptake in EVs. It remains to be seen whether supply can keep up with demand in 2022 and beyond. There are real world constraints to transitioning to EVs including: range of vehicles, choice of vehicles, price of vehicles, charging of vehicles, EV charging

[6] https://www.transport.gov.scot/media/50970/a-network-fit-for-the-future-draft-vision-for-scotland-s-public-electric-vehicle-charging-network-pdf.pdf

[7] https://www.reuters.com/business/retail-consumer/nissan-bets-big-uk-with-ev-battery-plant-new-crossover-2021-07-01/

technology and vehicle supply. Despite this, significant advances have been made, although the limited supply of vehicles is a threat in the near to medium-term.

Figure 4-1. Number of UK Public Charging Points by Type (2016-to date)

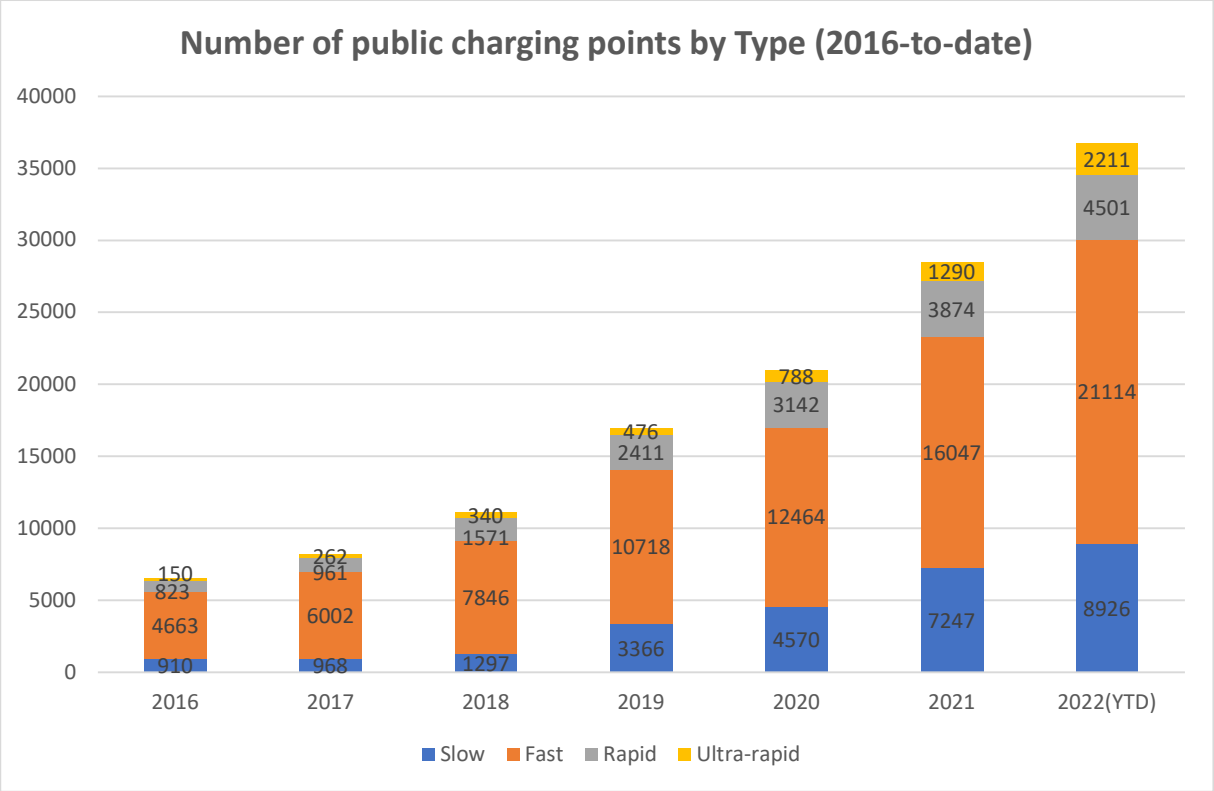
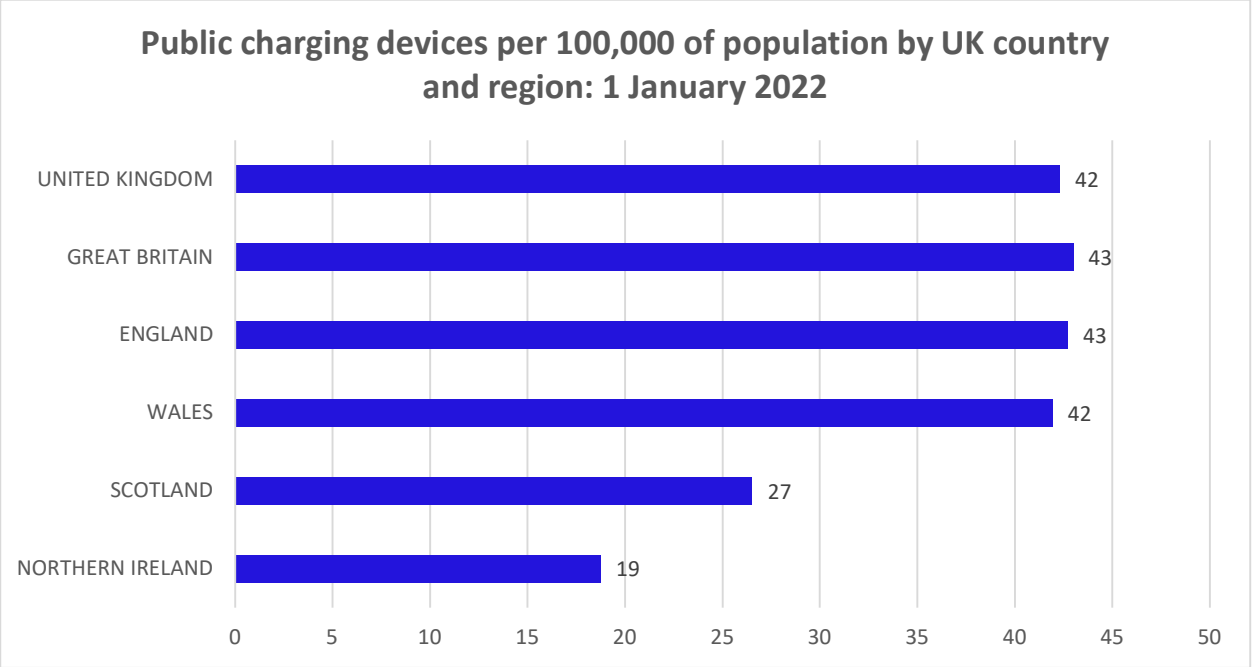


Figure 4-1 shows the breakdown of charge point devices by trickle (3-5kW), fast (7-22kW), rapid (25-99kW) and ultra-rapid (100kW+) power rating for the past five years and 2022 to date.

As the chart shows, the past few years has seen a dramatic increase in the number of public EV charge points in the UK. Between the end of 2016 and 2022 YTD there has been an increase of 508% in the number of public chargers. Another trend is the growth in trickle chargers, as local authorities install on-street charging options to enable EV purchase for people without off-street parking.

Figure 4-2 shows the number of public charging devices per 100,000 of population by UK country. In comparison to the UK, England and Wales; Scotland has approximately 15 fewer public charging devices per 100,000 of population.

Figure 4-2. Public charging devices per 100,000 of population by UK country: 1st January 2022

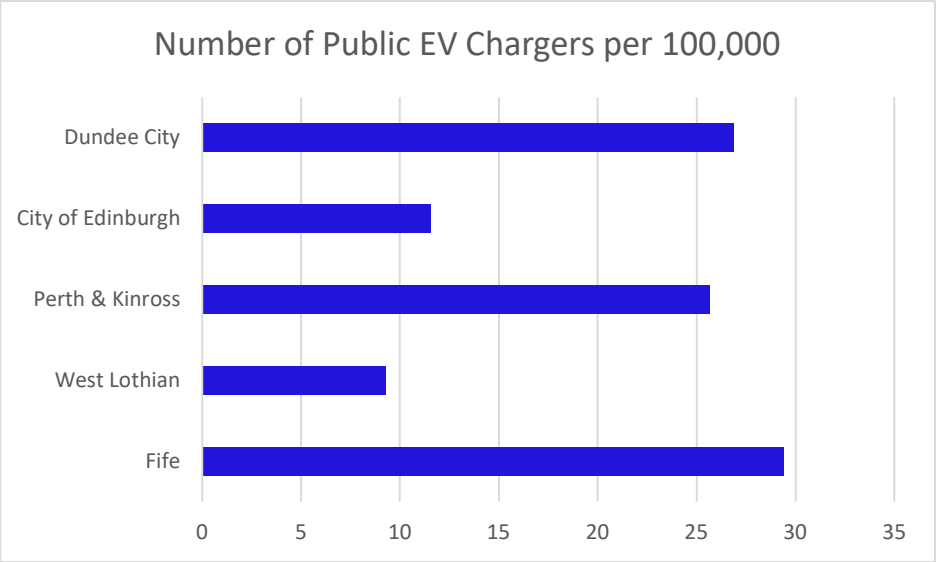


4.2 Current Situation in Fife

4.2.1 Current Charging Network

Figure 4-3 compares the number of public charging devices per 100,000 population in Fife to neighbouring authorities. Fife has more than double the number of public charging points per 100,000 compared to the City of Edinburgh and West Lothian and similar numbers to Dundee City and Perth and Kinross. This highlights that at an overall level, the current EV infrastructure provision in Fife is relatively good when compared to other parts of Scotland.

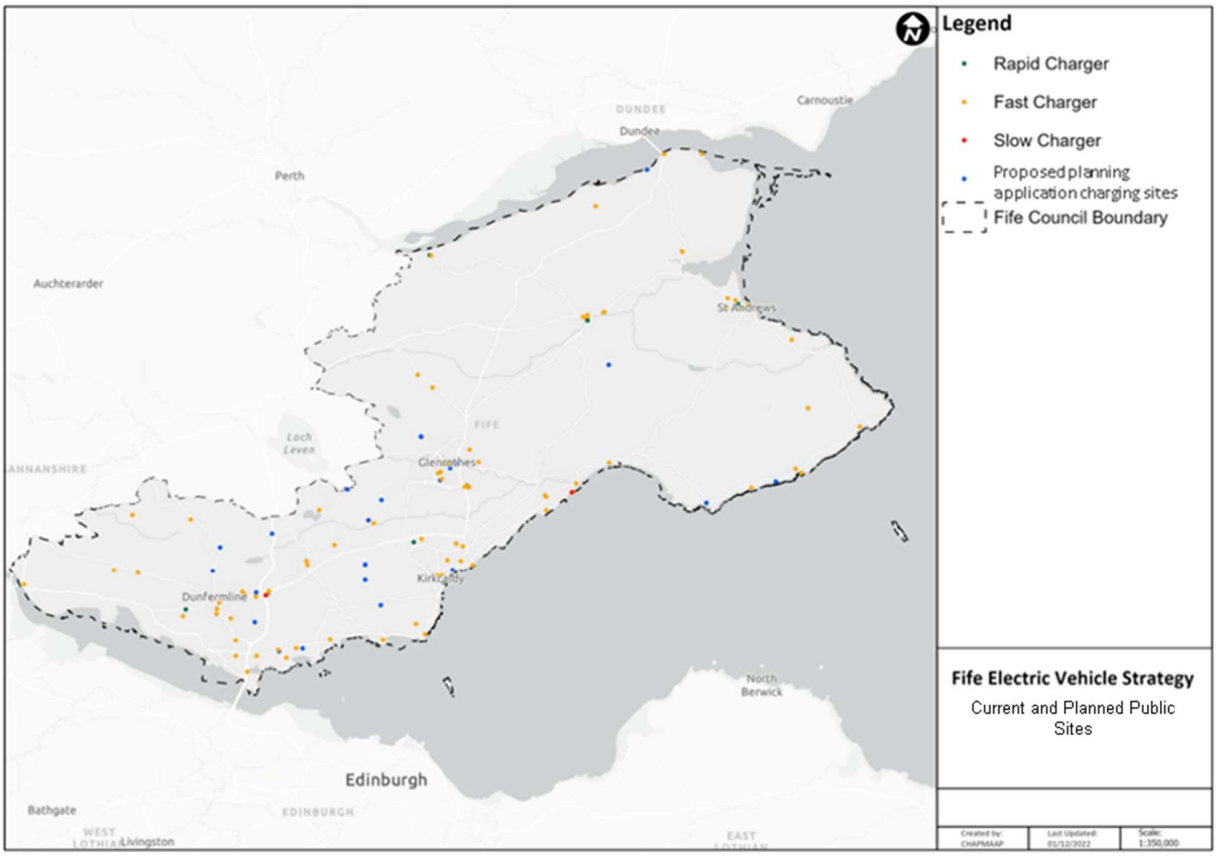
Figure 4-3. Number of Public EV Chargers per 100,000



The location the locations of existing sites in Fife are shown below in Figure 4-4. The map has been created using data from ChargePlace Scotland, National ChargePoint Registry and Zap-Map[8] and shows the overall charging infrastructure across Fife, with 17 'rapid' chargers, 91 'fast' chargers and 2'trickle' chargers in operation at the time of writing.

In Fife the charging infrastructure is predominately located around the main settlements of Dunfermline, Glenrothes and Kirkcaldy whilst rural settlements have less coverage including Crail, Cupar and Tayport – however each of these settlements has at least one charge point. Charging infrastructure is also located in close proximity to the main strategic routes, most notably on the M90 near the Queensferry Crossing.

Figure 4-4 Current and proposed planning application charging sites across Fife.



4.2.2 Utilisation of Current Charge points

Figure 4-5 below compares the differences in typical energy consumption patterns for a single charging event, across the different charging types across the eFife network.

Around 8% of all AC charging events consume 10kWh while only less than 1% of AC charging events consume 60kWh. For the rapid chargers, 5% of all charges consume 10kWh while 1% of all charges consume 60kWh. The percentage of charging events consuming more than 60kWh does not differ between the two charging types. The average consumption for a rapid charge is 24kWh whereas the average consumption for an AC charge is 2kWh.

Figure 4-5 Distribution of energy consumption during a single charge event by charger type

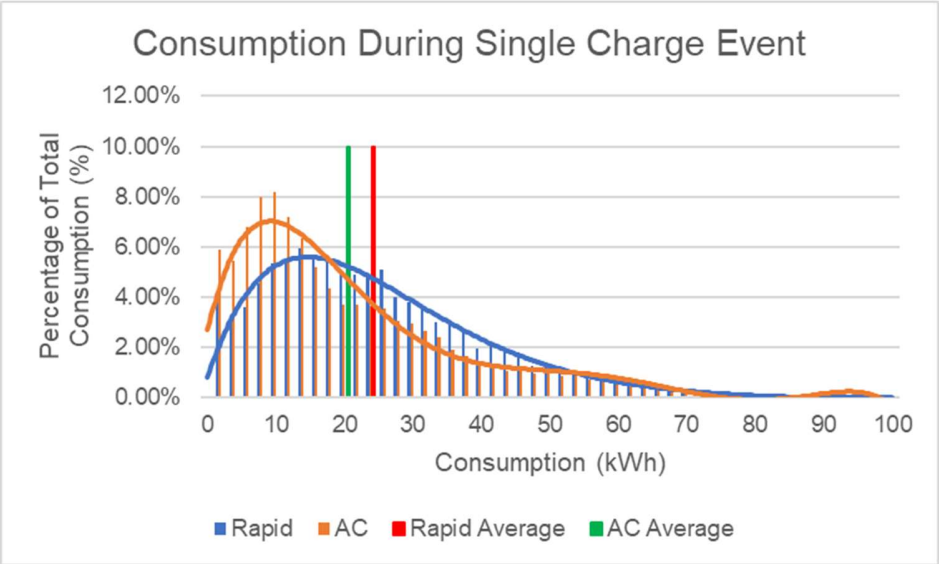


Figure 4-6 below compares the typical durations required for a single charging event, across the different charging types.

There is a great difference between rapid and AC charging events with 35% of all rapid charging events only last one hour with a minimal proportion lasting greater than 4 hours Meanwhile, AC charging events have a more uniform distribution in proportion of their durations with a small peak of 2 hours accounting for 5% of all charging events but for charging events in the range of 8 hours to 15 hours, there is around 1% of charging events that last up to each hour in this range. The average rapid charge takes 1.5 hours which would be expected as these chargers are designed to be used quickly with a higher turnover of users while the average AC charge takes 5.5 hours.

Figure 4-6 Distribution of charging duration by charging type.

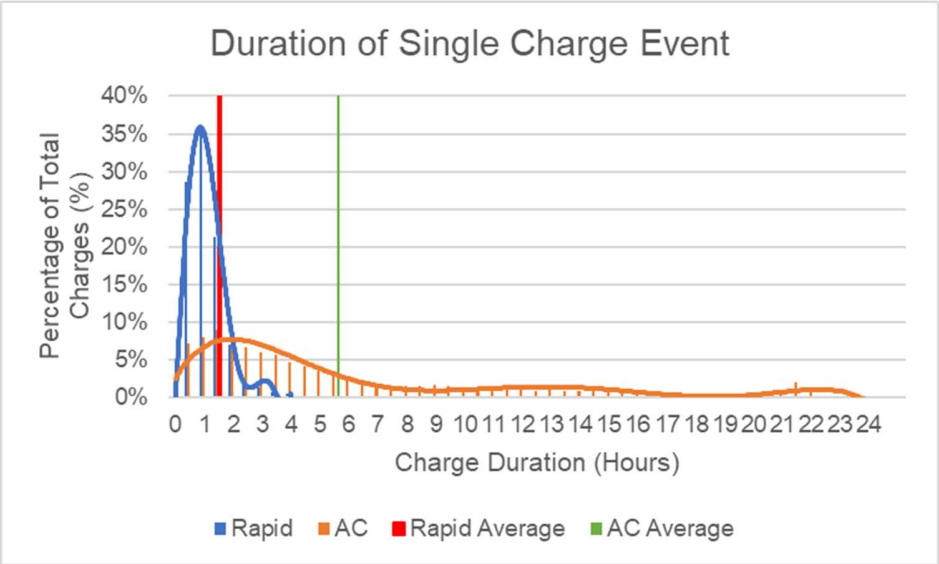


Figure 4-7 below compares the typical starting time for a charging event, across the different charging types. Figure 4-7 highlights that there is a rise in both charging types in the percentage of charging events starting in the morning which may indicate users charging at their place of work or at a park and ride facility. There is a further steep rise in the percentage of AC charging events starting with a peak of 10% at 1pm as a peak whereas the percentage of rapid charging events starting remains around 7/8% from 10am, until 5pm before beginning to fall again. The charging events starting in the afternoon for both charger types may indicate people using chargers after the typical lunch time break. There is the expected near 0% start times during the night since it is expected that people are not active during these hours.

Figure 4-7 Distribution of the charging start time by charging type.

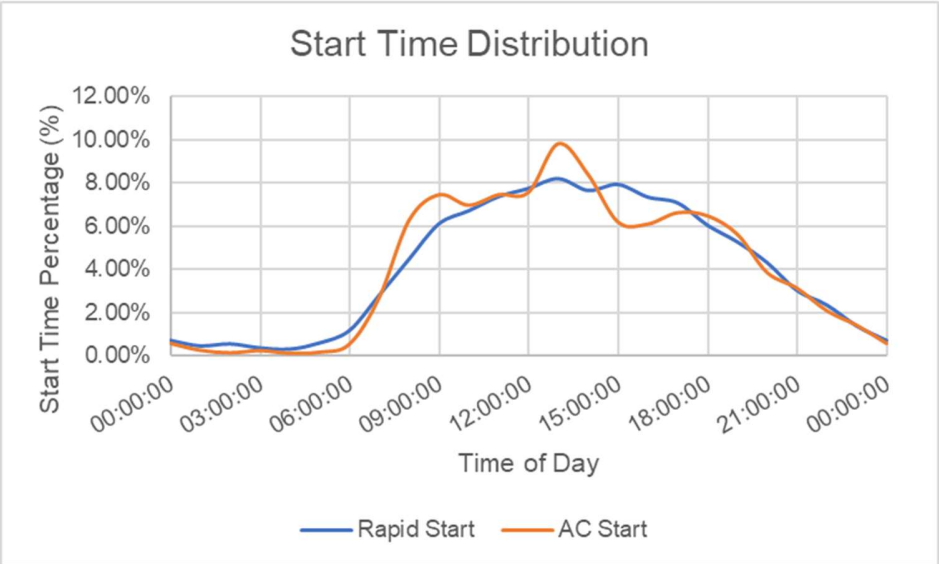
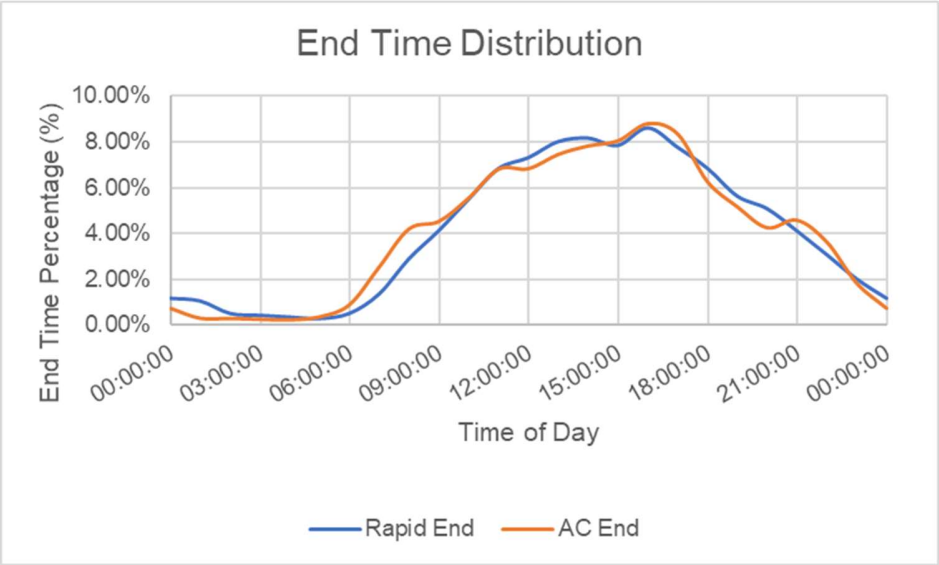


Figure 4-8 below compares the typical ending time for a charging event, across the different charging types. Figure 4-8 illustrates that there is a gradual rise in the percentage of charging events ending from <1% at 6 am to 8% at 1pm, the AC and rapid chargers follow a similar end time pattern. There is a gradual decrease in percentage of end times from 8% to <1% from 3pm to 12am. Figure 4-6As expected there is close to 0% activity during the night for both rapid and AC charging.

Figure 4-8 Distribution of the charging end times by charging types.



The average utilisation levels of the current infrastructure in Fife, alongside the 10 most and least utilised sites is shown below in Table 4.1. This highlights that the Rothesay House in Glenrothes has the highest average utilisation across all the sites in with, with 56.1%; followed by St Andrews Road Car Park in Anstruther which has an average utilisation of 36.9%. The lowest average utilisation is at Pitcorthie Nursery, with 0.1%.

The average utilisation across all sites in Fife is 10.9% which shows that there is an overall low level of utilisation across the network which could be as a result of the location of chargers not well aligning with the location of demand or not enough EV users on the network.

Rapid charger types do not feature in the top sites in terms of average utilisation, the lowest utilisation of rapid chargers that are available in Fife all have a rate of between 3.6%.

Table 4.1 The average, top10 and bottom 10 utilisation of charging connectors

Site	Connector Type	Connector Utilisation	Daily Energy (kWh)
AVERAGE UTILISATION ACROSS ALL SITES	-	10.9%	27.90
Top 10 performing sites when considering average utilisation			
St Andrews Road Car Park, Anstruther	AC	36.9%	78.68
Rosyth Railway Station Car Park, Queensferry Road, Rosyth	AC	33.1%	34.81

Kirkcaldy Railway Station Car Park, Whyte Melville Road, Kirkcaldy	AC	24.4%	38.56
Marketgate Car Park, Crail	AC	24.4%	52.33
Dalgety Bay Rail Halt Car Park, Main Street, Hillend	AC	21.0%	45.83
East Basin Car Park, Anstruther	AC	16.6%	31.89
Argyle Street Car Park, St Andrews	AC	16.3%	22.93
The Common Car Park, St Monans	AC	15.8%	40.99
Viewfield Terrace Car Park, Dunfermline	AC	15.7%	28.99
South Street Car Park, Leven	AC	15.7%	21.19
Bottom 10 performing sites when considering average utilisation			
Halbeath Park and Ride	AC	4.0%	84.35
Cupar Road Car Park, Newburgh	RAPID	3.6%	37.90
Lochore Meadows	AC	3.5%	14.24
Halbeath Nursery	AC	3.1%	3.80
Oakley Centre*	AC	3.0%	9.35
Leuchars Rail Station Car Park	AC	2.2%	11.55
Tay Bridge*	AC	2.2%	8.24
Fife Early Years Rosyth Resource Centre	AC	1.5%	3.15
Thistle Street Car Park, Kirkcaldy**	AC	0.4%	0.98
Pitcorthie Nursery	AC	0.1%	0.21

*Recently Installed **Unit has been relocated as car park is now closed

4.2.3 Household Type

Not every household in Fife has access to off-street parking which can accommodate individual charging points. People without access to off-street parking might therefore be discouraged to shift to EVs because

of this reason. This section of the report presents the local household access to off-street parking and identifies potential areas where higher demand for on-street charging demand may exist.

To carry out the analysis, Census household data from nomisweb[8] has been gathered. This has included a review of household characteristics to identify types of dwelling likely to have access of driveways and garages. The following dwelling types were considered to have limited off-street parking availability:

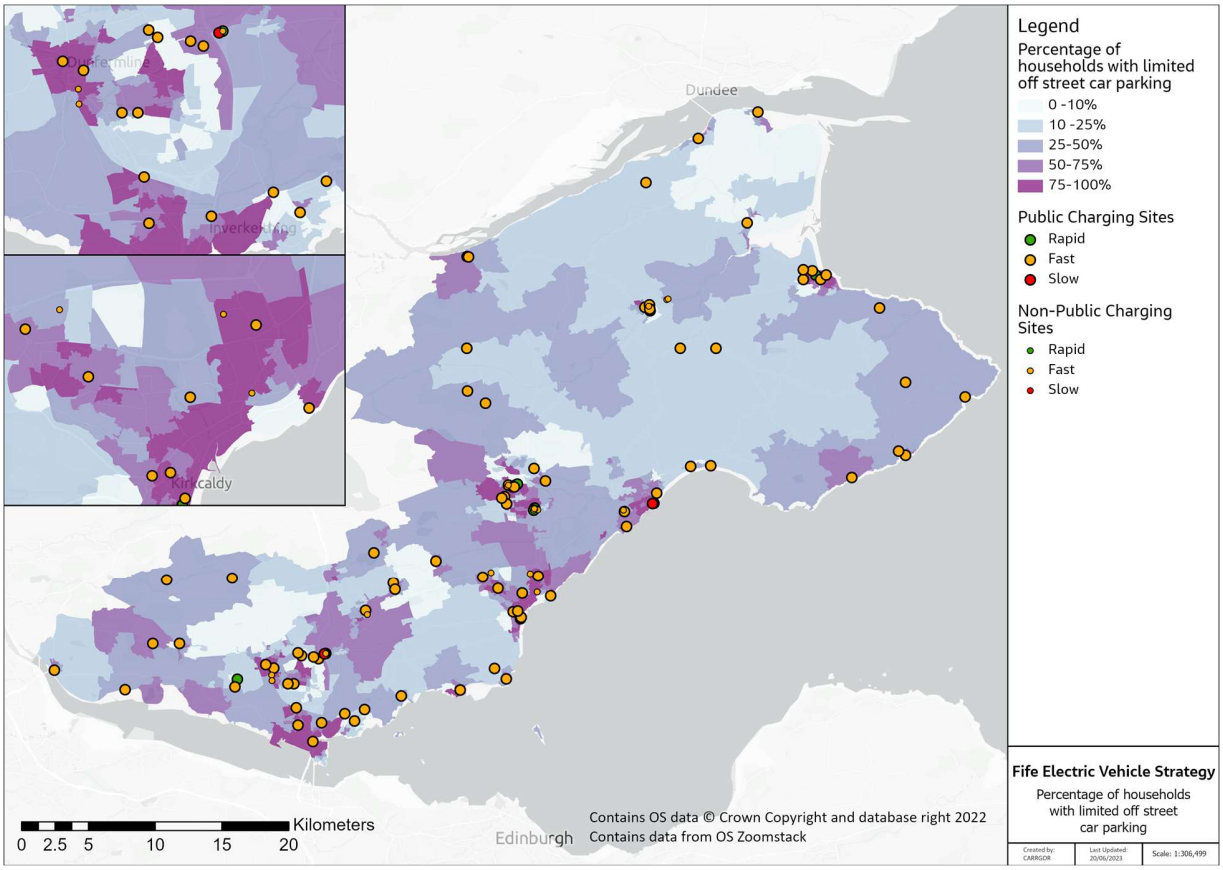
- Whole house or bungalow: Terraced (including end-terrace);
- Flat, maisonette or apartment: Purpose-built block of flats or tenement;
- Flat, maisonette or apartment: Part of a converted or shared house (including bed-sits);
- Flat, maisonette or apartment: In a commercial building; and
- Caravan or other mobile or temporary structure.

The output of this analysis has been mapped, and Figure 4-9 shows the density of dwellings with limited off-street parking in the main towns and key service centres in Fife, along with the existing charging points.

The majority of areas without off-street parking are concentrated in denser urban areas, including Dunfermline, Kirkcaldy and Glenrothes. In comparison, there is a lower concentration of areas without off-street parking in the less dense settlements across Fife including Strathkinness, Dalgety Bay, and Crossford where the population is more dispersed. Settlements with a high percentage of off-street parking in Fife are commonly associated with low levels of deprivation in accordance with the 2020 Scottish Index of Multiple Deprivation (SIMD).

[8] https://www.nomisweb.co.uk/

Figure 4-9 Existing Charging Points and Limited Off-Street Parking Availability



4.2.4 Electric Vehicle Uptake

Figure 4-10 shows the number of licensed EVs in Fife, broken down into BEV and PHEV by quarter from 2016 to the second quarter of 2022. As the chart shows, there has been a substantial increase in the number of licensed ULEV's in recent years, in particular over 2021 and 2022 where the number of BEVs have doubled.

Figure 4-10 Number of Licensed ULEVs in Fife by Quarter 2016 Q1 – 2022 Q2

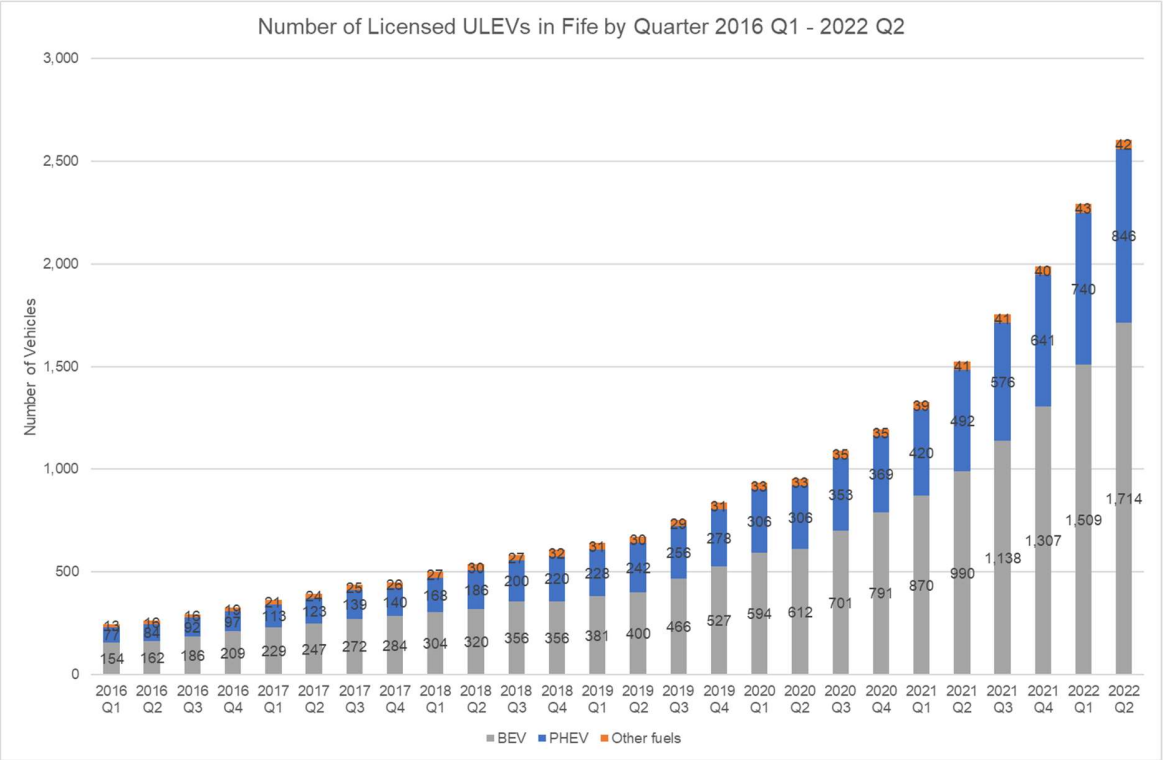


Figure 4-11 shows the number of licensed vehicles per 100,000 population for Fife and surrounding local authorities from 2014. The chart shows that there are approximately 600 licensed ULEVs per 100,000 people for Fife which is significantly lower than neighbouring Perth and Kinross which has approximately 900 licensed ULEVs per 100,000 people.

Figure 4-11 Number of ULEVs licensed per 100,000 population in Fife and Neighbouring Council Areas

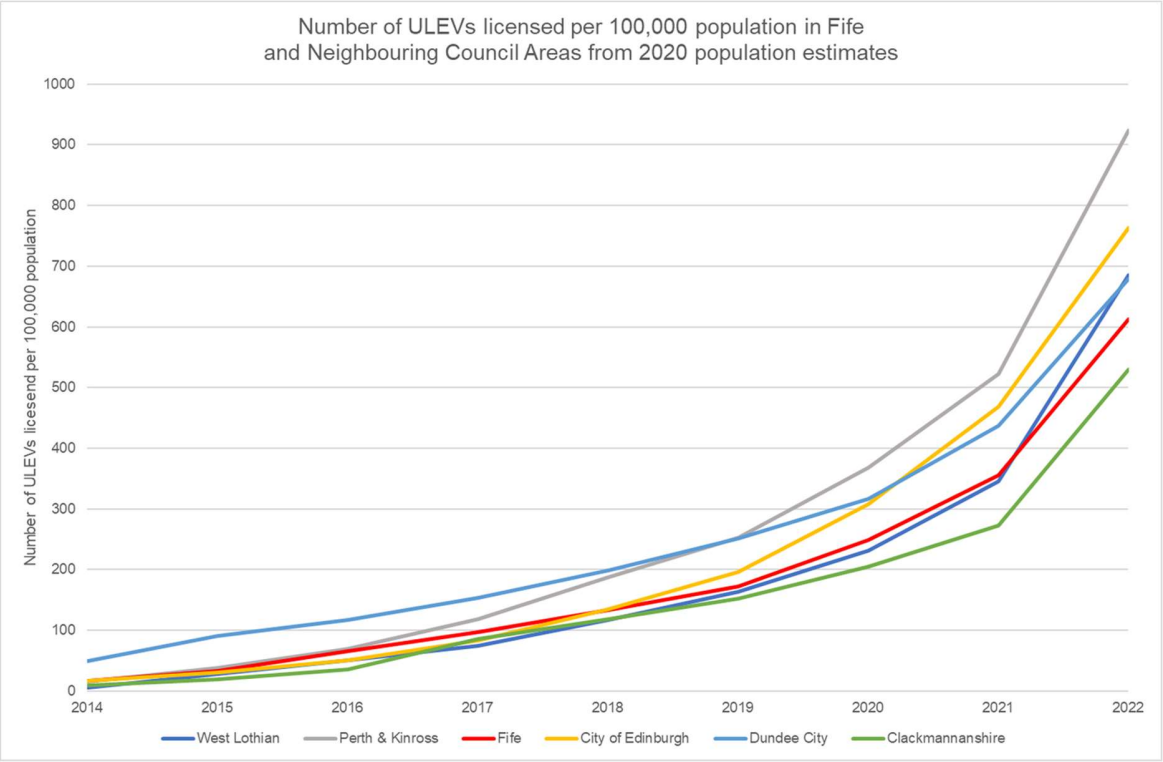
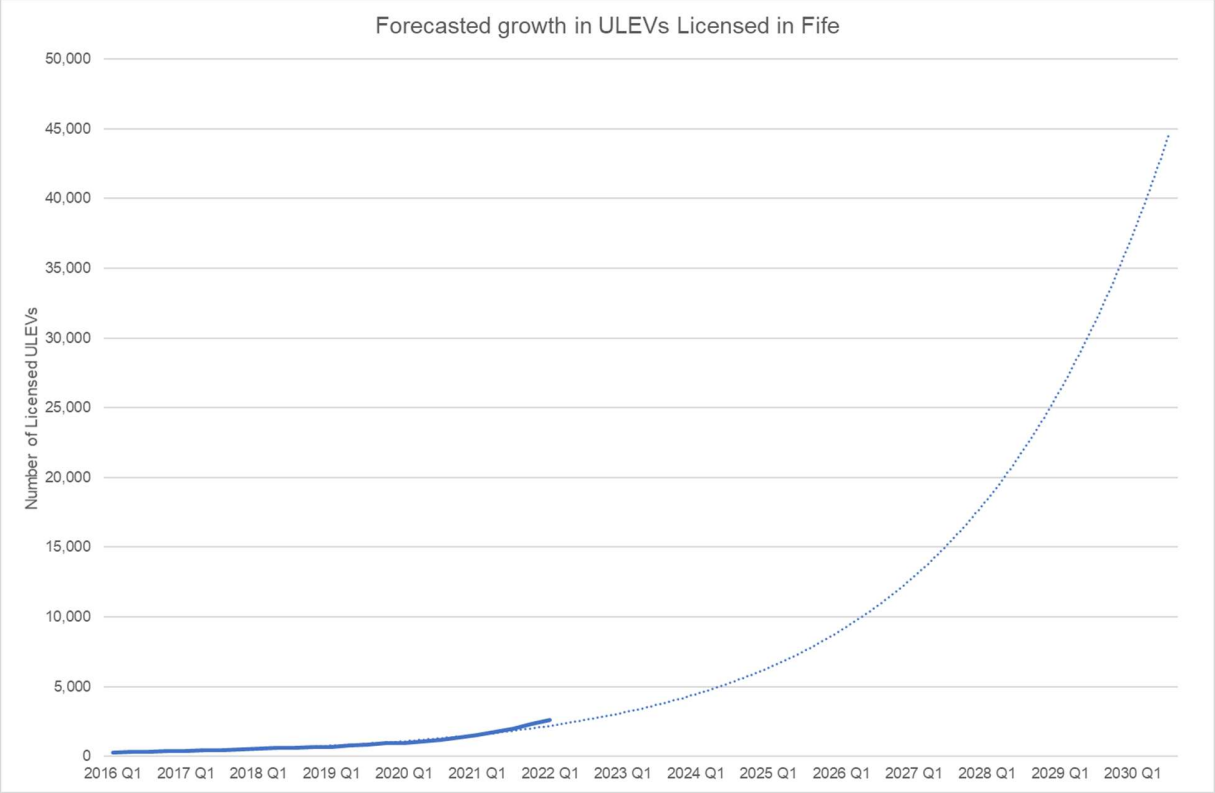


Figure 4-12 shows the number of registered EVs in Fife up to Quarter 2 of 2021 and a projected trend line to 2030 based on the historical growth curve between 2016 and 2022. The projected growth curve to 2030 for registered EVs in Fife would result in approximately 45,000 vehicles.

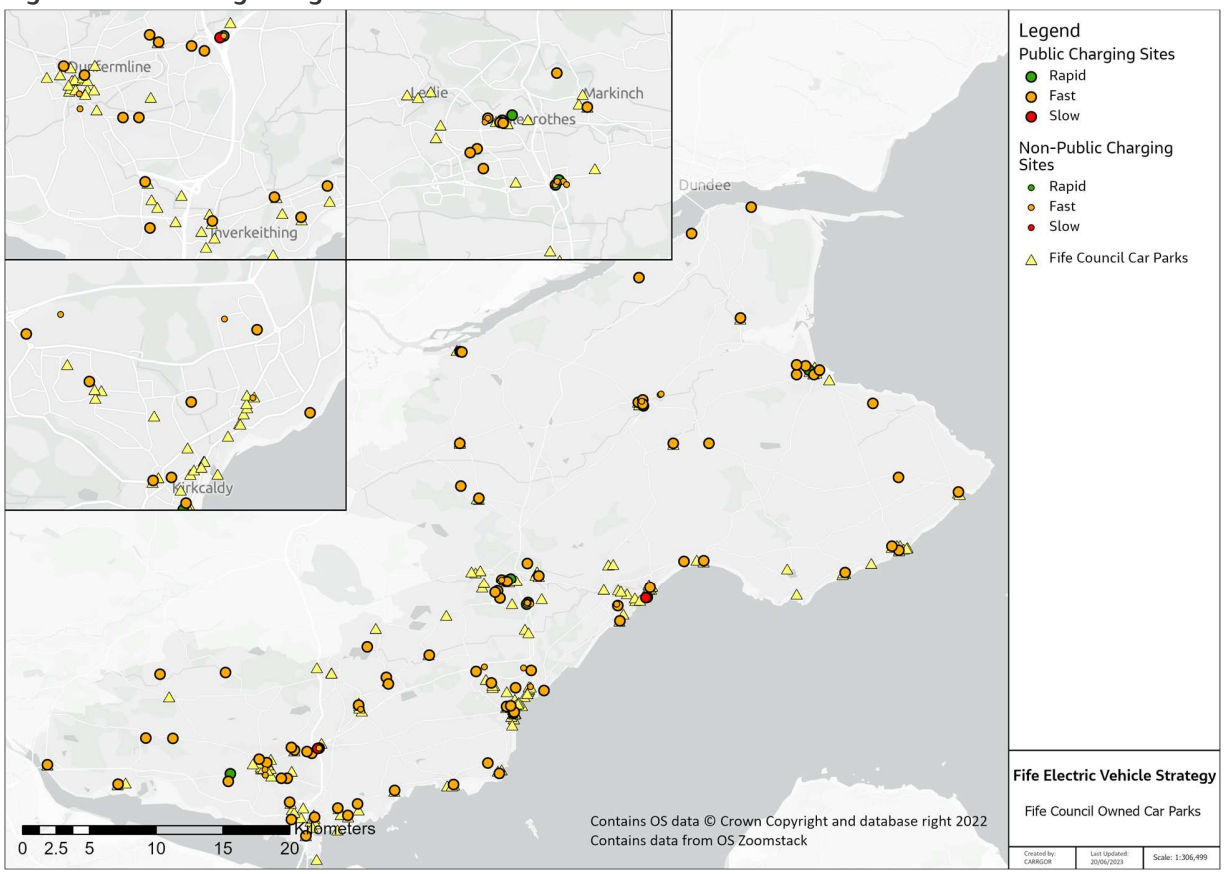
Figure 4-12 Forecasted growth in ULEVs Licensed in Fife



4.3 Council Owned Parking

One relatively straightforward way of increasing the provision of EV infrastructure is to utilise existing council owned car parks and provide charging posts at these sites. Figure 4-13 illustrates the council owned car parking within Fife alongside existing charge points in the area. Car Park data was provided from Fife Council.

Figure 4-13 Existing Charge Points and Fife Council Car Parks



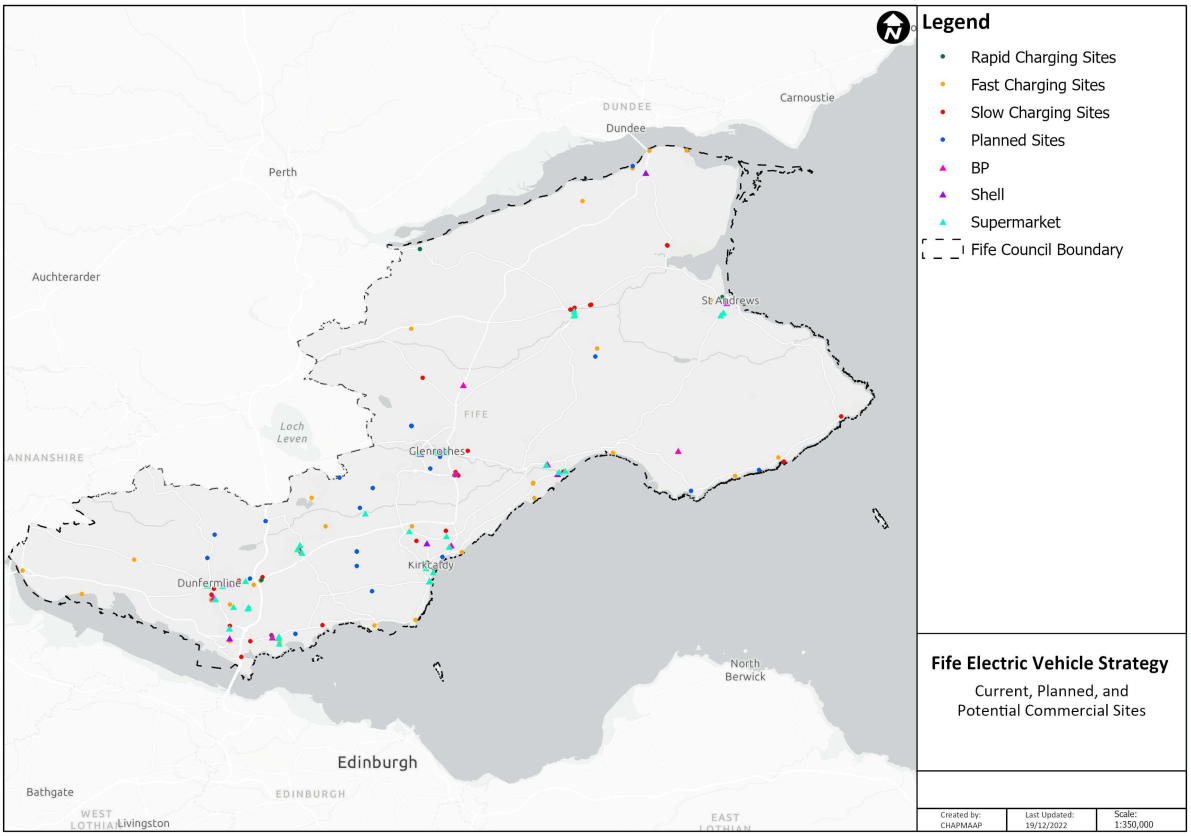
4.4 Potential Commercial Sites

One source of potential future public EV infrastructure is through commercial sites which are split into the following:

- BP and Shell forecourts as both companies have committed to installing charge points at their forecourts; and
- Supermarkets which are increasingly working with charge point operators to install charge points at their stores.

Figure 4-14 illustrates this alongside the future sites planned by Fife Council to highlight that there are more potential commercial sites in and around major population centres such as Dunfermline, Glenrothes, and Kirkcaldy with some commercial sites also in minor population centres like Leven, Cupar, and St Andrews.

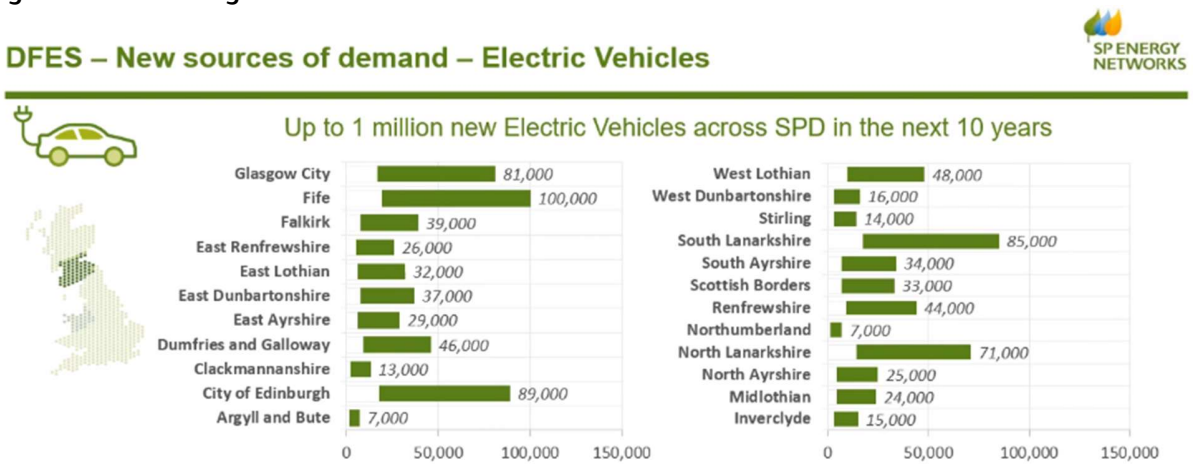
Figure 4-14 Existing, Planned, and Potential Commercial Sites



4.5 Initial High-Level Forecasting

Scottish Power Energy Networks (SPEN) have undertaken some high-level forecasting of potential demand for EV vehicles across Scotland over the next 10 years, as outlined below in **Figure 4-15**.

Figure 4-15 SPEN High Level Forecasts



This highlights that Fife is one of the locations in Scotland with the highest predicted potential EV demand and underlines the need for a strategy in order to set out the approach for new EV infrastructure.

Note that a more disaggregate and specifically Fife focused demand forecasting modelling exercise has been undertaken as part of this strategy which provides estimates of the EV charging need by use case and at a settlement level. This has been used in order to inform the site selection and wider strategy and is outlined in Sections 7 and 9.

5. Delivering an Accessible and Equitable Network

5.1 Equitable Network

This section discusses an equitable transition to EV charging infrastructure with Fife. This includes: design standards for charge points, how communities without access to home charging can access the public network at a fair tariff, geographical balance of the network, social impacts, and emerging technologies and best practice that is helping level up access to EV charge points.

5.1.1 Geographic Balance

The following figure sets out which settlements in Fife currently have public charging infrastructure. The current network is favoured in the more densely populated central and southern regions of Fife, in Glenrothes, Kirkcaldy and Dunfermline. There is a lack of charging infrastructure in the east and in some parts of the north and west where the settlements are sparsely populated.

Figure 5-1 Fife Settlement Hierarchy Split by Existing Charging Infrastructure

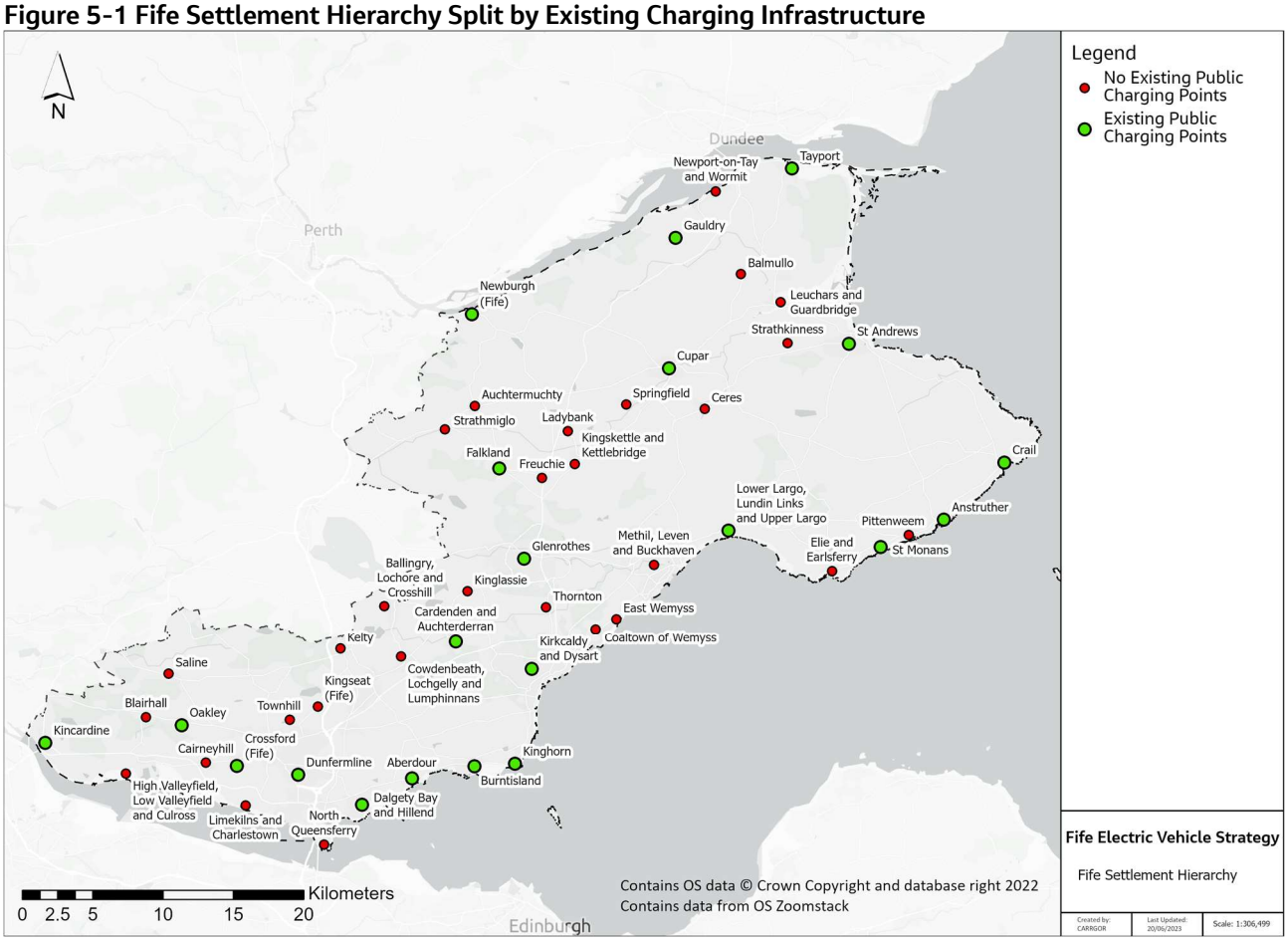


Table 5.1 details the Fife settlement hierarchy and identifies which settlements currently have public charging points. The primary centres; Dunfermline, Glenrothes and Kirkcaldy all have access to rapid charging points whilst the Secondary centres all have access to fast charging points. Less than 40% of the smaller towns and villages in Fife have access to an Electric vehicle charging point.

Table 5.1 Settlement existing charging infrastructure assessment and recommendations

Settlement	Existing Charging Infrastructure	Rapid	Fast	Trickle
Primary Centre				
Dunfermline	Yes	✓	✓	✓
Glenrothes	Yes	✓	✓	⊘
Kirkcaldy and Dysart	Yes	✓	✓	✓
Secondary Centre				
Cowdenbeath and Lumphinnans	Yes	⊘	⊘	✓
Cupar	Yes	✓	✓	✓
Dalgety Bay and Hillend	Yes	⊘	✓	✓
Leven	Yes	⊘	⊘	✓
Methil	Yes	⊘	✓	✓
Rosyth	Yes	⊘	⊘	✓
St Andrews	Yes	✓	✓	✓
Small Town				
Aberdour	Yes	⊘	⊘	✓
Anstruther	Yes	⊘	✓	✓
Auchtermuchty	Yes	⊘	✓	⊘
Ballingry, Lochore and Crosshill	Yes	⊘	✓	⊘
Balmullo	No	⊘	⊘	⊘
Blairhall	No	⊘	⊘	✓
Buckhaven	Yes	⊘	✓	⊘
Burntisland	Yes	⊘	✓	⊘
Cairneyhill	No	⊘	⊘	⊘
Cardenden and Auchterderran	Yes	⊘	✓	⊘
Carnock	No	⊘	⊘	⊘
Ceres	Yes	⊘	✓	⊘
Coaltown of Balgonie	No	⊘	⊘	⊘
Coaltown of Wemyss	No	⊘	⊘	⊘
Comrie (Fife)	No	⊘	⊘	⊘
Crail	Yes	⊘	✓	⊘
Crossford (Fife)	Yes	✓	✓	⊘
Crossgates	No	⊘	⊘	⊘
East Wemyss	No	⊘	⊘	⊘
Elie and Earlsferry	No	⊘	⊘	⊘
Falkland	Yes	⊘	⊘	✓
Freuchie	No	⊘	⊘	⊘
Gauldry	Yes	⊘	✓	⊘
Guardbridge	Yes	⊘	✓	⊘
High Valleyfield, Low Valleyfield and Culross	Yes	⊘	✓	⊘
Inverkeithing	Yes	⊘	⊘	✓
Kelty	No	⊘	⊘	⊘

Kennoway	No	⊘	⊘	⊘
Kincardine	Yes	⊘	✓	⊘
Kinghorn	Yes	⊘	✓	⊘
Kinglassie	No	⊘	⊘	⊘
Kingseat (Fife)	No	⊘	⊘	⊘
Kingskettle and Kettlebridge	No	⊘	⊘	⊘
Ladybank	No	⊘	⊘	⊘
Leslie	No	⊘	⊘	⊘
Leuchars	Yes	⊘	⊘	✓
Limekilns and Charlestown	No	⊘	⊘	⊘
Lochgelly	Yes	⊘	✓	⊘
Lower Largo, Lundin Links and Upper Largo	Yes	⊘	✓	⊘
Markinch	Yes	⊘	⊘	✓
Newburgh (Fife)	Yes	✓	✓	⊘
Newport-on-Tay and Wormit	Yes	⊘	✓	⊘
North Queensferry	No	⊘	⊘	⊘
Oakley	Yes	⊘	✓	⊘
Pittenweem	No	⊘	⊘	⊘
Saline	No	⊘	⊘	⊘
Springfield	No	⊘	⊘	⊘
St Monans	Yes	⊘	✓	⊘
Strathkinness	No	⊘	⊘	⊘
Strathmiglo	No	⊘	⊘	⊘
Tayport	Yes	⊘	✓	⊘
Torryburn and Newmills	No	⊘	⊘	⊘
Townhill	No	⊘	⊘	⊘
Windygates	No	⊘	⊘	⊘
Thornton	No	⊘	⊘	⊘

It will not necessarily be economically viable to deliver public charge point infrastructure in every small town and village. Instead, most EV charging should occur at private homes or where there is existing charge point provision. However, as part of delivering an equitable network, there may be a need in the future to install public infrastructure in some of the smaller towns and villages on a case-by-case basis in order to create a balanced network.

5.1.2 On-Street and Off-Street Parking the EV Charging Cost Disparity

Not all areas within Fife will have access to off-street parking. There is a significant advantage to having off-street parking when owning an EV as this means the owner can charge the vehicle from their own electricity supply on a tariff which is substantially cheaper than a public EV charge point. Moreover, a lack of off-street parking creates more demand for on-street parking and therefore an inconvenience if the on-street EV charge point cannot be accessed. Within Fife, many of the locations which do not have access to off-street charging correlates with areas with low-income housing. Using SIMD data, as well as other information such as the percentage of vehicles parking on-street, the nearest existing charging infrastructure and council housing stock a ranking was created to reflect deprived areas with limited off-street parking (as shown in Figure 4.9 above). The top three areas are listed in Table 5.2.

Table 5.2 Low Income Areas with no Off-Street Parking

Rank	Location
1	Kirkcaldy - Linktown
2	Burntisland - Burntisland Docks
3	Kirkcaldy - Gallatown West

Kirkcaldy – Linktown

Linktown is a residential area in Kirkcaldy made up of largely terraced housing and communal flats. Towards the north of the area there are detached and semidetached houses and bungalows with off-street car parking. Along the coast, existing centralised parking could be utilised to install EV infrastructure to serve the purpose-built flats.

Burntisland - Burntisland Docks

Burntisland Docks is largely an industrial area centred around the harbour docks near the town's only train station. In the north of the area, it is densely populated consisting of residents with terraced housing and flats. This area has limited access to off-street car parking with the majority of residents parking along the street. A small number of residents have access to a purpose-built car parking or have converted their garden to a parking space.

Kirkcaldy - Gallatown West

This is a residential area consisting largely of flats and semidetached houses with limited off-street car parking. Only 10% of households have access to off-street car parking and a small number of residents have converted their front gardens to accommodate a car parking space.

5.1.2.1 Cost Differential Example

A number of solutions are being trialled to enable home electricity supplies (and cheaper tariffs) to be used to charge EVs on the public highway. These solutions take a range of forms including gullies set into the pavement that carry cables from residential homes and bespoke sockets at the edge of the kerb that connect back to residential homes. Further evaluation of these solutions is required to determine their applicability and suitability to the particular highways contexts in Fife including appetite for risk and maintenance/ operational liabilities.

According to Ofgem, the average electricity bill in the UK was around £764 per year for 2021 however this will be significantly higher for 2022 as the energy price cap rose from April 1st, 2022. This means that households on default tariffs paying a direct debit will see an increase of approximately 54 percent for both electricity and gas. These figures translate into unit costs of £0.28 per kWh for electricity for 2022[9].

To fully charge an EV at home, with the example of a Nissan LEAF (2018) with a 40kWh battery size, it would cost approximately £11.20. This full charge would provide an approximate 'real-world' range of 168 miles meaning that it would cost 6.67 pence per mile[10]. The cost of installing a home charger for an EV must also be taken into account. This can typically cost between £800 to £1500 depending on the home charger installer and the choice of charge model opted for[11].

According to pod point, most public network chargers range from being free to one of the most expensive ways to charge an EV. As of April 2022, the cost of charging at a public charge point is approximately £0.44 per kWh. This is supported by Shell Recharge as the price per kWh for a fast charger on their network is £0.45/kWh[12], however looking at examples on Zap-Map in Fife, there are a number of the Chargeplace Scotland sites which are significantly cheaper with a range between £0.12p/kWh and £0.29p/kWh. However, it should be noted that

9 https://www.ofgem.gov.uk/publications/price-cap-increase-ps693-april

10 https://pod-point.com/guides/driver/cost-of-charging-electric-car#:~:text=Average%20domestic%20electricity%20rate%20in,about%20200%20miles%20of%20range.

11 https://www.drive-electric.co.uk/guides/charging/how-much-does-it-cost-to-get-an-electric-charger-installed-at-home/

12 https://shellrecharge.com/en-gb/public-charging/public-charging-tariffs

with the emphasis of new Transport Scotland funding streams on commercial viability, levels this far below typical UK market pricing is unlikely to last as operators look to make a profit and therefore the price would be expected to rise. For the Nissan LEAF with a 40kWh battery size, on a £0.44 per kWh tariff, it would cost approximately £17.60 to fully charge for the same 'real world' range of 168 miles. This equates to 10.47 pence per mile[13].

Over the course of 2019, the average car mileage for the UK was 7,400 miles14. In 2020, this dropped to 6,800 miles however this reflects the impacts of the COVID-19 pandemic lockdown. Therefore, the cost of driving the average miles in the UK when charging an EV at home would be approximately £493.58 per year at 6.67 pence per mile. In comparison, the cost of driving the average miles when charging an EV using a public charge point would be approximately £774.78 per year at 10.47 pence per mile.

Home Charging Stations[15] provides an online tool that estimates a breakeven timeframe for charging at home versus using the public charge point network. Using the figures outlined above, estimating the average cost of installing a home charger at £1150, the breakeven is approx. 3 years and 6 months. After this point, the EV driver may begin to save money by having a home charger installed, however this depends on a number of factors such as energy prices, the prices for public charging and the energy consumption of the specific driver and the EV.

5.1.3 Potential Impacts on Social Characteristics

This section will provide a summary of the potential impacts of varying policy or strategy choices for the provision of EV infrastructure.

Table 5.3. Potential Impacts on Protected Characteristics

Is there an actual or potential positive/ neutral/ negative impact on these specific characteristics?								
Age	Y		Marriage & Civil Partnership		N	Religion & Belief		N
Disability	Y		Pregnancy & Maternity	Y		Sex	Y	
Gender Reassignment		N	Race		N	Sexual Orientation		N

Table 5.4. Potential Impacts on Public Health Characteristics

Is there an actual or potential positive/ neutral/ negative impact on these specific public health characteristics?								
Other Vulnerable & Disadvantaged Groups	Y		Social & Economic	Y		Mental Health & Wellbeing	Y	
Health Inequalities	Y		Physical Health	Y		Access to Services	Y	

Table 5.3 and Table 5.4 above have been identified as characteristics that could be impacted on, whether positively and/or negatively, by the installation of EV charging infrastructure. The more rural nature of Fife has potential to create social disadvantages for some communities living there due to isolation from urban areas

13 https://pod-point.com/guides/driver/cost-of-charging-electric-car#:~:text=Average%20domestic%20electricity%20rate%20in,about%20200%20miles%20of%20range.

14 https://www.nimblefins.co.uk/cheap-car-insurance/average-car-mileage-uk#:~:text=Average%20Mileage%20per%20Day%2C%20Week%2C%20Month%20and%20Year&text=On%20a%20daily%20basis%2C%20cars,and%207%2C400%20miles%20a%20year.

15 https://www.homechargingstations.com/cost-home-charging-vs-public-charging/

and services. The urban areas are more likely to have easier and more convenient access to a public EV charge point, whereas in the rural areas, CPOs are less likely to install infrastructure due to the lack of perceived demand as rural areas are less densely populated than urban areas. The characteristics marked with an N are not deemed applicable.

5.1.4 Mitigations

The table below outlines some of the potential mitigations which can be used to provide an equitable network when considering the above characteristics.

Table 5.5. Recommended Mitigating Actions

	Age	Disability	Pregnancy & Maternity	Sex	Other Vulnerable & Disadvantaged Groups	Health Inequalities	Social & Economic	Physical Health	Mental Health & Wellbeing	Access to Services
Engage with a wide range of stakeholders and umbrella groups as part of developing Fife's ULEV/EV strategy to ascertain their feedback and inform strategy development (please see separate list below)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Consider how charging infrastructure can be provided for residents who do not have off-street parking whilst avoiding negative impacts from impacting footway users. A place-based approach is recommended within Fife which considers nature of property types, income levels and the public highway	✓	✓	✓		✓					✓
Consider how the cost differential between charging from home and charging on publicly available infrastructure can be addressed or mitigated, especially for areas of low income housing with no off-street parking. E.g., Kirkcaldy – Linktown, Burntisland Docks					✓		✓			✓

Mitigating Action	Characteristics									
and Kirkcaldy - Gallatown West										
Establish a clear policy on trailing cables being used as a temporary solution to charge EVs and the enforcement protocols needed	✓	✓	✓							
Ensure the design and functionality of charge points on behalf of Fife Council and partner organisations is clear, accessible, and easy to use. Consideration should be given to whether all charge points and/or charge points installed in disabled parking bays adhere to the emerging BSI standards for accessible charge points.	✓	✓								
Ensure all charging infrastructure is installed in safe and secure areas with good lighting and in a way that is accessible for everyone, i.e., on a dropped kerb		✓		✓	✓					
Consider how charging infrastructure can be provided in areas not currently attractive to the private sector (due to rurality or perceived lack of demand due to lower incomes)					✓	✓	✓			

Mitigating Action	Characteristics									
Ensure that EVs sit within the wider transport hierarchy and modal shift occurs to active travel and public transport where feasible. Fife's Active Travel strategy notes the potential for modal shift in the main settlements where some journeys are less than 5km.					✓			✓	✓	✓
Monitor usage of all public charge points and assess customer feedback	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

5.1.5 Accessible Charge Points

5.1.5.1 Emerging BSI Standards

Although charge point technology and design has improved over the last 10 years challenges still remain for people with disabilities and the overall consumer experience does not always meet expectations, with many frustrations reported by EV owners. Current charge point challenges include:

- Charge point design, including challenges for some group using this equipment due to its height, space around the charge point, bollards, confusing interfaces, heavy cables, lack of cable management systems, and connectors that require significant force to be applied for a successful connection.
- The built environment surrounding charge points that lacks signage, uses unclear or confusing language, high kerbs, limited space around the vehicle, and poor placement of the charge point relative to the kerb/bay.
- Charge points being located in remote and dark areas with no CCTV or lighting.

To address these issues the BSI is due to publish new standards for EV charge points to ensure they are accessible and meet consumer's needs. The standards will be important for improving the overall customer experience and to ensure people with disabilities can access charge points. The standards will cover publicly available charge points including the equipment, the surrounding build environment, signage, and information provided to consumers. A previous consultation has been held with key disability and EV charging stakeholders, and the standards were published in October 2022.

5.1.5.2 Fully Accessible Charge Points

There are limited examples of charge points that adhere to the standards likely to be published shortly by the BSI, however product design consultancy Duku claim their solutions is likely to fully adhere., with Figure 5-2 showing the Duku EV charge point designs.

Figure 5-2. The Duku EV Charge Points – Unlocking Accessibility, Domestic and UE ONE MK3 Pop-Up

A feasibility project was undertaken to ensure that accessibility was considered during the design process in line with the emerging BSI standards for the world's first accessible EV charger. The 'Unlocking Accessibility' chargers, shown on the left in Figure 5-2 are fast chargers (7-22kW) and can be replaced in approximately 10 minutes due to modular mounting methods and the plug and play system. Features of the charge point infrastructure that makes it more accessible include:

- An automatic, motorised cable management system that allows the charging cable to coil and uncoil without manual force needing to be applied.
- No collision barriers surrounding the charge point due to the impact resistant base that protects the unit from damage.
- High visibility with colour coded key features, ambient lighting, and a tap to pay interface that removes the requirement for touchscreens and apps.

The domestic 7kW charger, centre image in Figure 5-2, is available as a socket or a tethered cable and is capable of being wall or pedestal mounted. The socket is protected by a sliding socket cover. The Domestic Charger has smart charging functionality and is compatible with home automation systems such as Alexa or Google Home, allowing for charging sessions to be scheduled and controlled with remote starting and stopping.

Finally, the image on the right of Figure 5-2 shows the UE ONE MK3 pop-up charger which has been installed throughout Plymouth as part of an Innovate UK funded project and builds on the MK1 and MK2 chargers previously installed in Oxford and Dundee respectively. The charger is flush with the pavement and extends to 900mm high when initiated via an app. Given the patchy mobile reception in some areas of Fife, this method may not be appropriate universally.

5.2 Summary

This accessibility and equitability assessment highlights several key findings to be considered when providing EV charging post infrastructure. This includes:

- Geographic balance: As identified above the primary centres and secondary centres in Fife all have access to fast charging points. However, less than 40% of the smaller towns and villages in Fife have access to an Electric vehicle charging point. As such, new public EV charging post infrastructure will need to be delivered in a way that offers equal access to all.
- On-Street and Off-Street Parking the EV Charging Cost Disparity: The costing example above illustrates that on average it is cheaper to charge an EV from home rather than using the public network. Consideration will be needed for areas with limited off-street parking so that charging can occur at a fair price.
- Social characteristics: Potential impacts on social characteristics are outlined such as ensuring that EV charging post infrastructure is accessible to all. An example of a fully accessible charging post is Duku EV.

5.3 Encouraging Sustainable and Active Travel

5.3.1 Introduction

The Climate Change Act means that the UK must achieve net-zero carbon dioxide emissions by 2050. The CCC's Sixth Carbon Budget (2020) sets the limit on allowed UK territorial greenhouse gas emissions over the period 2033 to 2037. The latest budget requires a 78% reduction by 2035. As such, there will need to be a step change in the way people and goods are transported. A chapter in the associated Methodology Report focusses on surface transport and recommends a swift and sharp increase in EV infrastructure to facilitate EV take up.

Around 10% of the emissions saving in the Balanced Pathway in 2035 comes from changes that reduce demand for carbon-intensive activity. This is important given surface transport is currently the UK's highest emitting sector. Equally important will be embedding sustainable transport as a viable alternative to the current dependency on ICE vehicles.

Finally, there is a consistent policy mandate at all levels for reducing car travel for example at a national level the DfT's Decarbonisation Strategy (2021) states that cycling and walking should be the natural choice for shorter trips. This same message is reiterated in Scotland's Public Electric Vehicle Charging Network Strategy (2022). Fife's Local Transport Strategy (2023 - 2033) states a key objective in the strategy is to 'enable the fair roll-out of electric vehicle charging to provide appropriate numbers of chargers and levels of reliability as demand increases'[16]. Furthermore, the Local Transport Strategy also seeks to ensure that a fair transition to EVs is not at the expense of a modal shift to active modes and in reducing the need to travel (where possible). As such, EVs have an important role to play in the future of mobility but are only part of the solution.

It should also be noted that as well as the importance of decarbonisation as a driver to switch to active travel, there are also other individual factors such as personal health, economic and quality of life. This ties into concepts in Scotland's National Planning Framework (NPF) such as the 20-minute neighbourhood. However, the rural nature of many parts of Fife means that a certain level of personal car use will still be expected in the smaller, less accessible villages.

The remainder of this section outlines some wider mobility concepts that EV charge points could support across Fife.

5.3.2 E-Car Clubs

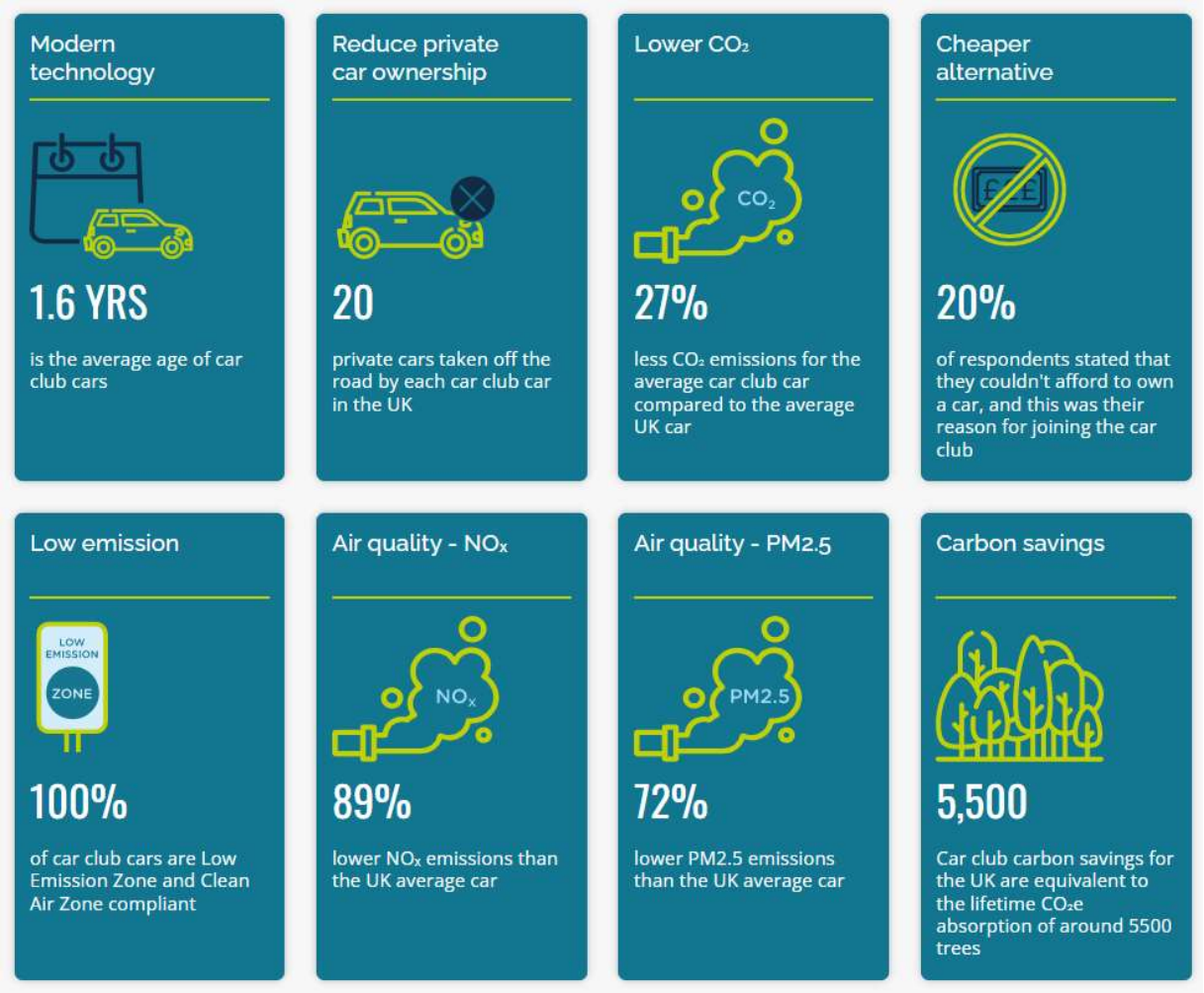
Car clubs are short-term car rental services that allow members access to locally parked cars and pay by the minute, hour, or day. 1999 saw the first formal commercial car clubs charging by the hour and by distance. As of March 2022, there were 297,172 active car club members in the UK. There are nearly 5,000 car club vehicles around the UK and 418 of them in Scotland[17]. The development of EVs now mean that E-Car Clubs are becoming increasingly prevalent.

5.3.2.1 Benefits

Collaborative Mobility UK (CoMoUK), the national charity for shared transport, produces an annual report on car club research – the key benefits of E-Car Clubs are summarised below in Figure 5-3. The figure illustrates that car clubs offer a range of environmental, social, and economic benefits.

[16] https://www.fife.gov.uk/__data/assets/pdf_file/0020/450155/Local-Transport-Strategy-for-Fife-2023-2033-draft-for-consultation-v2.pdf
[17] CoMoUK, https://www.como.org.uk/shared-cars/overview-and-benefits

Figure 5-3. CoMoUK Benefits of Car Clubs, Key Findings



5.3.2.2 Car and E-Bike Sharing

Fife Council have teamed up with South East Scotland Transport Partnership (SEStran) to develop the Tripshare Fife Carshare scheme, which is a free and user-friendly website that links people making the same or similar journeys (either as part of a regular commute or as a one-off journey).

The following case studies highlight the successes and benefits of car sharing and e-bike sharing schemes from other locations across the country, providing examples of potential enhancements for Fife.

5.3.2.2.1 Moray Carshare and E-Bike Share Case Study

The Moray Carshare scheme was founded in 2007 with 15 member and 3 cars. The community-based car club's mission is to provide convenient and affordable transport options that minimise environmental damage and encourage social cohesion.

Moray Carshare scheme enables users to book and drive in: Findhorn, Forres, Kinloss, and Aberlour/Craigellachie. 1/3 of the fleet is electric and all other vehicles are low emissions. To date there are now 15 vehicles available and over 300 members. The Moray E-bike scheme also sits alongside allowing users to travel greater distances in comparison to regular cycling. 14 E-bikes can be found in Findhorn, Forres, Kinloss and Aberlour/Craigellachie.

5.3.2.2.2 Exeter and the South West – Co-Cars and Co-Bikes Case Study

In 2019, a successful funding bid to innovate the UK, known as The Local Sustainable Transport Fund (LSTF) enabled Devon County Council and a consortium of private sector partners to install and operate several on-street electric vehicle charge points.

Co-Cars is the hire-by-the-hour car club fleet for people, communities and businesses across Exeter and the South West. Co-Cars runs the largest car club fleet of low emission petrol, hybrid and electric vehicles within the area offering a smarter and affordable alternative to private car ownership. Users can start their Co-Car journey in four easy steps: join, book, unlock and drive, only paying for the hours they drive.

Similarly, Co-Bikes is an on demand electric bike scheme across Exeter and the South West helping to reduce congestion and pollution and encourage active travel choices. Users can register via the app, rent, ride, and return from £2 per hour. Co-Bikes also offers various package bundles where users are free to use their minutes how and when they choose. For example, the 'Corporate Bike rider – Bikeride900' provides employees with 900 minutes of cycling for £25 which can be used at any time, helping employees to make healthy, zero carbon active travel choices as they commute to work.

5.3.2.2.3 Derwent Valley Car Club, County Durham Car Club and E-Bike Case Study

The Derwent Valley Car Club, based in Blackhall Mill, has been funded with a grant of £47,500 from the National Lottery's Village SOS Programme. The grant has enabled the development of the Car Club and the purchase of an electric Nissan Leaf. The car is based at the Blackhall Mill Community Centre, which hosts an electric charge point for the car and a public charge point. The grant also provided of an array of PV (solar) panels, which offsets the electrical charging needed to run the vehicle making the car club emission free. The Club is currently operated under the Blackhall Mill Community Association and will be developed into a member led Social Enterprise scheme made up of interested local people and will link in with other car clubs in the region. The Club is open to anyone in the local area and costs from £3 to use the car for an hour with no additional mileage fees. As part of the Car Club a Volunteer Driver Scheme has been developed for people who cannot drive themselves. The Club are looking for volunteers to assist in the development and running of the Car Club and volunteer drivers.

Electric Bike Hire – the club also have 3 electric bikes to hire from £2.50 per hour. To use the car, bikes or the voluntary driver scheme users need to join the car club which costs £5 per month which is refunded against usage of the bikes, car, or driver scheme.

5.3.3 Mobility Hubs

CoMoUK[18] define Mobility Hubs as follows:

"Mobility hubs are highly visible, safe, and accessible spaces where public, shared, and active travel modes are co-located alongside improvements to public realm and where relevant enhanced community facilities. The redesign and reallocation of space from the private car, is intended to enhance the experience of travellers as well as benefiting residents and businesses."

SEStran[19] are working in partnership with Fife Council to identify opportunities to implement Mobility Hubs in the East Fife area. As part of this work, technical assessments and business cases were prepared which support the implementation of Mobility Hubs at the following locations:

- St Andrews;
- Leuchars; and

[18] https://como.org.uk/shared-mobility/mobility-hubs/what/
[19] https://sestran.gov.uk/wp-content/uploads/2020/05/SEStran-Mobility-Hubs-Strategic-Study-Final-Report.pdf

- Leven and Cameron Bridge.

Two successful examples from elsewhere are detailed below, which Fife could look to incorporate at the locations above and with EV charge point infrastructure, therefore not relying completely on EVs.

5.3.3.1 The O2 Arena, BP mobility hub

This is a small-scale transport hub where different sustainable and shared transport modes are linked with one another. Key components are:

- Car club parking bays;
- High-quality cycle parking;
- Proximity to a public transport stop;
- Safety features such as good lighting; and
- Access for all.

5.3.3.2 Plymouth mobility hub network

The aim of this scheme is to deliver up to 50 multi-modal hubs across Plymouth to enhance connectivity and carbon reduction. These hubs will be strategically integrated into the public transport network and contribute to local community needs. The network of hubs aims to provide:

- 300 electric vehicle charging points;
- 400 e-bikes;
- Car club bays;
- 0.5 megawatts of solar carports; and
- A smart journey planning system.

5.4 Summary

This accessibility and equitability assessment highlights several key findings to be considered when providing EV charge point infrastructure. This includes:

- Fife's Local Transport Strategy highlights the importance of rolling out a fair and just transition to EVs, but not to the detriment of building upon walking and cycling growth, especially in the main settlements where many journeys can be less than 5km.
- E-car clubs and mobility hubs should be considered to complement EV charge point infrastructure and not embed EV dependency. Fife should consider the successes of schemes elsewhere in the country.
- Mobility hubs offer a potential solution to the integration of EV and public transport and hubs of different scopes and sizes are currently being implemented/planned within the wider UK.

6. Stakeholder Engagement

Building on the evidence base, experience has shown that stakeholder engagement and feedback is a crucial component to obtaining local knowledge regarding the region's EV context. This section outlines a number of stakeholder events which have been conducted within the context of Fife's EV strategy and their key findings.

6.1 Key Stakeholders

6.1.1 Workshop with Fife Council Officers and NHS Fife

A workshop was undertaken on the 17th of November 2022, with Fife Council officers; NHS Fife; and Jacobs Consultants. The following section summarises the key themes that were discussed at the workshop:

- Importance of ensuring all council strategies are linked together, particularly those that are potentially contradictory e.g. car-km 20% reduction targets and sustainable transport hierarchy;
- Importance of a fair EV pricing structure in order to aid a just transition;
- Managing competition for grid capacity between various interests e.g. heat pumps and EVs;
- Consideration of the implications and challenges associated with multiple residential properties linked to a single grid supply point;
- Consideration of grid constraints and the requirement to work closely with DNOs;
- Consideration of the difficulty in managing on-street provision at locations where there are existing parking issues and the need to maintain fairness. Examples of existing similar issues when proposing disabled parking bays;
- Importance of ensuring the correct mix of charging speeds; and
- Consideration of units on carriageway rather than on already constrained footways (when considering on-street residential provision).

6.1.2 Fife Council Land and Air Quality

An additional call was held with the Fife Council Land and Air Quality team to discuss the strategy, with a summary of the key points of the discussion outlined below:

- Ensure the following documents are considered within the strategy:
    - Air Quality Strategy for Fife 2021-2025
    - Air Quality Action Plan – Bonnygate
    - Air Quality Action Plan – Appin Crescent.
- Imperative that all complementary council strategies are properly aligned and take cognisance of each other;

- Good existing EV provision at 2 Air Quality Management Areas (Bonnygate, Cupar and Appin Crescent, Dunfermline), so focus should be on locations with borderline air quality while ensuring a comprehensive spread across the council area.;

- Must maintain a focus on modal shift and not simply conversion to EVs;

6.1.3 Fife Council Climate and Energy

A separate call was held with the Fife Council Climate and Energy team, who could not attend the stakeholder workshop, to discuss the strategy, with a summary of the key points of the discussion outlined below:

- Already working with SPEN to consider how best to link households that use heat pumps and EVs and understand usage requirements and required levels of future proofing in capacity. Consider how EV strategy fits into this – let the Strategy confirm what Fife want to deliver and allow SPEN to confirm how and when (maintaining flexibility);

- The strategy must consider energy as a whole system – how much is required to deliver the strategy (demand); how much is available (supply); and where is the available supply (if it's in the wrong place then need to move and store). Energy trade-offs will be required when identifying sites;

- Need to constantly consider the differences in cost and carbon footprint between fuel vehicles and EVs to encourage people to transition – presenting the differences in cost per mile will ensure people carefully consider transitioning;

- Ensure the strategy takes cognisance of Fife Climate Change Strategy and is 'climate friendly; climate ready; and climate just.' Need to ensure EVs are implemented in a way that is fair and equitable and caters for all communities across Fife (not just for the wealthier in society). Careful consideration on how to help more deprived communities' transition.

6.1.4 Fife Council Roads Network Management

- Concerns around the provision of on-street charging, particularly risks associated with charging infrastructure, particularly cables, creating a trip hazard on the footway and risks to visually impaired;

- Furthermore, this is likely to exacerbate the existing on-street parking issues (multiple cars per household in many areas). There are no issues with Fife Council identifying an on-street locations as a hub, but the challenge will be dealing with displaced vehicles that currently park on these spaces given there are already parking demand constraints. Additional challenge will be ensuring only vehicles charging park in EV spaces, with enforcement and penalties required; and

- Suggestion, given the risks associated with on-street charging in Fife, that destination charging is much more appropriate and less problematic, as long as the most practicable and accessible locations are selected.

6.1.5 Fife Council Street Lighting Team

An additional call was held with the Fife Council Street Lighting team on 21st December 2022 to discuss the strategy, with a summary of the key points of the discussion outlined below:

- There are a number of significant difficulties around powering chargers from lighting columns, most notably power capacity given the power required for street lighting is significantly less than for EV chargers;

- Also issues to overcome around the different earthing systems that would be required, with safety a particular concern; and
- The view of the Street Lighting team is that there are significant technical issues to overcome, therefore charging EVs via lighting columns is not recommended.

6.2 DNO Engagement

6.2.1 Scottish Power Energy Networks (SPEN)

A call was undertaken on the 21st of November 2022, with Jacobs Consultants and contacts at SPEN, with the following section summarising the key points of the discussion:

- Consideration of grid performance;
    - North east Fife is subject to significant capacity constraints, however more capacity is expected in St Andrews from 2026, through the delivery of a new substation.
    - The network around Leven is under stress, however improvements are programmed (to timeline provided).
    - Good levels of grid performance in Kirkcaldy and Dunfermline.
    - The network to the south of Dunfermline is constrained, with no details provided on any programmed improvements.
- Consideration of current approach to grid capacity involves just providing enough and it will take time to transition to an approach that future proofs to accommodate increased demand;
- Consideration of time constraints in providing new substations as a result of difficulties in obtaining equipment and buying land. Current estimates are 3 years for a secondary substation and 9 years for a primary substation;
- Promptly provide SPEN with details of location of proposed sites (including number of charge points and type) and they will undertake a feasibility study to determine any grid constraints; and
- Rolling out individual charge points for any residential units currently as part of a loop service, however this will take considerable time to roll out given the number of properties that are linked.

6.3 Conversations with Charging Point Operators

Further to the above, one-on-one conversations have also been conducted across a range of commercial Charging post Operators (CPO) to discuss their interest in Fife. This has included the following organisations:

- Ubitricity;
- Connected Kerb;
- Charge My Street;
- Osprey;

- For:EV;
- Urban Electric;
- Cha-rgy
- Trojan Energy;
- Liberty Charge; and
- Swarco

A summary of the key points from the engagement with all CPOs is presented below:

6.3.1 Ubitricity

- Keen to install infrastructure in Fife;
- Can provide residential solutions (lamppost charging) – don't want to add to footway clutter;
- Currently undertaking a small scale pilot with Argyll and Bute Council using satellite bollard (traditional style bollard) that brings power to front of kerb;
- 5kW – focus on charging through the day or night (average session 4-6 hours). Costs significantly less than others as don't have large and bulky equipment (lamppost less that £1k and bollard £1.2 – 1.5k);
- Have access to shell solutions – so can access different infrastructure (up to 22kW if required) Would pay Fife Council rental charge of £20 / site per year and 10% of charge revenue;
- Can draw excess power from lighting columns to charge EV and not impact on operation of lighting. Can always draw power when lights are off (capped at 5kW);
- Low power and a low cost enables the possibility of mass rollout; and
- 15 + 2 year contract (can match and top up if govt funding available or can provide a fully funded offering).

6.3.2 Connected Kerb

- Keen to install infrastructure in Fife, however, provide residential charging only;
- Modular 7 or 22kW single or dualled unit and all key elements are below ground, therefore easy to replace if damage above ground;
- View is that Local Authorities shouldn't be installing 22kW chargers as this only caters for a small number of cars / more affluent sections of the population;
- Provision in Local Authority car parks along with on-street residential offering;
- Flexible funding model, including fully funded option (but while this reduces the risk for the Local Authority, it limits the ability to share in profits);
- 20 (+5) year contract – may reduce to 15 years depending on the amount of risk;

- Pay-as-you-go app based payment system (can link to RFID card);
- Happy to go to more remote locations (and offset with more profitable sites);
- Can provide what's needed now and build in future proofing (all civils done and DNO connection in place);
- Happy to aggregate demand with other sectors e.g. NHS Fife; and
- Software can be updated remotely to ensure they keep on top of technological advancements.

6.3.3 Charge My Street

- Keen to install infrastructure in Fife and have already undertaken some feasibility work in Saline;
- They are a social enterprise, meaning any profits are channelled back into new infrastructure to help communities;
- Install fast chargers (7kW & 22kW) and are getting better at utilising existing supply e.g. community centres;
- Free standing, pedestal or wall-mounted infrastructure offerings;
- Focus on locations that have communal parking (public car parks) as do not deliver on-street infrastructure;
- Specialise in rural areas (make sure provision is fair and seeks to benefit those that don't have off-street provision) – 5 mins from somewhere that doesn't have access to off-street charging;
- Local Authorities suggest sites and the public have the opportunity to identify sites also via an online feasibility study (the final provision is a mixture of both);
- 7-10 year contract;
- Happy to work as part of a team with other CPOs;
- App based payment (subscription options and pay-as-you-go); and
- Use of team of local volunteers called 'charge point champions' to support back office staff.

6.3.4 Osprey

- Keen to install infrastructure in Fife;
- Switched on in terms of where chargers should go, so would be looking to augment the findings of this strategy;
- DC rapid charging focus but where appropriate can implement AC (7kW-22kW);
- Compact site - 75kW (where there's connection) with 3 as minimum number of points (15 year lease);
- Hub site – minimum of 6 (up to 32) – up to 150kW rapids that are load balanced (25 year lease);

- Fully funded (no risk to council). Share revenue with council (typically 15-20%) and will put together proposal with revenue forecasting. All costs and grid connections covered by Osprey. 15-20 year contract;
- Key is making sure good sites are selected now and into the future;
- Market led on payment – always allow for debit / credit card payment at chargers + app that integrates with Zap map / Zap pay, Google to view availability of chargers etc – seamless payment key as demonstrated in recent Zap Map Survey; and
- Happy to aggregate demand and have experience in London and Wales.

6.3.5 For:EV

- Keen to install infrastructure in Fife;
- Partner hardware supplier in Finland – 22 – 1000kW (complete flexibility to cater for freight etc);
- End-to-end process that takes out stress for council (feasibility to implementation);
- Willing to invest in non-core as well as core sites – focus on widening offerings for communities (offset by commercially viable sites);
- Flexible in terms of funding from co-investment to fully funded and flexible length of contract as well;
- Contactless payment or pay on phone (all pay-as-you-go). Integrated with roaming tariff operators;
- All installations are mobility friendly;
- Remote technology refresh; and
- Currently looking at aggregating demand for Police Scotland (along with Ambulance and Fire).

6.3.6 Urban Electric

- Specialise in delivering a well-designed, comprehensive and people focused network that is accessible and reliable;
- Partnering with Local Authorities only to help transition residents with no access to off-street charging;
- Retractable chargers, flush with the footway when not in use. Can provide a suite of solutions for all locations e.g. on-street and council car parks;
- Fully funded contract option (minimum 15 years but ideally 20 years);
- Very strong on innovation (as retractable charger demonstrates);
- Currently work closely with carshare hubs e.g. in Dundee;
- Have spent a lot of money in ensuring infrastructure is reliable;
- Happy to consider more remote and less profitable sites offset by more profitable sites. Will consider the bigger picture;

- App based payment, but looking to enable contactless once legislation allows;
- Happy to aggregate demand e.g. NHS;
- Engineer never more than 2 hours from charge point and if can't repair then will replace unit. The current up-time is 99%; and
- Units made in the UK.

6.3.7 Cha-rgy

- Range of 7-22kW offerings, including lamppost (front and back of kerb) and bollard. Dual option from early 2023;
- Fully funded option -15 year contract;
- Fully web-based payment (contactless from April 2023). Pay-as-you-go or subscription (with option of reduced night-time rate);
- Prefer more charge points at smaller number of sites but happy to consider bespoke offering;
- Would pay council rental charge of £20 / site per year and 10% of charge revenue;
- Servicing operated by AA who would inform Char-gy engineers who would go out and fix (usually within 24 hours) – council will receive monthly optimization report for each site); and
- All units made in Coventry.

6.3.8 Trojan Energy

- Keen to install infrastructure in Fife (Scottish company with Scottish assembly);
- Residential charging only, no destination charging;
- Unique offering with discreet underground charge points (100mm diameter disc on footway when not in use and a slim lance as close to the edge of the footway as possible when in use);
- Hub offering – new DNO connections with up to 15 points from 1 feeder cabinet (22kW). Flexibility on how you layout e.g. can be over 2 streets if feeder placed at junction;
- Individual offering – off residential connection and power likely to be 7kW (but depends on property);
- Flexible funding model (usually look for part funding) but for individual offering council could offer no funding and simply give permissions, but prefer all parties to be involved;
- Plug and play offering; and
- Many faults can be repaired remotely but like to employ local technicians that can be on the ground in 30 minutes.

6.3.9 Liberty Charge

- Keen to install infrastructure in Fife;
- Deliver a fully funded solution;
- End-to-end service (including DNO engagement / upgrades, installation, operation, and maintenance);
- Full range of charging solutions and speeds;
- On-street, off-street, e-mobility hubs, e-car clubs, and adoption of legacy networks;
- Installation and maintenance by Virgin Media O2 team;
- 100% renewable energy to power chargers; and
- Non-exclusive 15 year agreement.

6.3.10 Swarco

- Already operate existing chargers for Fife Council and very keen to develop the relationship;
    - Technically straightforward and seamless transition of existing charge points on the CPS network onto the Swarco network.
- POGO, who are under the Swarco brand, offer a fully funded solution. Swarco also offer other flexible options including concession models with flexible contract lengths;
- Full range of charging solutions and speeds, with expertise in the provision of 150kW chargers, which Swarco consider to be the charger of choice given its adaptability going forward;
- Considerable experience operating in Scottish rural settings and in rural local authorities, so no issues operating across Fife;
- Understand the challenges of on-street provision but can provide such networks, but ample experience delivering destination and hub charging;
- Excellent back office provision, with 24 / 7 monitoring of charger performance and majority of issues can be fixed remotely. Where this isn't the case, given Fife is in a central location an engineer can be on site swiftly; and
- Flexible payment options, including app based payment and contactless at charge points.

7. Public Consultation

7.1 Introduction

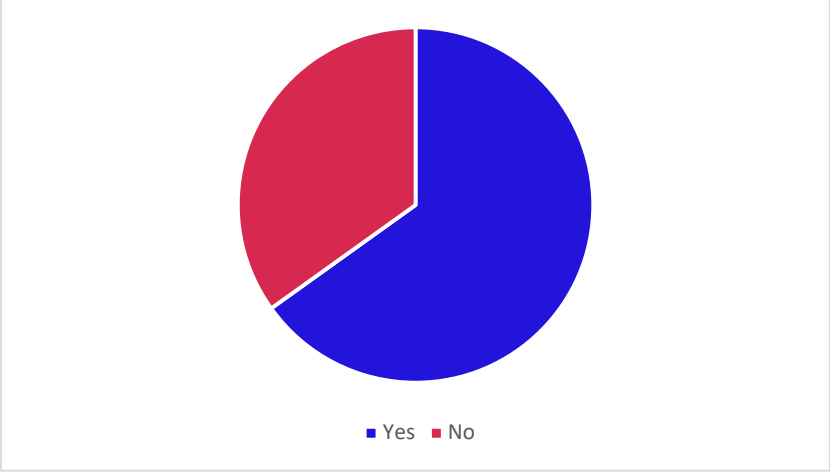
Between 21st June and18th July 2024, a public consultation survey was conducted to gather insights on various aspects of EV usage and infrastructure within the community. The survey received a total of 256 responses, primarily collected through an online platform. In addition, two respondents provided their feedback via email. The survey focused on key topics, including EV ownership, usage patterns, satisfaction with the current network of EV charge points, views on the proposed EV strategy, and the Council's priorities for future development. Respondents were also invited to suggest potential locations for new charging points. The following section presents the key findings from the survey.

7.2 Online Platform Survey Responses

The questions asked and responses from the online platform are outlined within this section, this has been summarised against the following types of question and response:

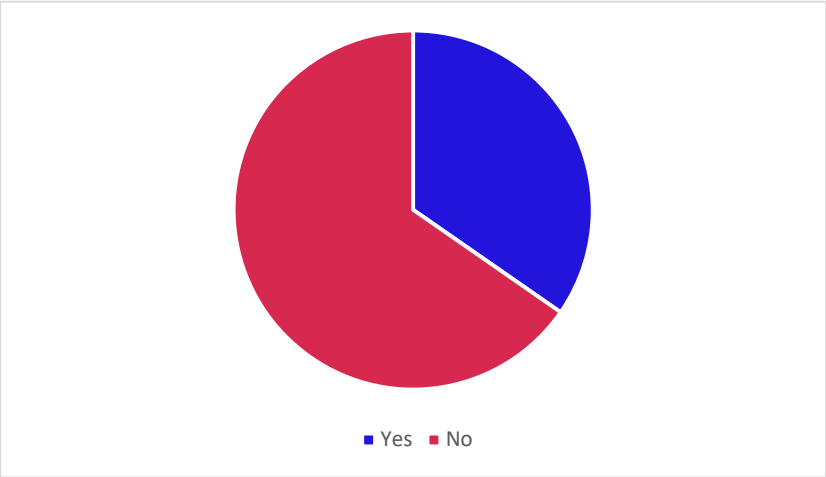
- **Structured question responses**: Those which has a yes/no or numerical answer are presented in the form of a pie chart or bar chart displaying the overall response.
- **Freeform question responses**: Those where provision was made for the respondent to write in their own comment into the online form are presented in the form of a word cloud based on summarising the various responses into a series of key word categories.

7.2.1 Do you own an EV?



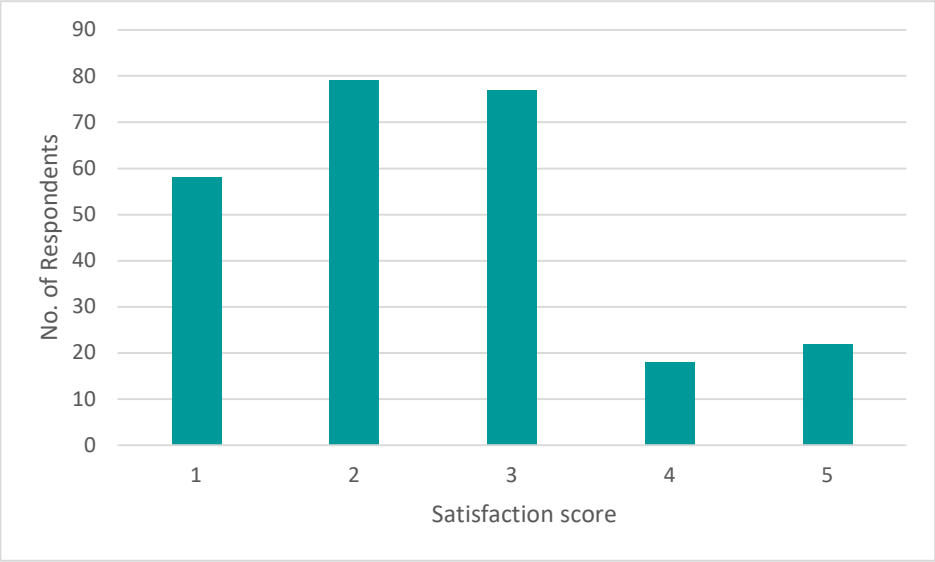
This shows that the majority (approx. 2/3) of respondents are active owners of EV's.

7.2.2 Do you drive an EV for work or hire an EV?



This shows that approximately a third of those respondents use or hire an EV vehicle for work

7.2.3 On a scale of 1 to 5, how satisfied are you with the current network of EV charge points in Fife? (including eFife, ChargePlace Scotland and all other Commercial operators)? 5 is Extremely satisfied and 1 is Extremely Dissatisfied



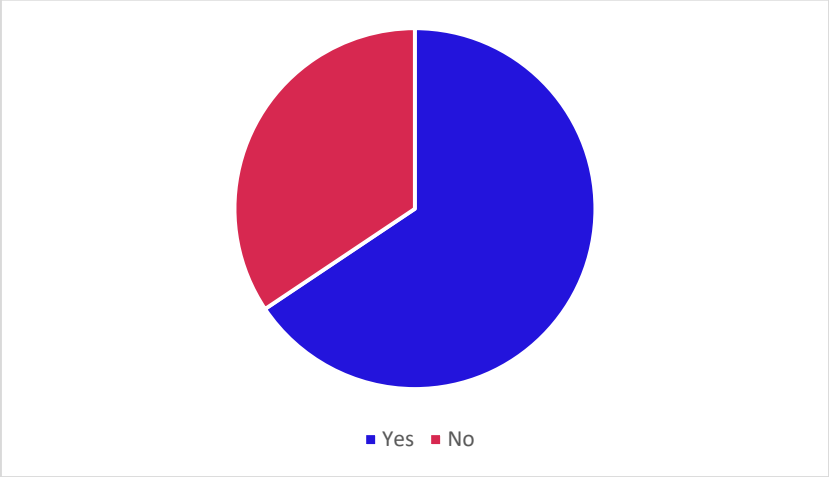
This response outlines the need for expansion of the current EV charging infrastructure within Fife, with 54% of residents either extremely dissatisfied or dissatisfied with the current levels of provision.

7.2.4 EV Proposals Part 1 – Do you agree with the following strategy proposals?

- *Work in partnership with a commercial charge point operator to both expand the network across Fife and support the existing network. This would be supported by a limited amount of grant funding provided by Transport Scotland to provide charge point locations which will improve charging opportunities for those on low incomes, in rural areas or otherwise which may be less commercially viable in the short-term (promoting a Just Transition).*

- *Increase the number of charge points across Fife with a mix of 7kW, 22kW and 50kW by increasing the number of charge points at some existing locations to create hubs and install charge points in locations that do not currently have a Council charge point. Sites have been identified by members of the public, local members, and by the demand on existing charge points as well as modelling software.*

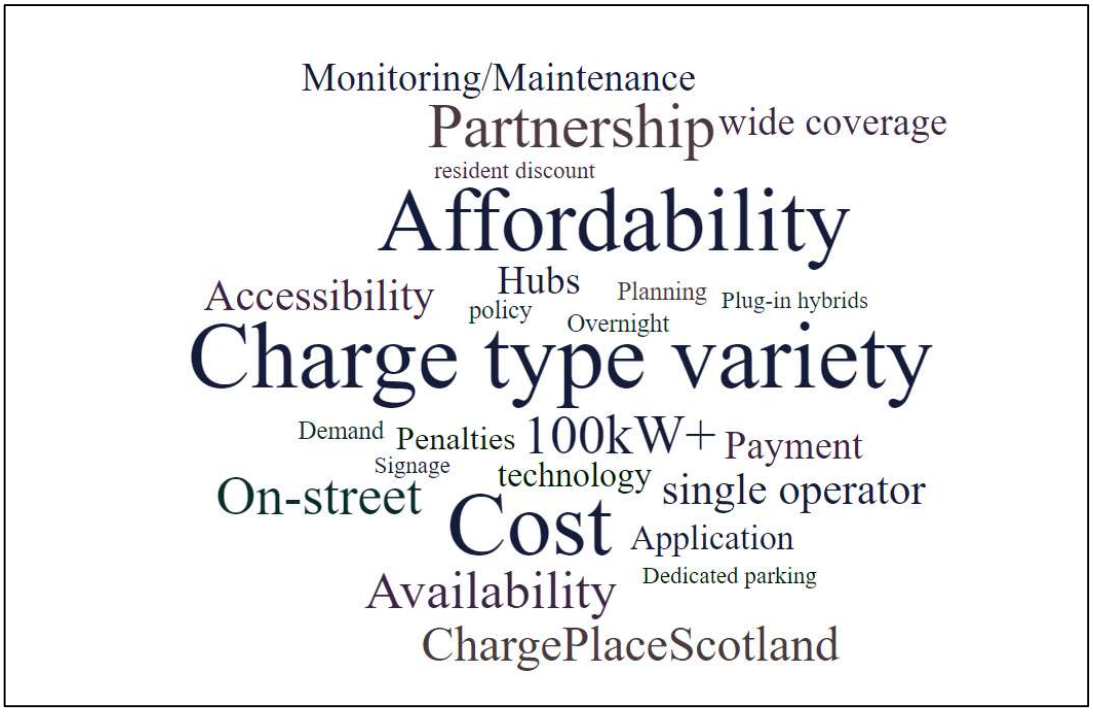
- *Have the same network operator across all Fife Council charge points with the same back office so only one account is needed for all Fife Council operated charge points, similar to using ChargePlace Scotland.*



This response highlights that approximately 2/3 of respondents agree with the listed strategy proposals.

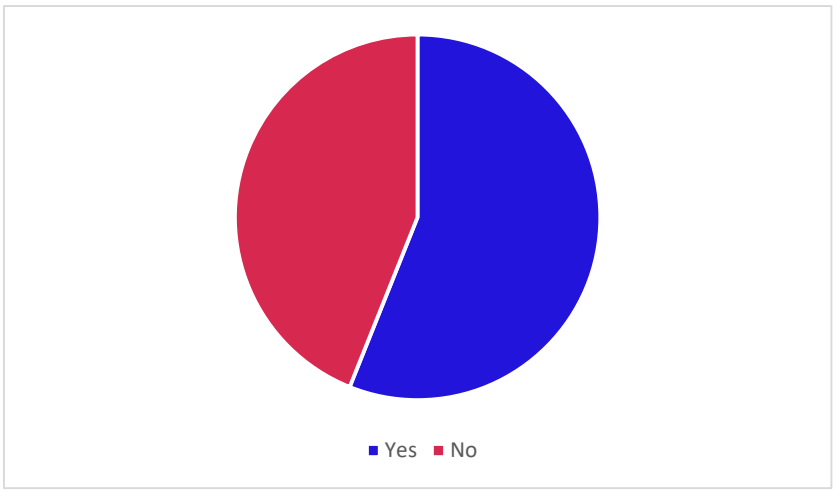
7.2.5 Do you have any questions, suggestions, or comments on these strategy proposals?

The following word cloud summarises the range of responses to this question, by using a series of key words to track repeated themes across the large variety of responses commenting on this first set of strategy proposals. It is clear from the word cloud that the key most repeated themes from the public feedback are related to topics on affordability, the variety of charge types and cost.



7.2.6 EV Strategy Proposals Part 2 – Do you agree with the following strategy proposals?

- *Deliver new public EV charging infrastructure in a way that offers equitable access to all, for example in publicly accessible areas such as car parks.*
- *On-street charging provision is not proposed in this Strategy in the short-term i.e. 0-5 years.*
- *Support and encourage commercial operators, Fife businesses and communities to install their own EV charging infrastructure.*



This response highlights that slightly less respondents, just over half, agree with the second set of listed strategy proposals. From reviewing the comments, this drop appears to be primarily due to the longer term provision for on-street charging.

7.2.7 Do you have any questions, suggestions, or comments on these strategy proposals?

The following word cloud summarises the range of responses to this question, by using a series of key words to track repeated themes across the large variety of responses commenting on this second set of strategy proposals. A clear popular theme from the public feedback is the future consideration within the EV strategy, or future iterations, around the provision of on-street charging.

7.2.8 What do you think the Council's priorities should be in delivering electric vehicle charging points in the years ahead?

The following word cloud summarises the range of responses to this question, by using a series of key words to track repeated themes across the large variety of responses related to the future priorities which should be considered by Fife Council. Again, the future provision of on-street charging is a popular from the public feedback, as well as topics related to charge type, affordability and the availability of charge points.

7.3 Email Responses

As well as the online platform, there was also the opportunity to directly respond to Fife Council via email. On this basis there were two detailed emails that were sent and they key points from these have been summarised below:

- The need to revise current legislation around private companies operating within public car parks.
- Encouragement of cooperation with charge points operators and leverage of private capital.
- Consideration of the use of dynamic load management to help alleviate local grid constraints.
- The need to consider roaming platforms such as Octopus Electroverse, Paua and Zap-Pay, and facilitating the use of charge points without an app or RFID card.
- The need for consideration of on-street charging for users who do not have driveways as the EV strategy for Fife evolves.
- Further consideration of disabled user needs as the Fife EV charging network evolves.
- Ensuring new and existing charge points are not blocked by non-electric vehicles.
- Consideration of the balance of provision of different speed depending on the location.
- The consideration of more charging facilities in the villages in East Fife as the EV strategy evolves.

7.4 Summary of Findings

The overall summary of the responses to the online platform are summarised within this section, the structured questions revealed that:

- The majority (approx. 2/3) of respondents are active owners of EV's.
- Approximately a third of respondents use or hire an EV vehicle for work
- The majority of respondents are not satisfied with the current levels of EV charging provision within Fife
- Approximately 2/3 of respondents agree with the listed strategy proposals regarding working with a commercial partner, expanding the current EV provision across a range of charger speeds and having the same provider across the whole of Fife with the same back office.
- Just over half of respondents agree with the listed strategy proposals regarding equitable access to all, On-street charging provision not proposed in the short-term and support and encouragement to commercial operators, Fife businesses and communities.

The open questions highlighted that key popular topics which were raised throughout the public consultation exercise relate to topics related to:

- Overall affordability of EV charging.
- The need for a suitable variety of charger types to be implemented.
- Future provision for on-street EV charging options.

As well as this, there was also a large number of possible locations for chargers suggested throughout the public consultation. Although this long list of sites is not repeated here and have not been through the full suitability assessment in line with the suggested sites outlined within this strategy (full details found later in the report) they have been compiled for consideration in future expansions of the EV charging provision within Fife.

7.5 Considerations for the Wider Strategy

The public consultation responses are important in understanding public perceptions in relation to key elements of the strategy, including satisfaction with the existing network coverage and the need for expansion; fair and equitable access; and a mix of charging types and speeds.

Table 8.2 outlines proposed measures for Fife to consider taking forward as part of the strategy, within a short, medium and long-term timescale. The outputs of the consultation align well with the key recommendations within the strategy, with a summary of the key alignments as follows:

- Availability of chargers is a key priority for survey respondents, given over 54% of survey respondents expressed that they are dissatisfied with the existing network provision in Fife, with only 15% satisfied with the existing provision. This aligns with a number of recommendations within the strategy, aimed at increasing the number of chargers across the council area, including
    - Providing charging points at car parks and on-street for key destinations; and
    - On-route charging points on the Major Road Network.

- Accessibility is also a key theme within the consultation that the strategy seeks to address through the measures to provide charging points to support residents with limited access to off-street parking provision.

- Consideration of on-street charging was raised in the consultation as a key future priority for the council and this is considered within the strategy measure to provide charging points to support residents with limited access to off-street parking provision, with a focus on available car parks. Any remaining major gaps in provision will consider an approach to selectively look at implementing on-street charging in the longer term.

7.6 Summary

Between 21st June and18th July 2024, a public consultation survey was conducted to gather insights on various aspects of EV usage and infrastructure within the community. The survey received a total of 256 responses, primarily collected through an online platform. In addition, two respondents provided their feedback via email.

A summary of the key themes originating from the consultation are as follows:

- Approximately two thirds of respondents are active owners of EV's;

- Approximately one third of respondents use an EV for work;

- 54% of survey respondents are dissatisfied (including extremely dissatisfied) with the existing network provision in Fife;

- Approximately two thirds of the respondents agree with the strategy proposals to

    - work in partnership with a commercial charge point operator to both expand the network across Fife and support the existing network.

    - increase the number of charge points across Fife with a mix of 7kW, 22kW and 50kW by increasing the number of charge points at some existing locations to create hubs and install charge points in locations that do not currently have a Council charge point.

    - have the same network operator across all Fife Council charge points with the same back office.

- Just over half of the respondents agree with the strategy proposals to

    - deliver new public EV charging infrastructure in a way that offers equitable access to all, for example in publicly accessible areas such as car parks.

    - that on-street charging provision is not proposed in this Strategy in the short-term i.e. 0-5 years.

    - support and encourage commercial operators, Fife businesses and communities to install their own EV charging infrastructure.

- As well as the online platform, there was also the opportunity to directly respond to Fife Council via email. On this basis there were two detailed emails that were sent and they key points from these include the need to revise current legislation around private companies operating within public car parks; the need for consideration of on-street charging; and further consideration of disabled user needs as the network evolves.

- In addition to responses on specific topics, there was also a large number of possible locations for EV charging suggested by the public. These have been compiled for consideration in future expansions of the EV charging provision within Fife.

- Overall, the findings of the consultation align well with the measures proposed within the strategy, including on measures to increase the availability of charge points; and better network accessibility.

8. Geospatial Modelling

8.1 Overview of Model

The key driving force behind the siting of EV charge points is knowledge of exactly where Electric Vehicles will want to charge. So, to generate a reliable model for the infrastructure demand for charging, it is necessary to understand how the overall vehicle fleet will transition to EVs by creating a model for how a new technology will diffuse into an already existing fleet. The diffusion of the new vehicle models will be governed by two important characteristics outlined in Table 8.1.

Table 8.1. Characteristics defining model diffusion of new vehicles.

Characteristic	Description
The rate at which new vehicles are purchased.	This determines the "churn" of vehicles within the fleet overall. If few new vehicles are being purchased (due to a recession, say) then there will be a substantial slowdown in the transition to EVs as the population of vehicles is not being replaced
The probability of new vehicle purchases being an EV	If the fleet is to transition to EVs, the probability of each new vehicle being an EV should increase to 100%. This aligns with the 2030 target that has been set by the UK Government.

However, too frequently, in discussions about EV uptake the focus is on the second question, with little consideration given to the implications of the first question.

Therefore, for each question a systematic technique needs to be determined to derive the two results required, the level of new vehicles and the change that new vehicle is an EV.

To answer the first question, the data for income for each Intermediate Geography (IG), and the ratio of new vehicle to existing vehicle registrations was used to generate a probability of new vehicle purchase. This variable alters with income due to the strong relationship between average income and new vehicle purchase rates.

To answer the second question, a choice model was used. A choice model is a technique for providing a systematic method of choosing between multiple options, each of which may have benefits associated with it. The form of the logit choice model used in this work is a Binary Logit Choice Model, with changing variables over the two alternatives. This form of the model allows us to calculate the probability of choosing between two distinct, and exhaustive (meaning that the options represent the only options available to the purchaser, and they must choose one) options. The general form of this model is shown below.

$$\boldsymbol{P(C_1) = \frac{\exp(\lambda U_1)}{\exp(\lambda U_1) + \exp(\lambda U_2)}}$$

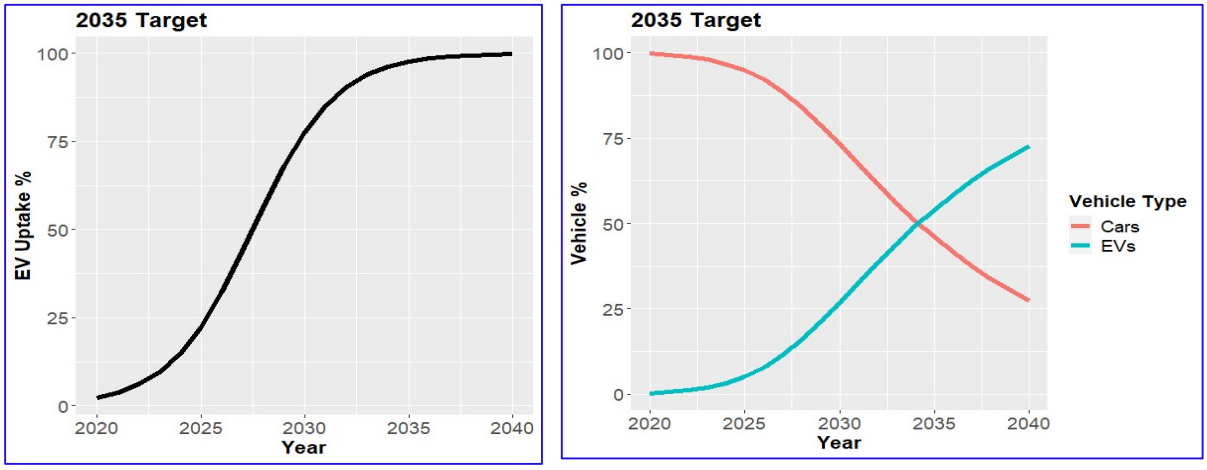
Here, C1 represents Option 1, U1 represents the Utility of that choice (defined through a combination of income and EV price) and λ is a parameter used to determine the sensitivity to change for the utility values within the logit choice model.

From this model, it is possible to create a stock flow equation which governs the movement of vehicles into and out of the vehicle fleet.

$$\boldsymbol{Fleet_{2021} = Fleet_{2020} + New\ Vehicles_{2021} - Scrapped\ Vehicles_{2020}}$$

Essentially, the fleet in 2021 is governed by the fleet in 2020 plus all new vehicles from 2021, minus those vehicles scrapped in 2020. The new vehicles will be composed of a mix of ICE and EV.

Figure 8-1: Indicative Comparison Between Uptake % and Overall Fleet %



EV Uptake Targets

Figure 8-1, displays the number of EVs in the fleet lags behind a potential 2035 goal for full decarbonisation of the new vehicle fleet. Even though 100% of all vehicles sold are EVs by 2035, the fleet still only contains approximately 50%.

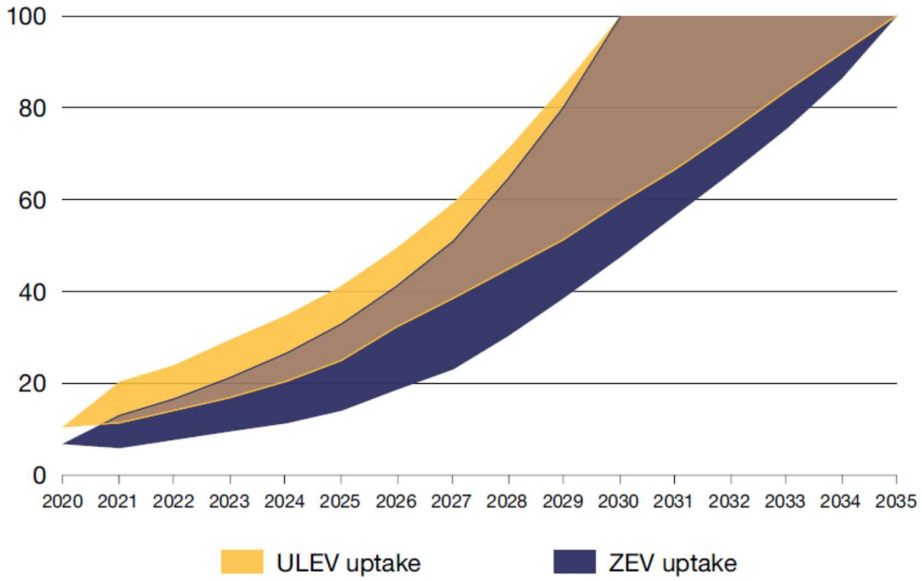
8.1.1 Forecast Scenarios

A range of scenarios have been considered to account for the level of uncertainty around available data, modelling variables, and advances in technology to understand what different futures might look like. These cover 'Low', 'Medium' and 'High' private vehicle uptake projections that generally align with the range of potential pathways, set out in the 'Transitioning to zero emission cars and vans: 2035 delivery plan'[20] (HM Government, 2021), to achieve their ambitions for 2030 and 2035. **Figure 8-2** illustrates these potential pathways for both ULEV (PHEV) and zero emission vehicle (ZEV)* private car uptake, showing a predicted range of distribution for each vehicle type (shaded in yellow and blue) and the level of uncertainty (shaded in brown).

**Due to prevalence of BEV and uncertainty over other zero emission fuels at this stage, BEV is the only vehicle type considered for the ZEV (e.g. excludes hydrogen) consideration of hydrogen transition at this stage for the purposes of forecasting.*

[20] Transitioning to zero emission cars and vans: 2035 delivery plan (HM Government, 2021)

Figure 8-2: **Potential pathway – Percentage of new car sales accounted for by Ultra Low Emission Vehicles (ULEVs) and Zero Emission Vehicles (ZEVs)**



The uptake of new company EVs has historically been at a faster proportional rate than the private market by approximately 2 years. The same curves have been accelerated by 2 years to calculate projections for company car and LGV uptake of ULEV (PHEV) and ZEV (BEV).

The scenarios for 'Low', 'Medium' and 'High' uptake apply the Government policy targets, banning different vehicle types in 2030 and 2035, and the varying levels of expected ULEV (PHEV) and ZEV (BEV) uptake on the following basis:

- **High –** assumes an optimistic ZEV (BEV) uptake, at the upper end of the projected range, reaching 100% of all new car sales by 2030.
- **Medium –** assumes a more moderate ZEV (BEV) uptake, in the middle of the projected range, reaching 100% of all new car sales by approximately 2032.
- **Low –** assumes that ZEV (BEV) uptake will be at the lower end of the projected, reaching 100% of all new car sales by approximately 2035. This is the latest by which all new vehicles will be ZEV (BEV).

8.1.2 Vehicle Charging: Location and Demand

The relationship between EVs and their charging requirements is an inherently spatial one, and as such it is necessary to understand where vehicles EVs are likely to be purchased, the level of charge they are likely to require, but also to subsequently understand where those same EVs are likely to charge.

The energy demand has been calculated through assuming that each EV will split its energy demand across four different fundamental charging situations.

- **Off-Street Residential Charging:** This is the charging that takes place on private land owned/rented by the household. The charging post itself is assumed to be private and only accessible by the owner.
- **On-Street Residential Charging:** This is charging which takes place in the immediate local vicinity of residential areas and is expected to be primarily used by those with no private off-street charging. The capture area for On-Street Residential charging is expected to be around 400m as this is a reasonable estimate for the distance people are willing to walk.

- **Destination Charging:** This is charging that is linked to specific destinations. As such it is likely to be used by all users, although it is likely to be used more by those without access to off-street charging. The capture area of Destination Charging is between 15km and 25km as this is the distance that a vehicle might be expected to travel to a destination for shopping/leisure/etc.
- **On Route Charging:** The demand for on route charging comes from the overall split between local and Strategic Road Network movement, with the assumption that longer scale movements will charge at locations within 1-2 km of the major road network.

The split between the different charging types is shown in Table 8.2.

Table 8.2: Energy split between charging types.

Residential Parking Type	Charging Location			
	Off-Street Residential	On-Street Residential	Destination	On Route
Owner with Parking Space	60%	0%	15%	25%
Owner with No Parking Space	0%	45%	30%	25%

To determine if an individual household had a parking space or not, we used the supplied data from Field Dynamics which has pre-labelled each UPRN in Fife by the number of parking spaces. A UPRN is a Unique Property Reference Number, and is a single unique number assigned to every property in the UK. The publicly available UPRN data includes all commercial properties, whilst the data provided by Field Dynamics had been pre-filtered to just residential. This allowed us to both identify the residential properties, determine if they needed on-street charging and, by a cross comparison with the global UPRN list, identify non-residential properties in Fife.

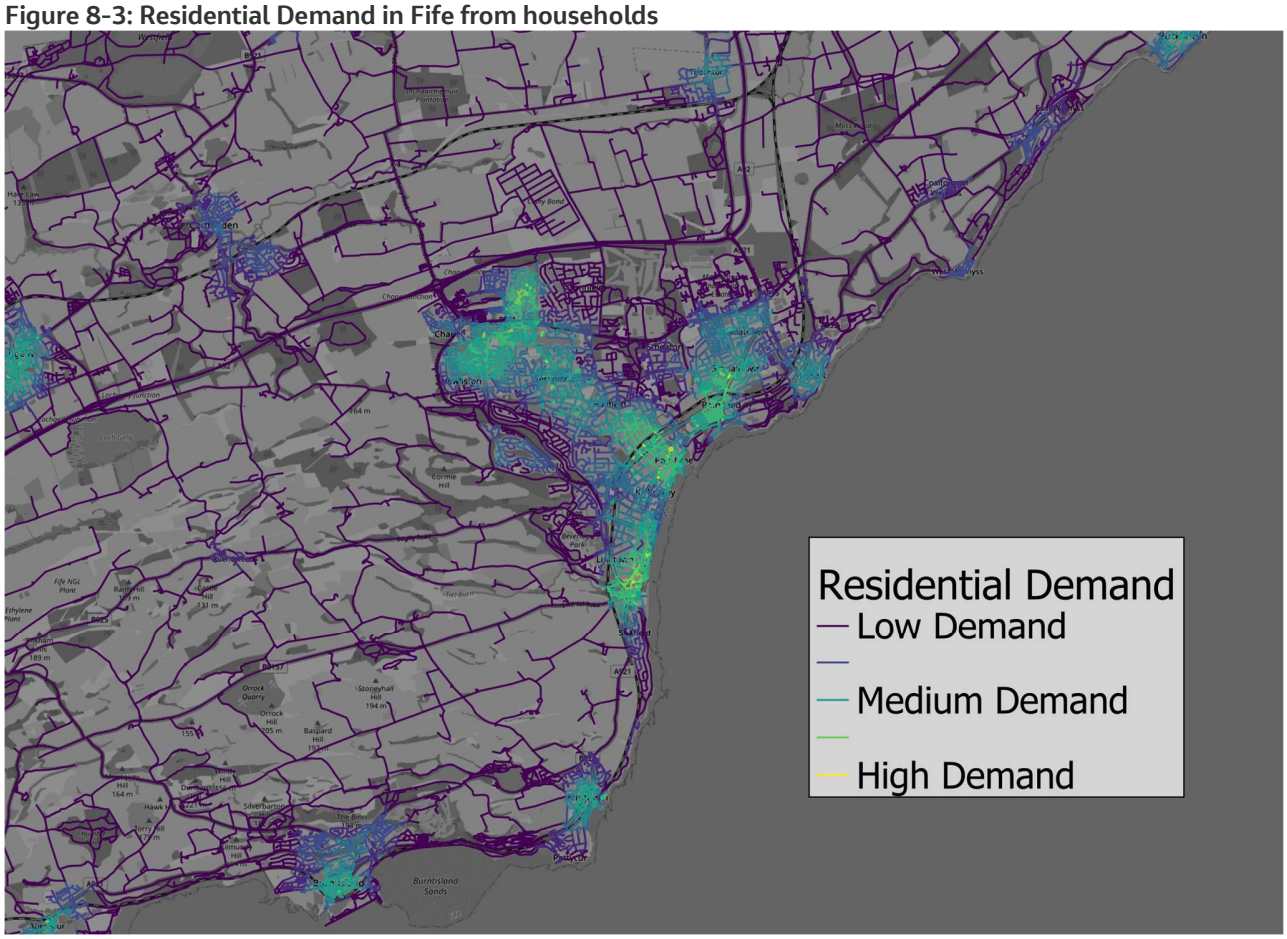
The individual energy demand at each household was converted into energy demand at potential sites.

For On-Street Residential charging, this was achieved through the following process.

1. Select the first household and extract the On-Street-Residential-Energy-Demand
2. Locate this household on the Fife road network.
3. Extract all elements of the Fife road network that are within 400m of this household.
4. Increase the On-Street-Residential-Energy-Demand for all the selected elements of the Fife road network by the On-Street-Residential-Energy-Demand from the selected household
5. Repeat the process for the next household.

This leads to a single value on each element of the Fife road network which determines the overall On-Street-Residential-Energy-Demand for that road element. An example of how this looks in practise is shown in Figure 8-3. Here we can see the residential charging demand around Kirkcaldy, overlaid over the road network.

Figure 8-3: Residential Demand in Fife from households



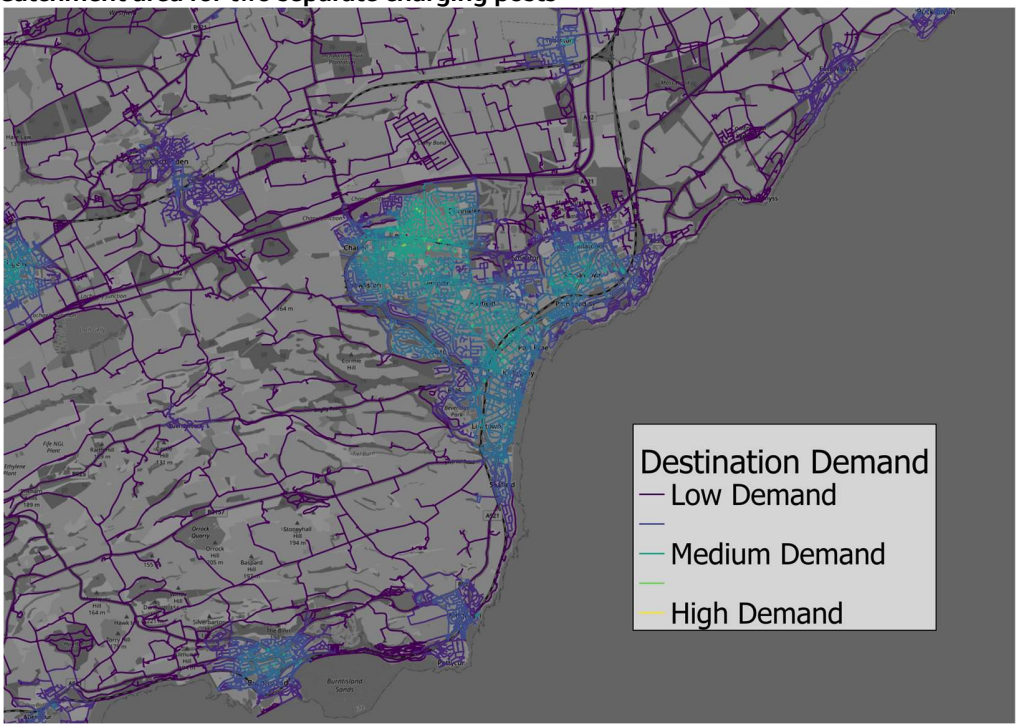
For Destination Charging, this was achieved through a similar process but also involving the incorporation of competing charging posts.

1. Select the first charging post and extract all households within 15,000m of this charging post.
2. For each household, increase the variable Charge-Points-In-Distance by 1.
3. Repeat until all charging posts have been selected.
4. Divide the Destination-Energy for each household, by the Charge-Points-In-Distance value. This ensures that households are "shared" between Destination Charging posts.
5. Select the first charging post and extract all households within 15,000m of this charging post.
6. Sum up the Destination-Energy for all households and assign to the charging post.
7. Repeat the process for the next charging post.

This process leads to each charging post summing up all Destination-Energy for the households, but if a household is within range of multiple destination Charging posts, then its Destination-Energy is shared between them.

The effect of this tends to be distribution of charging demand across a wider area than is seen in the residential charging demand. A schematic of how this may work in practise is shown in Figure 8-4. Here we can see the charging demand is more even than for residential charging demand.

Figure 8-4: Catchment area for two separate charging posts



Finally, for On Route charging, the process is much simpler. In this case the total energy for all On Route charging in the region is summed from each household. The energy is then distributed across all charging posts that are within a set distance of the main road network.

Whilst this is a relatively simple way of distributing the energy demand, it has the benefit of making no assumptions around the overall attractiveness (or otherwise) of specific sites.

8.2 Data Review of Information Feeding into the Model

The model has been constructed, where possible, through the combination of publicly available data sets.

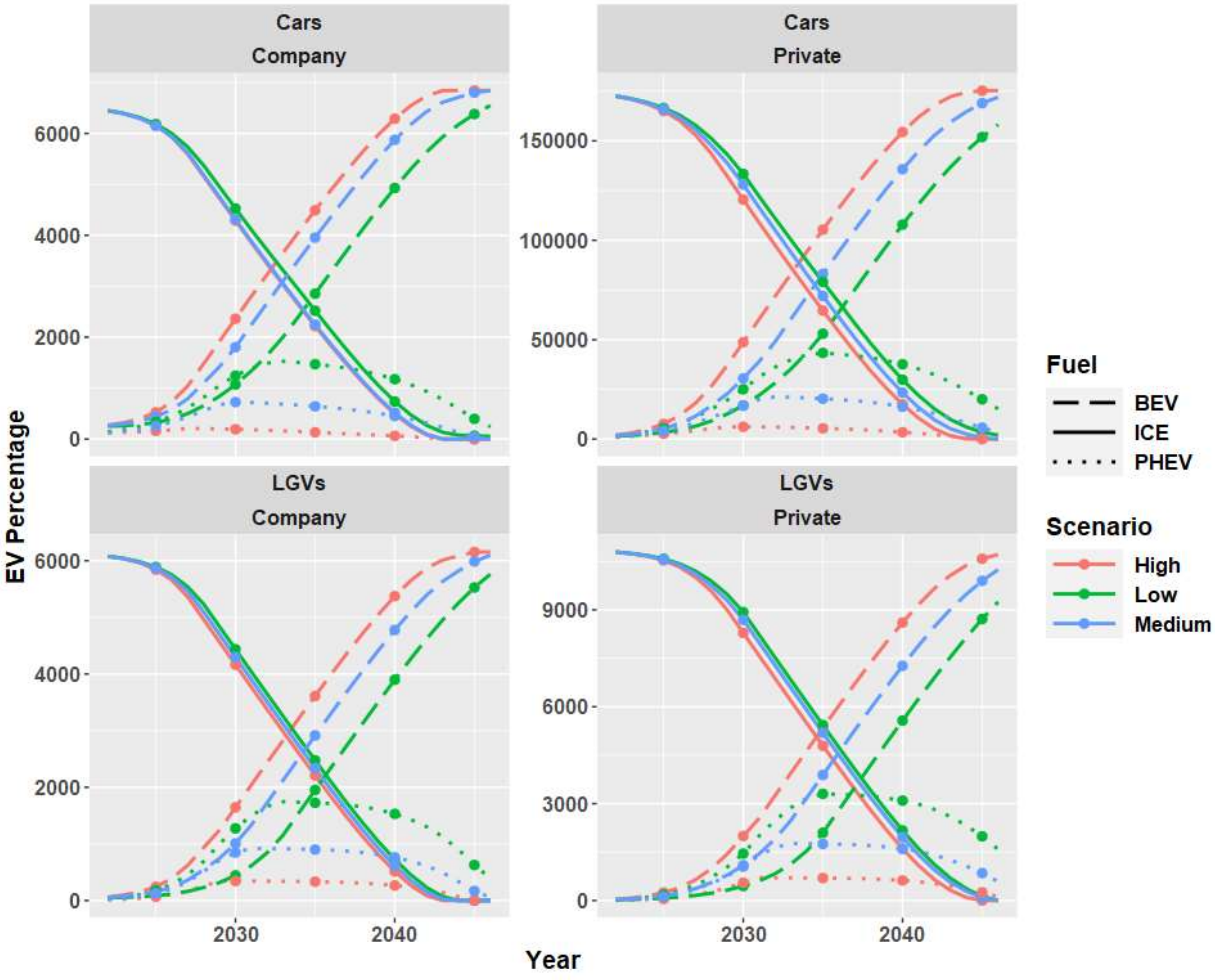
Table 8.3. Model Data Inputs

Data	Description	Use
Current EV Sales	The current EV sales by Local Authority	Used to determine both the current state of the EV market and also used to verify the uptake model
Current Car Totals	The current car totals by Output Area	Used to disaggregate the EV Uptake into smaller zones
Housing Distribution	Total numbers of houses, including housing type by Output Area	Used to determine the percentage of homes with off-street parking
Income Distribution	Median income by Intermediate Geography	Used to determine both EV Uptake percentage and the probability of purchasing a new vehicle
Employment Distribution	Employment type by Output Area	This is used to determine the destination charging potential using different employment types to categorise the zones
Journey to Work Origin-Destination Matrices	Survey data from Intermediate Geography to Intermediate Geography	Used to determine journey charging potential.

Data	Description	Use
OpenStreetMap Road Network	Open source road network	Used to construct a graph network of the UK which, with the Journey to Work matrices, is used to model long distance movements.
Field Dynamics Household Data	UPRN data for Fife, tagged by parking spaces	Used to determine those houses which will need on-street or off-street charging.

8.3 Forecasted Uptake in Fife

Figure 8-5: Forecasted uptake for Fife.



It can be seen from the above figure that despite the 2030 mandate for all new vehicles to be PHEV or BEV, and the subsequent switch to all BEV by 2035, the majority of all vehicles will still be ICE by 2034. This is essentially due to the inbuilt inertia of any vehicle fleet.

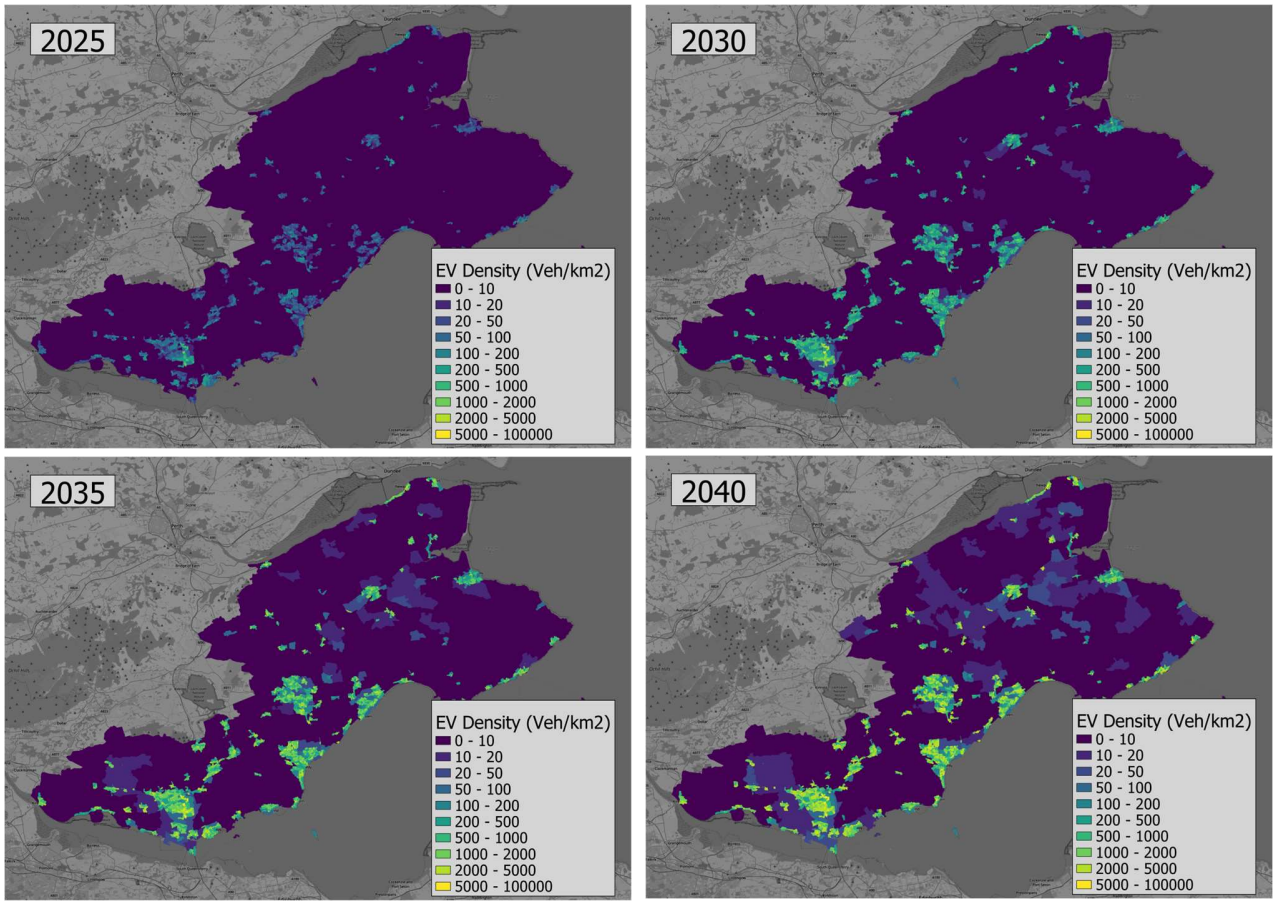
Transitioning a fleet requires two important considerations. The existing vehicles must be changed to a new vehicle, and the new vehicle must be an EV. It is the requirement that old vehicles must exit the fleet before new vehicles can be purchased, which creates the biggest "brake" on transitioning.

The impact of the different scenario can also be observed in the relative speed of the transition towards ZEVs. In the high uptake scenario, the majority of private cars will be ZEV by 2033.

8.4 Spatial Forecast Results

Figure 8-6 shows the distribution of electric vehicles in Fife, forecasted through to 2040 using the geospatial modelling tool. The figure shows that the greatest increase in vehicle numbers occurs in the 2025 to 2030 period. This represents the greatest increase in overall electric vehicle numbers, which corresponds to the steepest point on the graph in Figure 8-5.

Figure 8-6. Spatial EV Uptake Within Fife from 2022 to 2035



It is important to note that one of the underlying assumptions of this model, is that as the model looks further into the future, the distribution of EVs will begin to resemble the current distribution of vehicles more and more.

This will be particularly so for post 2035 where the model parameters will have led to the ever-increasing removal of ICE vehicles.

Post 2035, it is likely that the distribution of EV vehicles will begin to be dominated as much by factors which affect the overall ownership of vehicles, rather than those which specifically affect EV ownership. For example, a push towards active travel could lead to a reduction in urban travel.

8.5 Spatial Modelling

Figure 8-7. Distance to a Charging post on the Road Network

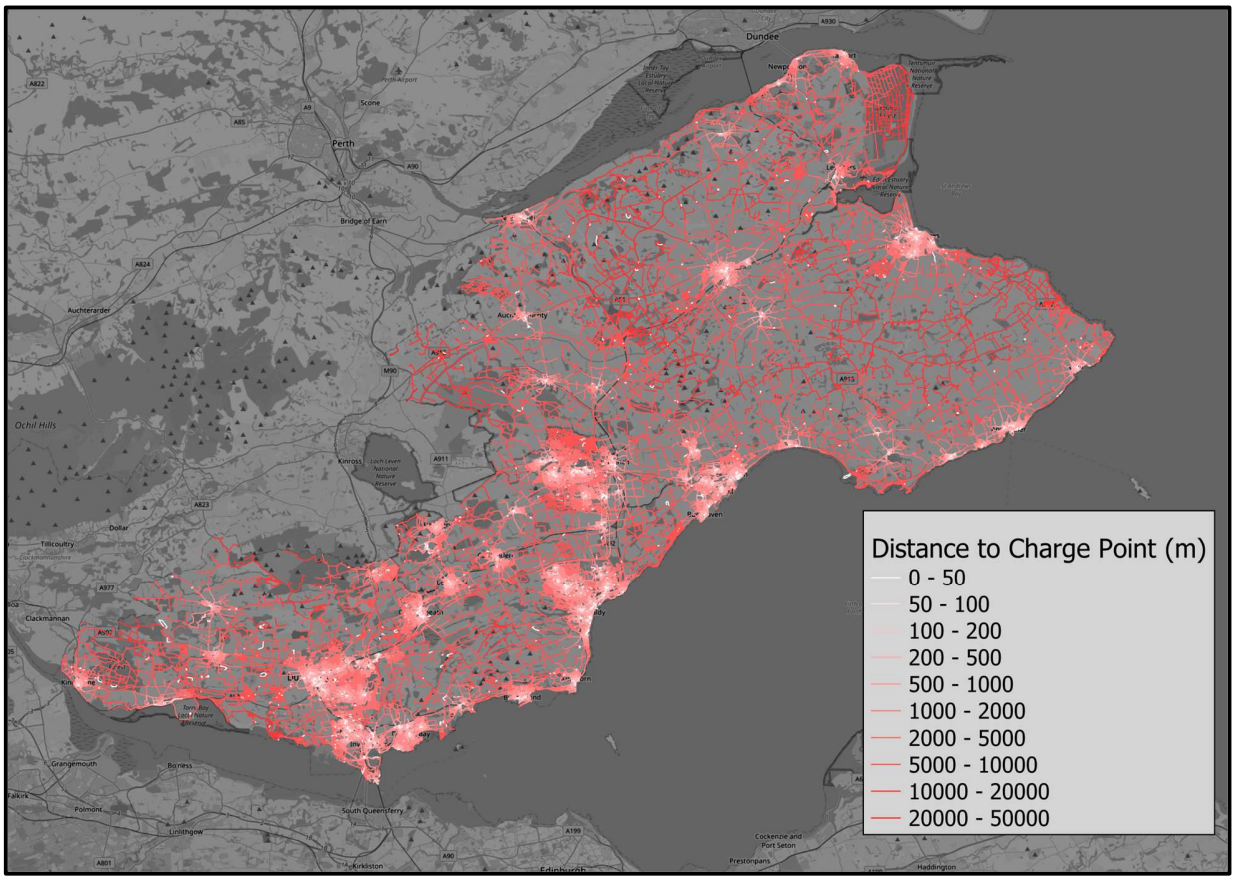


Figure 8-7 is a schematic diagram showing the distance from the existing charging posts to any location on the road network. As can be seen, the charging posts are generally clustered around population centres.

However, the data does demonstrate that there are large areas of Fife, particularly to the north east, where there is very limited charging infrastructure. This is to be expected, as it is also the area of lower population density, but it does highlight the potential issues of dealing with rural electromobility.

8.6 Second Hand EV Uptake

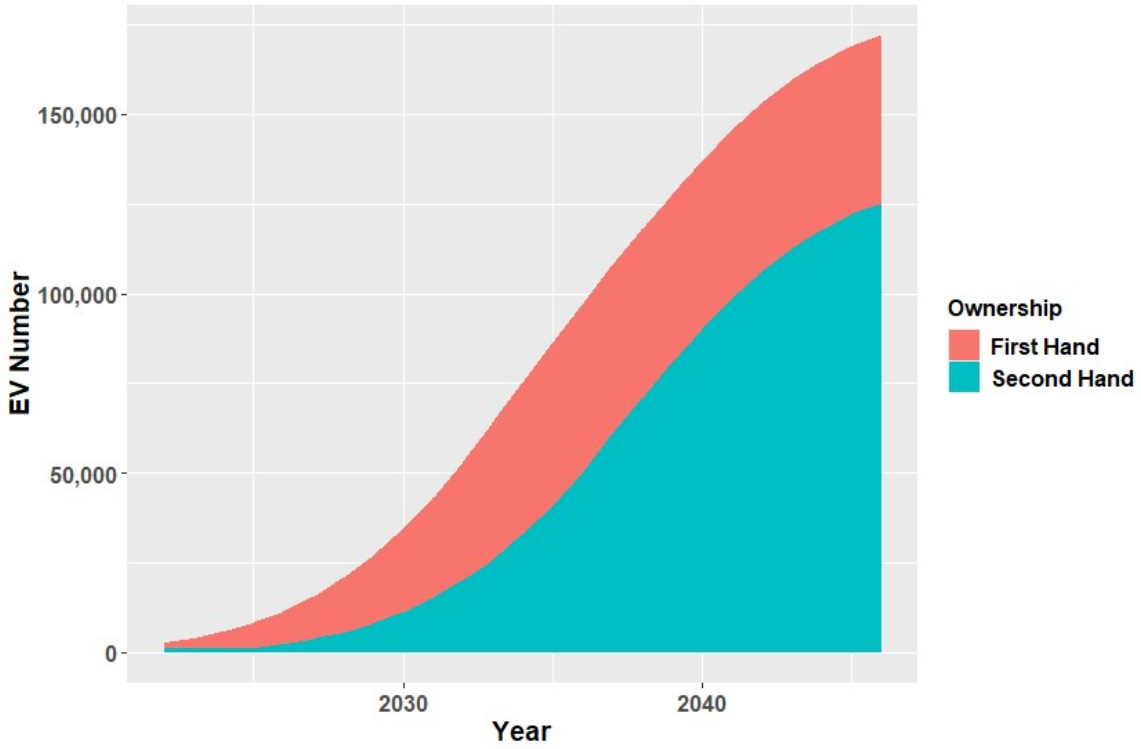
Generally, when considering EV uptake, the majority of the focus is on the purchase of new EVs. This is, in many ways, natural as it is the influx of EVs into the overall vehicle marketplace that will determine the overall success of the push towards electromobility. However, the final distribution of those vehicles (such as where they are parked at night, where they are parked during the day, who owns them etc.) will also be determined by the second-hand market.

Data on second-hand purchase of EVs is difficult to obtain. As current levels of EV ownership are relatively low, the probability of those EVs being sold is even lower. However, in the future this could be a key market in Fife due to affordability and strong sales of nearly-new vehicles.

The RAC report "Car Ownership in Great Britain"[21] shows the average length of time that a new vehicle is owned for. Based on the assumption that a new vehicle, once sold on, is then distributed across the local area purely weighted by the overall level of vehicle ownership, then it is possible to produce an EV population distribution.

Figure 8-8 shows the total number of Private EV cars across Fife. The two areas show how the total number of EVs increases across the years, for both First Hand and Second Hand vehicles. The figure shows that the total number of second hand EVs steadily increases from a small total number to a number forming a majority of the total EVs around 2032. This demonstrates that whilst the focus on new EVs is understandable in the near term, beyond 2030 an increasing proportion of EVs will start to become second hand and so any analysis must take this into account.

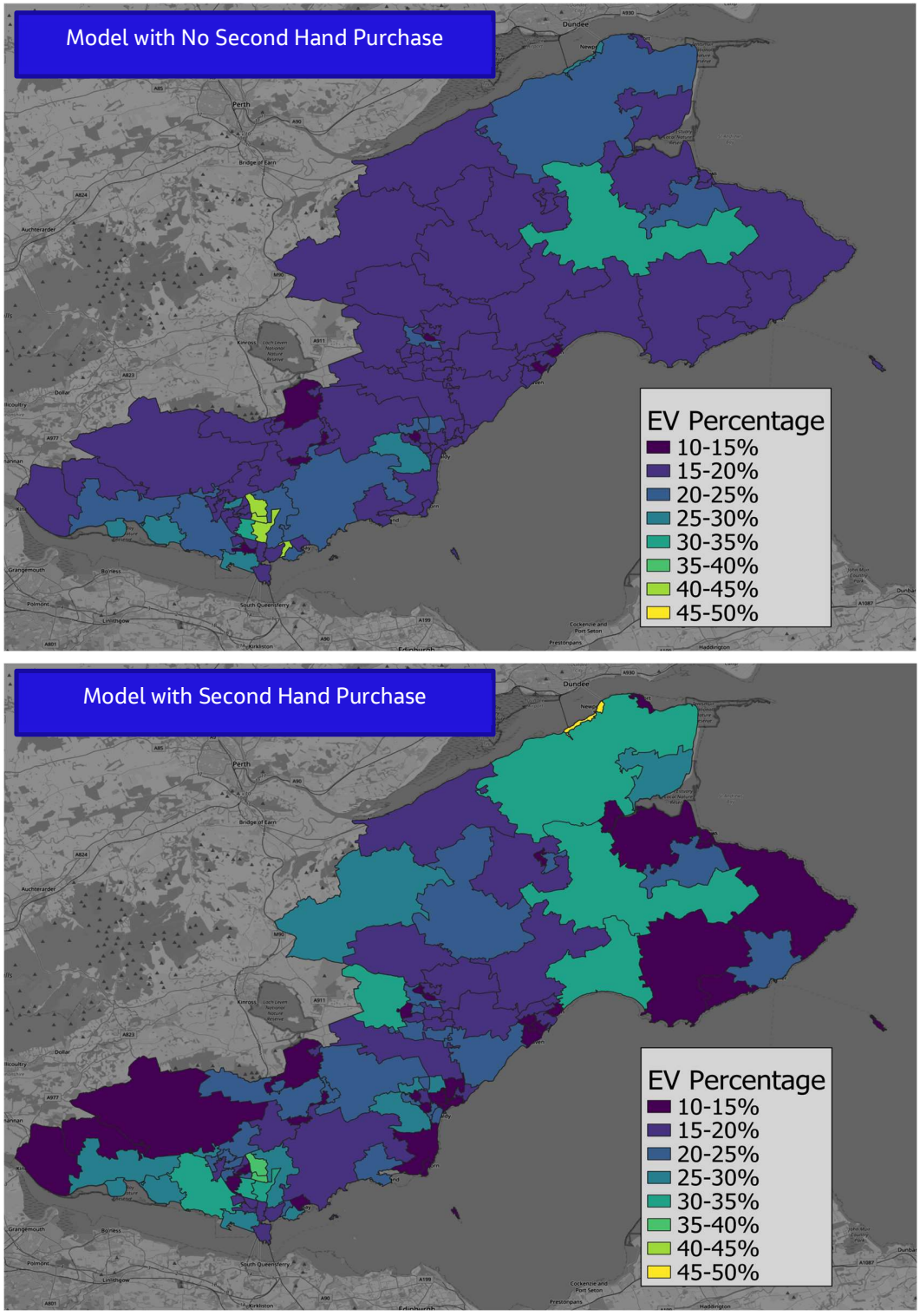
Figure 8-8. The Total Number of EVs, Including Second Hand EVs



The impact on spatial distribution of EVs from second hand vehicles is shown in Figure 8-9. The inclusion of second hand vehicles leads to a redistribution of EVs from the original high uptake areas to those which were not previously expected to see as much demand. Within Fife, this leads to a redistribution from the urban areas to the more rural areas. The data shown within this model is an estimate only, as more sophisticated second hand purchase models are difficult to create without purchased data sets.

[21] https://www.racfoundation.org/wp-content/uploads/2017/11/car-ownership-in-great-britain-leibling-171008-report.pdf

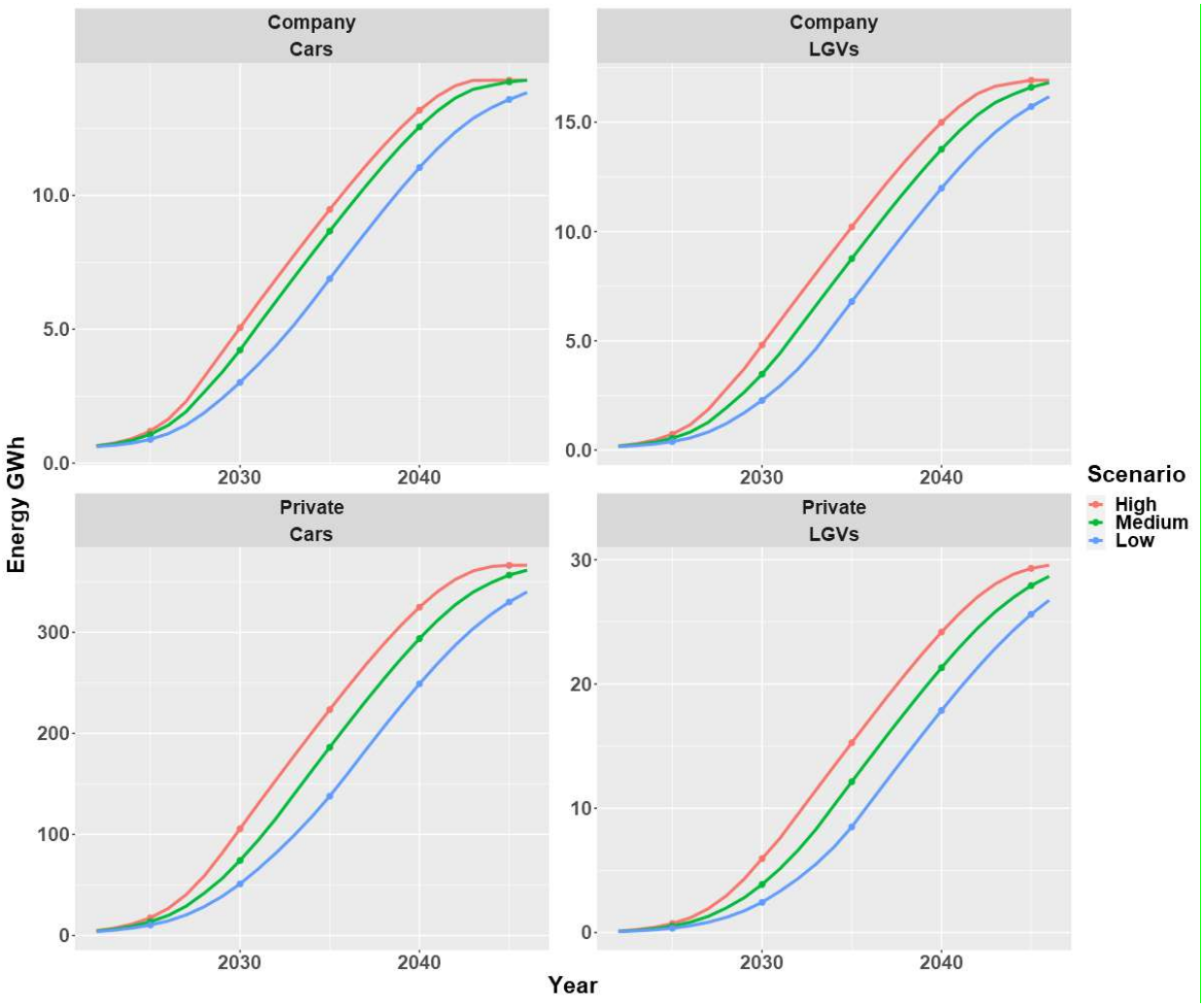
Figure 8-9. Images Showing how Incorporating Second Hand EVs Alters Spatial Distributions



8.7 Forecast Energy Demand

In Figure 8-10 we can see the overall energy demand for Fife across the different scenarios, keepership, and body types. The total energy demand reaches approximately 400 GWh in total over all ownership and vehicle body types.

Figure 8-10. Energy demand across scenarios, keepership, and body type



Whilst the energy demand starts from broadly the same level, and reaches the same level by 2045, it is instructive to consider the variation in energy demand between 2030 and 2040. Here we can see that there is substantial variation between the different scenarios, with the high scenario almost 100 GWh higher in 2035 for Private Cars, than the low scenario in 2035.

This helps to illustrate some of the fundamental uncertainties in trying to predict the patterns of energy usage (or indeed, overall EV uptake) in periods of transition. We know where we are starting from, and we know where we are going to, but the journey is altogether more uncertain.

8.8 Approach to Infrastructure Requirement Forecasting

In order to estimate the future EV infrastructure needs, further forecast modelling work has been undertaken to predict the different types of charging requirements across Fife at a settlement level. This has been done by predicting the annual kWh at each settlement for three different use cases.

The three use cases correspond to the Low, Medium, and High scenarios presented previously, with the energy demand for both Cars and LGVs, and BEV and PHEV generated separately.

As the energy demand is being predicted at the settlement level, it is not necessary to derive localised values for the different charging needs down to the individual street level. Therefore, the data presented has been aggregated up to the settlement and Fife-wide level and presented as an overall need across each settlement.

- Residential Charging: This uses an assumed vehicle km driven per year, combined with vehicle efficiency, to derive an overall energy demand. This is then proportional distributed to those sites with no off-street parking.

- Destination Charging: Similarly to Residential Charging, this generates an assumed energy for destination charging, based on the likely movement patterns.

- On Route Charging: This assumes that all current expected on-route charging is distributed amongst those charging posts near the main roads.

8.9 Results of Infrastructure Requirement Forecasting

The outputs from the infrastructure forecasting produces estimated charging requirements based on predicted energy need at a settlement level in Fife for the year 2026 (in order to coincide with timelines of SFT funding) across the low, medium, and high scenarios. Given the significant amount of data this entails, this has not been fully presented within this report for all scenarios, however the 2026 medium scenario predictions are outlined below in Table 8.4.

The results presented here refer to the raw number of chargers which would be required to supply each settlement. The actual number of charging locations would vary depending on the number of charge points per charging location.

Table 8.4. 2026 Medium Scenario Infrastructure Predictions by Settlement

Fife Settlement	Residential (Trickle)	Destination (Fast)	On Route (Rapid)
Dunfermline	88	50	30
Glenrothes	31	17	10
Kirkcaldy and Dysart	36	19	11
Methil, Leven and Buckhaven	14	8	5
Cowdenbeath, Lochgelly and Lumphinnans	10	6	4
St Andrews	7	4	2
Cupar	6	4	2
Dalgety Bay and Hillend	9	8	5
Burntisland	3	2	1
Kelty	3	2	1

Fife Settlement	Residential (Trickle)	Destination (Fast)	On Route (Rapid)
Leuchars and Guardbridge	1	1	0
Lower Largo, Lundin Links and Upper Largo	2	1	1
Ballingry, Lochore and Crosshill	1	1	1
Cardenden and Auchterderran	2	1	1
Newport-on-Tay and Wormit	7	4	2
Oakley, Carnock and Comrie	1	1	1
High Valleyfield	4	2	1
Tayport	3	2	1
Anstruther	5	2	1
Kinghorn	2	1	1
Kincardine	2	1	1
East Wemyss	1	1	0
Limekilns and Charlestown	2	1	1
Aberdour	2	1	1
Crossford (Fife)	1	2	1
Crail	2	1	0
Auchtermuchty	3	1	1
Cairneyhill	2	2	1
North Queensferry	1	0	0
Newburgh (Fife)	3	1	0
Balmullo	1	1	1
Elie and Earlsferry	1	0	0
Thornton	1	1	0
Ladybank	1	1	0
Saline	1	1	0
Kinglassie	1	1	1
Ceres	2	1	1
Pittenweem	1	1	0
Falkland	1	1	0
Gauldry	1	0	0
Freuchie	1	1	0
Strathmiglo	1	1	0
St Monans	1	0	0
Kingskettle and Kettlebridge	1	1	0
Blairhall	1	0	0
Springfield	0	0	0
Strathkinness	1	0	0
Townhill	1	1	0

Fife Settlement	Residential (Trickle)	Destination (Fast)	On Route (Rapid)
Kingseat (Fife)	1	0	0
Coaltown of Wemyss	0	0	0

9. Strategy and Recommendations

This chapter sets out a range of measures that could contribute towards an electric vehicle strategy for Fife and an assessment of whether these measures are most appropriate to be taken forward in the short, medium, and long-term.

9.1 Potential Measures

Table 9.1 outlines EV infrastructure measures that could contribute to the future Electric Vehicle strategy. The rationale for each proposed measure is also noted. The national and local information and considerations in the preceding chapters has informed the recommendations for the development of an action plan identifying short-, medium- and long-term priorities for Fife.

Table 9.1. EV Infrastructure Measures

Theme	Potential Measure	Rationale for Measure
Increase number and distribution of charging points	Increase provision of rapid charging infrastructure for taxis in convenient locations.	Engagement with the Hackney carriage (HC) and Private Hire Vehicle (PHV) industry elsewhere in the UK shows that quick top-up charging using rapid charging posts in convenient locations is important to enable taxis to transition to EV. A recent taxi study highlights that 95% of all drivers can do all days' worth of journeys without charging. Therefore, frequent charging throughout the day is unlikely to be required. Policy 16 of Fife Council's Local Transport Strategy supports the 'decarbonisation of Fife's rail network, bus network and taxi sector', but there are no details at present as to how this will be achieved and if there are plans to facilitate the transition the taxi fleet to EVs.
	Provide charging infrastructure for buses.	In line with Scotland's Bus Decarbonisation strategy there is a desire to strengthen local buses and accelerate the move away from diesel to zero-emission buses. The strategy for Scotland reflects the government support to Net Zero bus services. It should be noted that the rural geography of parts of Fife will present a challenge in the provision of a well-utilised zero-emission bus service. Longer distances and challenging topography can present challenges with achieving the range necessary for bus services. One potential solution can be the provision of a Demand Responsive Transport (DRT). Policy 16 of Fife Council's Local Transport Strategy supports the 'decarbonisation of Fife's rail network, bus network and taxi sector', however there are no details on plans to transition their bus fleet to electric.
	Provide charging points at car parks or on-street for key destinations	Evidence shows that the public highly value the opportunity to top-up at publicly accessible charging posts to complement the bulk of charging which is carried out at home. Without the public charging infrastructure in place, this could delay the uptake of EVs. Evidence demonstrates that some of the most popular publicly accessible locations for charging EV are key destinations where drivers can park for a significant period of time, such as city centres. In Fife there are also many popular tourism locations that have off-street parking that could be used as charging locations. These are outlined in more detail within the site assessment and recommendations.
	On-route charging points on the Major Road Network.	As noted above, the opportunity for top up charging is highly valued, particularly for when longer distance journeys are required. There are a number of major roads which travel through Fife such as the M90, A92, A91, A985 and A915.

Theme	Potential Measure	Rationale for Measure
		These roads provide direct access to the major settlements in Fife such as Dunfermline, Glenrothes, Kirkcaldy and St Andrews from both within Fife and from the wider Scotland and UK. This has been reviewed in detail within the site assessment and recommendations and available council owned car parks which are located on the outskirts of settlements near major roads have been highlighted as suitable for rapid on route charging.
	Provide charging points to support residents with limited access to off-street parking provision and charging, focussed on community hub locations.	Homes in areas with limited off-street parking may not have the option to introduce a household charging point and therefore will require alternative public charging points. From the baseline analysis and stakeholder consultation there are notable areas of low-income housing clustered throughout Fife which are likely to require on-street charging or alternative public charging car parks close to homes, e.g. Linktown (Kirkcaldy), Burntisland Docks and Gallatown West (Kirkcaldy). Focusing on consolidated community hub locations can be more feasible than committing to installing charging posts in front of all properties. Available car parks that can address this need have been highlighted in detail within the site assessment and recommendations. In the longer term there may be a need to look at available council land and work with local community groups to utilise their car parks. For any remaining major gaps, a selective look at on-street parking could be required in the longer term.
	Introduce charging forecourts.	Significant sized charging forecourts are being trailed in a number of locations around the UK on a commercial basis. At present the business case for larger and more extensive hubs is uncertain due to questions regarding the uptake of EV in the short to medium-term and how owners will charge their vehicles in the future. The current BP and Shell forecourts within Fife as well as supermarkets have been identified within this study. These sites lend themselves to potential areas for future EV charging forecourts, although as noted this is not seen as a short-term measure based on uncertainty around utilisation levels and future user behaviour.
	Continue to provide fleet chargers for the council's own fleet as necessary	Fife already has over 50 fleet chargers operating within the region, and so has a good basis for any future transition. Any further planned fleet transition to EV within will need consideration of whether further supporting charging infrastructure is required.

Theme	Potential Measure	Rationale for Measure
		The Fife Council Climate Action Plan 2020 – 2030 identifies ongoing work to reduce Fife Council's carbon emissions, through increasing the number of electric cars in the council's fleet.
	Introduce charging infrastructure for HGVs.	HGVs comprise a significant proportion of traffic and contribute to air quality issues and carbon emissions. However, at present there is a lack of commercially available EV options for HGVs and research into alternate fuel sources is still in progress. The Fife Council Climate Action Plan 2020 – 2030 identifies ongoing work to reduce Fife Council's carbon emissions, through increasing the number of electric cars in the council's fleet, however it is unclear whether this extends to the HGV fleet.
	Charging infrastructure to support shared mobility / micro-mobility e.g. e-car clubs and eScooters	E-car clubs eliminate the need to own an EV and are orientated around demand driven principles, thereby suiting the requirements of those on lower incomes. For low mileage (less than 5000 miles per year) it can be more cost effective to use car clubs rather than owning / leasing a vehicle. Fife Council have no current plans for e-car clubs and e-bikes in Fife, however there are a number of existing initiatives by Enterprise Car Club, in partnership with Ore Valley Housing Association, which have provision in Cardenden, Lochgelly, Kirkcaldy, Glenrothes and Dunfermline.
Local Policy Changes	Encourage EV transition through contract procurement	By building on new and existing contracts, the council would be able to influence the private sector and ensure an equitable network of infrastructure is delivered via a portfolio approach
	Local policy evolution	Creating an EV-friendly local policy background within Fife will allow the implementation of charging infrastructure to be both streamlined and hit the road running. Fife's Local Transport Strategy sets out to encourage the shift from petrol/ diesel vehicles to ULEVs and includes a high level action plan on how they will achieve this e.g. Building on these actions and providing manageable targets at a local level would help drive an increase in EV charging infrastructure across the districts in a way that is in line with their EV uptake forecasts.

Theme	Potential Measure	Rationale for Measure
	Improving/implementing coherent back-end data	There has historically been a limited flow of data from installed infrastructure to operators/landowners. A consideration of data flow at the time of installation could improve this and lead to better sifting in the future. Monitoring the utilisation of EV charging posts and consumer behaviour and using this alongside demographic information during the site selection process for expanding charging infrastructure could help to make the network more socially, environmentally, and financially beneficial.
	EV's should be considered within the wider hierarchy for transportation and strike a balance between encouraging uptake of EV's and allowing the council to maximise its ambitions around modal shift to active travel and public transport. There are examples of parking fee being incorporating into the EV charging infrastructure and technology exists to allow flexibility to vary tariff by time period. It is recommended these options are explored when procuring suppliers	Active Travel is a key priority for Fife Council, particularly targeting short everyday journeys particularly within the main settlements, with the Local Transport Strategy including an objective to increase the proportion of trips that are walked, cycled, or wheeled to 30% by 2033, from a baseline of 23% in 2019. However, due to the rural nature of parts of Fife, contributing to this increase will be more difficult in some of the smaller settlements. As such, increasing EV uptake should have a supporting role to play such as on longer journeys where active travel is not an option or where there are poor public transport links. The Council should ensure fair contribution to the cost of parking, whether a dedicated EV charging bay or not, in order to balance its financial responsibilities. Design and placing of charging sites should also show sensitivity to streetscape and competing demands e.g. walking and wheelchairs/prams. Examples of guidance for this can be found within the fourth edition of TfL's Streetscape Guidance and Edinburgh Design Guidance.
Engagement with the District Network Operator (DNO)	Continuous engagement and joint working with SPEN. Investigation of potential for distributed renewable energy solutions.	It will be important to work collaboratively with SPEN to address the challenges noted in this strategy and future proof key locations to address any supply issues as they arise. This will also help inform where supply may need reinforcing to support the future uptake of EVs. From April 2023, there are upcoming changes to OFGEM's regulation of Distribution Power Operators and how power network upgrades are funded. This has potential to shift the burden of costs away from new applicants and make more sites commercially attractive. The impact of this regulation change should be monitored, especially how it impacts sites previous identified as having high power reinforcement costs, notably in Dunfermline. SPEN have provided connection costs for each of the sites outlined in this strategy and some areas of Dunfermline are significantly more expensive.

Theme	Potential Measure	Rationale for Measure
Public Engagement	Consideration of public views on EV infrastructure	The public will be the end users of infrastructure and current EV users are only a small proportion of the ultimate future pool of users, therefore the needs of all of the public must be considered.

9.2 Assessment of Measures

Following on from the identification of the potential measures, a Red-Amber-Green assessment has been conducted for effectiveness and for deliverability. This is reported in the table below alongside a recommendation for whether the measures are brought forward in the short, medium, or long-term.

Table 9.2. Red-Amber-Green Assessment for Effectiveness and Deliverability for Potential EV Measures

Theme	Potential Measures	Effectiveness	Deliverability	Cost Level	RAG Rating Justification	Sequencing
	Increase provision of rapid charging infrastructure for taxis in convenient locations			High	A greater number of strategically located charging points for taxis could encourage EV uptake giving drivers confidence that reliable and accessible charging infrastructure is in place. The Local Transport Strategy supports the decarbonisation of the taxi sector, however there are no details as to how this will be achieved. This measure would benefit from being developed as part of a broader EV Taxi Strategy.	Medium/Long-Term
	Provide charging infrastructure for buses			High	Further engagement is required with industry stakeholders to determine the deliverability of transitioning buses to EV. Given the impact of the pandemic and historically declining levels of patronage, careful consideration is needed regarding how the costs of transitioning to EV can be accommodated, including the potential to secure grant funding. The Local Transport Strategy supports the decarbonisation of buses, however there are no details as to how this will be achieved.	Medium-term

Theme	Potential Measures	Effectiveness	Deliverability	Cost Level	RAG Rating Justification	Sequencing
	Provide charging points at car parks or on-street for key destinations			High	Council owned car parks are located around the primary and secondary settlements and coastal sites. Providing charging infrastructure at key locations will give people the confidence to transition to EV. A mixture of trickle and fast charging posts could be delivered at sites depending on the length of stay of users. SFT funding is available for Fife Council to progress this, and commercial funding should also be maximized. OZEV grants are available for employers, and these could be promoted through existing Fife communication channels with employers. A detailed analysis of potential gaps and recommended infrastructure can be found with the site assessment chapter.	Short-term
	On-route charging points on the Major Road Network			High	This option is largely deliverable due to public sector ownership of land in towns located in key positions along the M90, A91, A92, A915 and A985 and various potential funding sources for installation of charging posts. This would also likely benefit fleet vehicles who need top up charging during daily operations. Public surveys point to the availability of top up charging being key to the uptake of EVs however there is some uncertainty regarding how well these charging posts would be utilised in practice. Potential for on route charging is a key metric within the site assessment and a detailed analysis can be found within that section of the report, it has also been highlighted within the geospatial forecast modelling that through traffic is a significant part of the estimated future charging demand within Fife	Short-term

Theme	Potential Measures	Effectiveness	Deliverability	Cost Level	RAG Rating Justification	Sequencing
	Provide charging points to support residents with limited access to off-street parking provision and charging, focussed on community hub locations.			Medium	This measure would increase the visibility of charging infrastructure and may increase confidence amongst residents for investing in EVs, particularly in areas of limited off-street parking. Introduction of on-street charging for residents may be met with resistance from some residents, particularly if EVs have parking priority in spaces with charging infrastructure. This is particularly relevant to the areas of Linktown and Gallatown West in Kirkcaldy and Burntisland Docks, which have areas with limited residential off-street parking. For this reason, focusing on consolidated community hub locations is recommended option.	Short/Mediu-Term
	Provide off-street charging points to support residents with limited access to parking provision and home charging			High	As above, this measure would provide a charging solution for people who do not have off-street parking to charge their vehicle. This measure would be more deliverable, for instance using council-owned car parks, but there may be challenges with off-street parking being distant from residential units that may affect the attractiveness of this charging infrastructure. Where feasible, residential charging has been addressed in the strategy through available council owned car parks located in residential areas.	Short-Term
	Encourage and where possible support the introduction of charging forecourts			Very High (for funding of hubs by LA) or Low for engaging commercial partners	Due to limited EV uptake in Fife in the short-term and uncertainties regarding the medium/long-term demand, there is a question mark regarding the business case for charging hubs. In the short-term, it is recommended that smaller clusters of charging infrastructure are provided (linking to the use cases outlined above) to give users the confidence a charging post will be available for use. For larger charging hubs	Short-Term

Theme	Potential Measures	Effectiveness	Deliverability	Cost Level	RAG Rating Justification	Sequencing
					it is recommended that Fife engage with commercial partners in the medium to long-term.	
	Introduce charge points for the Council's own fleet and potentially the grey fleet			Medium	Decarbonising the Council's own fleet and grey fleet is being considered. Fife Council's 'Climate Fife: Sustainable Energy and Climate Action Plan (2020-2030)', sets out a focus on the decarbonisation of the Council's vehicle fleet and increasing the uptake of Electric Vehicles (EVs). To support the plan, the Council has commissioned the development of this EV Study, with a focus on future charging infrastructure and decarbonising the Council's fleet of vehicles. Notwithstanding this, there is no detail of any proposals to achieve this, as such detailed further analysis is required. However, any planned fleet transition to EV will need to consider supporting charging infrastructure.	Short-term
	Introduce charge points for HGVs			N/A	Due to there being limited commercially available EV options for HGVs this measure is not recommended at this time, however the situation should be kept under review to understand future developments for electric or hydrogen technology.	Long-term

Theme	Potential Measures	Effectiveness	Deliverability	Cost Level	RAG Rating Justification	Sequencing
	Charging infrastructure to support shared mobility / micro-mobility e.g. e-car clubs picking			Medium	Relatively low levels of charging infrastructure would be required to support measures such as e-car clubs and this could double as publicly available charging posts. It doesn't appear that Fife have any existing e-car clubs, other than Ore Valley partnership with Enterprise outlined previously, therefore provision of e-car clubs could give flexible and low-cost access to EVs across Fife. This would complement local policy that emphasises the importance of an integrated transport offer such as the Fife Local Transport Strategy 2023 - 2033.	Short-term
Engagement with the District Network Operator	Continuous engagement and joint working with SPEN. Investigation of potential for distributed renewable energy solutions.			Low	It will be important to work collaboratively with SPEN to address the challenges noted in this strategy and future proof key locations to address any supply issues as they arise. Initial contact has been undertaken with SPEN as part of this strategy which focused on grid performance, with particular locations of constraint in northeast Fife, Leven and south of Dunfermline. Further information on grid constraints, in relation to the short-term sites identified within this strategy, have been provided by SPEN in the form of estimates of connection costs.	Continuous engagement recommended
Local Policy Changes	Local policy evolution e.g. contract procurement and reviewing parking standards			Low	Ensuring policies are up to date could have a high impact at relatively low cost to guide developers and contactors to deploy their own funds in line with strategic objectives for electrification.	Ongoing

10. Site Assessment

10.1 Long List of Sites

An initial long list of all 165 available council owned car park was identified and this formed the long list of possible sites which could be used to address the predicted 2026 demand as outlined in Section 7.

This long list has been assessed based on a range of criteria in order to produce a short list of locations for charging infrastructure. That assessment is provided in more detail in the next section but for clarity the long list highlights the results of the assessment across a range of categories as below.

Table 10.1. Long list Assessment Categories

Category
Not Suitable
Not Fife Council Ownership
Uncertain Ownership
Preferred Site Agreed with Fife Council
Discounted for size
Suggested for medium/long-term provision

The full long list and categorisation is outlined below.

Table 10.2. Long list of Council Owned Car Parks

Car Park Name	Street Name	Town	Assessment
Aberdour - Station Car Park	Livingstone Lane	ABERDOUR	Preferred Site Agreed with Fife Council
Livingston Lane	Livingston Lane	ABERDOUR	Discounted for size
George Street Car Park	George Street	ANSTRUTHER	Discounted for size
Mayview Avenue Car Park	Mayview Road	ANSTRUTHER	Not Suitable
Crail Road Car Park	Crail Road	ANSTRUTHER	Preferred Site Agreed with Fife Council
James Street Car Park	James Street	ANSTRUTHER	Discounted for size
John Street Car Park	John Street	ANSTRUTHER	Discounted for size
Anstruther Harbour Car Park	Harbour (The Folly + East Basin)	ANSTRUTHER	Preferred Site Agreed with Fife Council
Station Road (A) Car Park	Station Road 'A'	AUCHTERMUCHTY	Preferred Site Agreed with Fife Council
Station Road (B) Car Park	Station Road 'B'	AUCHTERMUCHTY	Discounted for size
Kirkland Avenue Car Park	Kirkland Avenue	BALLINGRY	Not Suitable
Wellesley Road Car Park	Wellesley Road	BUCKHAVEN	Preferred Site Agreed with Fife Council
College Street Car Park	College Street	BUCKHAVEN	Suggested for medium/long-term provision
Links Place Car Park	Links Place	BURNTISLAND	Preferred Site Agreed with Fife Council
Seaforth Place Car Park	Seaforth Place	BURNTISLAND	Not Suitable
Somerville Street Car Park	Somerville Street	BURNTISLAND	Discounted for size
Station Road Car Park	Station Road	CARDENDEN	Preferred Site Agreed with Fife Council

Bog Well Car Park	Bog Well	CERES	Preferred Site Agreed with Fife Council
School Road Car Park	School Road	COALTOWN OF BALGONIE	Preferred Site Agreed with Fife Council
Bridge Street & High Street Car Parks	Bridge Street & High Street	COWDENBEATH	Preferred Site Agreed with Fife Council
Central Park Car Park	Central Park	COWDENBEATH	Preferred Site Agreed with Fife Council
Hall Street Car Park	Hall Street	COWDENBEATH	Suggested for medium/long-term provision
Stenhouse Street Car Park	Stenhouse Street	COWDENBEATH	Preferred Site Agreed with Fife Council
Foulford Street Car Park	Foulford Street	COWDENBEATH	Preferred Site Agreed with Fife Council
Marketgate South Car Park	Marketgate (South)	CRAIL	Preferred Site Agreed with Fife Council
Nethergate Car Park	Nethergate	CRAIL	Not Suitable
Halbeath Park & Ride Car Park		DUNFERMLINE	Uncertain Ownership
Balgownie West Car Park	Balgownie West	CULROSS	Suggested for medium/long-term provision
Low Causeway Car Park	East Low Causeway	CULROSS	Suggested for medium/long-term provision
East Burnside Car Park	East Burnside (Fluthers)	CUPAR	Preferred Site Agreed with Fife Council
Short Lane Car Park	Short Lane	CUPAR	Discounted for size
Bonnygate Car Park	Bonnygate	CUPAR	Preferred Site Agreed with Fife Council
Bay Centre Car Park	Regents Way	DALGETY BAY	Discounted for size
Dalgety Bay Station Car Park	Dalgety Bay Rail Halt	DALGETY BAY	Preferred Site Agreed with Fife Council
Dalgety Bay Leisure Centre	Harbour Drive	Dalgety Bay	Preferred Site Agreed with Fife Council
St. Davids Harbour Car Park	St Davids Harbour	DALGETY BAY	Preferred Site Agreed with Fife Council
Pentland Rise Car Park	Pentland Rise	DALGETY BAY	Suggested for medium/long-term provision
Hospital Hill Car Park	Hospital Hill	DUNFERMLINE	Preferred Site Agreed with Fife Council
Izatt Avenue Car Park	Izatt Avenue	DUNFERMLINE	Suggested for medium/long-term provision
Station Car Park	Station Car Park / St Margaret's Drive	DUNFERMLINE	Suggested for medium/long-term provision
Carnegie Birthplace	Priory Lane	DUNFERMLINE	Preferred Site Agreed with Fife Council
Walmer Drive Car Park	Walmer Drive	DUNFERMLINE	Preferred Site Agreed with Fife Council
Woodmill Street 1 Car Park	Woodmill Street / Station Car Park	DUNFERMLINE	Preferred Site Agreed with Fife Council
Queen Margaret Station Car Park	Queen Margaret Station	DUNFERMLINE	Not Suitable
Buchanan Street Car Park	Buchanan Street	DUNFERMLINE	Suggested for medium/long-term provision
Abbeyview Car Park	Abbey View	DUNFERMLINE	Suggested for medium/long-term provision

Canmore Street Car Park	Canmore Street	DUNFERMLINE	Suggested for medium/long-term provision
New Row/Canmore Street Car Park	Canmore Street / New Row	DUNFERMLINE	Not Fife Council Ownership
St. Margaret Street Car Park	St. Margaret Street 1&2	DUNFERMLINE	Discounted for size
Viewfield Terrace Car Park	Viewfield Terrace	DUNFERMLINE	Preferred Site Agreed with Fife Council
West Drive Car Park	West Drive	DUNFERMLINE	Discounted for size
Leys Park Road Car Park	Leys Park Road	DUNFERMLINE	Preferred Site Agreed with Fife Council
Priory Lane Car Park	Priory Lane	DUNFERMLINE	Suggested for medium/long-term provision
Woodmill Street 2 Car Park	Woodmill Street No.2	DUNFERMLINE	Preferred Site Agreed with Fife Council
Carnegie Drive East	Carnegie Drive / Winterthur Lane	DUNFERMLINE	Discounted for size
Carnegie Drive West	Carnegie Drive / Winterthur Lane	DUNFERMLINE	Discounted for size
Glen Bridge Car Park	Glen Bridge	DUNFERMLINE	Preferred Site Agreed with Fife Council
The Vennel	Kirk Park Road	ELIE	Preferred Site Agreed with Fife Council
Back Wynd Car Park	Back Wynd	FALKLAND	Preferred Site Agreed with Fife Council
Cross Wynd Car Park	Cross Wynd	FALKLAND	Discounted for size
Church Street Car Park	Church Street	GLENROTHES	Suggested for medium/long-term provision
St. Ninians Church	Durris Drive	GLENROTHES	Suggested for medium/long-term provision
Glenwood Centre Car Park	Glenwood Centre	GLENROTHES	Not Fife Council Ownership
CISWO Car Park	CISWO - North Street	GLENROTHES	Suggested for medium/long-term provision
Flemington Road Car Park	Flemington Road	GLENROTHES	Preferred Site Agreed with Fife Council
Glamis Centre (East & West) Car Park	Glamis Centre (East & West)	GLENROTHES	Preferred Site Agreed with Fife Council
Ferry Toll Car Park	Ferry Toll Park and Ride	INVERKEITHING	Suggested for medium/long-term provision
Binning Road Car Park	Binning Road	INVERKEITHING	Discounted for size
Chapel Place Car Park	Chapel Place	INVERKEITHING	Suggested for medium/long-term provision
King Street Car Park	King Street	INVERKEITHING	Suggested for medium/long-term provision
Queens Street Car Park	Queen Street	INVERKEITHING	Preferred Site Agreed with Fife Council
Admiralty Road Car Park	Belleknowes Park and Ride	INVERKEITHING	Suggested for medium/long-term provision
Keltyhill Road Car Park	Keltyhill Road	KELTY	Preferred Site Agreed with Fife Council
Main Road Car Park	Main Street	KELTY	Preferred Site Agreed with Fife Council

Maple Terrace Car Park	Maple Terrace	KELTY	Suggested for medium/long-term provision
Bishops Court Car Park	Bishops Court	KENNOWAY	Suggested for medium/long-term provision
Leven Road Car Park	Leven Road	KENNOWAY	Suggested for medium/long-term provision
Kilconquhar Car Park	Main Street	KILCONQUHAR	Suggested for medium/long-term provision
Walker Street Car Park	Walker Street	KINCARDINE	Preferred Site Agreed with Fife Council
Baliol Street Car Park	Baliol Street	KINGHORN	Suggested for medium/long-term provision
Nethergate Car Park	Nethergate	KINGHORN	Preferred Site Agreed with Fife Council
Lochty Avenue Car Park	Lochty Avenue	KINGLASSIE	Preferred Site Agreed with Fife Council
Victoria Road Car Park	Victoria Road	KIRKCALDY	Preferred Site Agreed with Fife Council
Templehall Avenue Car Park	Templehall Avenue	KIRKCALDY	Uncertain Ownership
Whyte Melville Road Car Park	Whyte Melville Road	KIRKCALDY	Preferred Site Agreed with Fife Council
Wilson Avenue Car Park	Wilson Avenue	KIRKCALDY	Preferred Site Agreed with Fife Council
Esplanade C Car Park	Esplanade 'C'	KIRKCALDY	Not Suitable
Station Road Car Park	Station Road	KIRKCALDY	Suggested for medium/long-term provision
St. Clair Street South Car Park	St. Clair Street (South)	KIRKCALDY	Suggested for medium/long-term provision
Loughborough Road Car Park	Loughborough Road	KIRKCALDY	Discounted for size
Strathearn Road Car Park	Junction Road	KIRKCALDY	Preferred Site Agreed with Fife Council
Oswald Wynd Car Park	Oswalds Wynd	KIRKCALDY	Preferred Site Agreed with Fife Council
Esplanade A Car Park	Esplanade 'A' - Opp. Ambassadeur	KIRKCALDY	Suggested for medium/long-term provision
Birnam Road Car Park	Birnam Road	KIRKCALDY	Preferred Site Agreed with Fife Council
Malcolm's Wynd	Malcolm's Wynd	KIRKCALDY	Discounted for size
Mid Street B Car Park	Mid Street 'B'	KIRKCALDY	Discounted for size
Nether Street Car Park	Nether Street	KIRKCALDY	Not Fife Council Ownership
Milton Road Car Park	Milton Road	KIRKCALDY	Suggested for medium/long-term provision
Nicol Street Car Park	Nicol Street	KIRKCALDY	Preferred Site Agreed with Fife Council
Charlotte Street B Car Park	Charlotte Street 'B'	KIRKCALDY	Suggested for medium/long-term provision
Cromarty Place Car Park	Cromarty Place	KIRKCALDY	Suggested for medium/long-term provision
St. James Church Car Park	St. James Church	KIRKCALDY	Discounted for size
Aitken Street Car Park	Aitken Street	KIRKCALDY	Suggested for medium/long-term provision
Brodick Road Car Park	Brodick Road	KIRKCALDY	Preferred Site Agreed with Fife Council
Alford Avenue Car Park	Alford Avenue	KIRKCALDY	Suggested for medium/long-term provision
Charlotte Street A Car Park	Charlotte Street 'A'	KIRKCALDY	Suggested for medium/long-term provision
Esplanade Multi Car Park	Esplanade Multi	KIRKCALDY	Not Suitable
Fish Wynd Car Park	Fish Wynd	KIRKCALDY	Discounted for size
Mid Street Car Park	Mid Street	KIRKCALDY	Preferred Site Agreed with Fife Council

St. Brycedale Car Park	St. Brycedale	KIRKCALDY	Discounted for size
Esplanade D Car Park	Esplanade 'D'	KIRKCALDY	Suggested for medium/long-term provision
Coal Wynd/Dunnikier Road Car Park	Coal Wynd / Mitchell Street	KIRKCALDY	Preferred Site Agreed with Fife Council
Dunnikier Road Car Park	Dunnikier Road	KIRKCALDY	Discounted for size
High Street Car Park	212 High Street	LESLIE	Suggested for medium/long-term provision
Greenside Car Park	Greenside	LESLIE	Preferred Site Agreed with Fife Council
Mansfield Road Car Park	Mansfield Road	LESLIE	Preferred Site Agreed with Fife Council
Railway Station Car Park	Railway Station	LEUCHARS	Preferred Site Agreed with Fife Council
Forth Street Car Park	Forth Street	LEVEN	Preferred Site Agreed with Fife Council
Shore Head Car Park	Shorehead	LEVEN	Suggested for medium/long-term provision
South Street/Viewforth Car Park	South Street / Viewforth	LEVEN	Preferred Site Agreed with Fife Council
Victoria Road Car Park	Victoria Road	LEVEN	Suggested for medium/long-term provision
Mitchell Street Car Park	Mitchell Street	LEVEN	Suggested for medium/long-term provision
North Street Car Park	North Street	LEVEN	Preferred Site Agreed with Fife Council
Promenade Car Park	Promenade	LEVEN	Not Suitable
South Street/Seagate Car Park	Seagate	LEVEN	Suggested for medium/long-term provision
School Lane Car Park	School Lane	LEVEN	Discounted for size
Commercial Road Car Park	Commercial Road	LEVEN	Suggested for medium/long-term provision
Francis Street Car Park	Francis Street	LOCHGELLY	Suggested for medium/long-term provision
Landale Street Car Park	Landale Street	LOCHGELLY	Suggested for medium/long-term provision
Harbour Wynd Car Park	Harbour Wynd (Old Station)	LOWER LARGO	Not Suitable
The Temple Car Park	The Temple	LOWER LARGO	Preferred Site Agreed with Fife Council
Glass Street Car Park	Glass Street	MARKINCH	Suggested for medium/long-term provision
Railway Station Car Park	Railway Station	MARKINCH	Suggested for medium/long-term provision
Betson Street Car Park	Betson Street	MARKINCH	Preferred Site Agreed with Fife Council
Balgonie Road Car Park	Balgonie Road	MARKINCH	Discounted for size
Wellesley Road Car Park	Wellesley Road	METHIL	Preferred Site Agreed with Fife Council
Birch Grove Car Park	Birch Grove	METHIL	Uncertain Ownership
Methil Brae Car Park	Methil Brae	METHIL	Preferred Site Agreed with Fife Council
Ossian Crescent Car Park	Ossian Crescent	METHIL	Preferred Site Agreed with Fife Council
Oakvale Road Car Park	Kirkland Walk / Oakvale Road	METHIL	Discounted for size
Logie Street Car Park	Logie Street	METHIL	Suggested for medium/long-term provision
Tay Street/Lyall Place Car Park	Tay Street / Lyall Place	NEWBURGH	Discounted for size
Battery Road Car Park	Battery Road	NORTH QUEENSFERRY	Preferred Site Agreed with Fife Council

High Street Car Park	Market Place	PITTENWEEM	Preferred Site Agreed with Fife Council
Burnside Crescent Car Park	Burnside Crescent (68-86)	ROSYTH	Suggested for medium/long-term provision
Admiralty Road Car Park	Admiralty Road (70-88)	ROSYTH	Uncertain Ownership
Aberlour Street 1&2 Car Park	Aberlour Street	ROSYTH	Preferred Site Agreed with Fife Council
Queensferry Road Car Park	Queensferry Road (99-101 & 103-115)	ROSYTH	Suggested for medium/long-term provision
Rosyth Rail Station Car Park	Rosyth Rail Station	ROSYTH	Suggested for medium/long-term provision
Main Street Car Park	Main Street / West Road	SALINE	Preferred Site Agreed with Fife Council
Woodburn Place Car Park	Woodburn Place	ST ANDREWS	Not Suitable
Argyle Street/Doubledykes Road Car Park	Argyle Street / Doubledykes Road	ST ANDREWS	Preferred Site Agreed with Fife Council
Murray Place Car Park	Murray Place	ST ANDREWS	Not Suitable
Petheram Bridge(A) Car Park	Petheram Bridge 'A'	ST ANDREWS	Preferred Site Agreed with Fife Council
St. Mary's Place Car Park	St Mary's Place	ST ANDREWS	Discounted for size
Bruce Embankment Car Park	Bruce Embankment	ST ANDREWS	Not Suitable
The Common	The Common	ST MONANS	Suggested for medium/long-term provision
East Street Car Park	East Street	ST MONANS	Discounted for size
Hope Place Car Park	Hope Place	ST MONANS	Preferred Site Agreed with Fife Council
Petheram Bridge (B) Car Park	Petheram Bridge	ST. ANDREWS	Suggested for medium/long-term provision
Strathore Road Car Park	Strathore Road	THORNTON	Preferred Site Agreed with Fife Council
Thornton Railway Station	Main Street	THORNTON	Preferred Site Agreed with Fife Council
Durie Bank Car Park	Durie Bank	WINDYGATES	Discounted for size

10.2 Development of Shortlist

To develop a shortlist of sites for the installation of EV infrastructure, the starting point was the long list all available off-street car parks operated by Fife Council. To identify a shortlist of sites suitable for delivering short-term infrastructure in line with the EVIF funding goals (2024-2026) (detailed in section 11.5.1) a number of steps were taken as outlined below:

- The forecast model outputs of predicted charging requirements by use case were used to identify the charging use predicted case need for 2026 forecast infrastructure requirements at a settlement level.
- Estimates of potential future commercial EV infrastructure from supermarkets and petrol stations were the considered and the total charging requirements in each settlement was adjusted accordingly.

- A qualitative review was then undertaken of the available sites within each settlement to highlight any sites that had very low numbers of parking spaces and/or safety of security concerns.
- The remaining sites were then allocated potential use cases based on the remaining forecast model charging requirements at a settlement level based on a review of their location and number of parking spaces.
- The draft shortlist of sites was then reviewed by representatives in Fife Council, who provided further information with regards to local considerations and nuances on the suggested sites and use cases.

The purpose of these assessments is to identify a forward pipeline of suitable sites for further investigation and design, which takes cognisance of the upcoming feasibility work including seeking budget estimates from SPEN prior to progressing with the deployment of sites. The final list of council owned car parks and the suggested EV infrastructure that would help meet 2026 forecast charging demand is outlined below in

Table 10.3. Final Proposed Short List of Sites (* denotes car parks that are not in Fife Ownership or ownership status is unknown)

Proposed Site			Proposed Charging Mix		
Location	**Settlement**	**Number of Spaces**	**7 kW**	**22 kW**	**50 kW**
Aberdour - Station Car Park	Aberdour	69	1	1	2
Crail Road Car Park	Anstruther	31	2	0	0
Anstruther Harbour Car Park - East Basin car park	Anstruther	97	0	1	1
Station Road (A) Car Park	Auchtermuchty	26	3	1	2
Parking area off Wilson Avenue	Blairhall	Approx 22 (unmarked)	1	0	0
Beacon Leisure Centre	Burntisland	TBC	2	0	1
Links Place Car Park	Burntisland	TBC	1	0	0
Cairneyhill Primary School (Community Use)	Cairneyhill	Approx 20	2	0	0
Station Road Car Park	Cardenden	46	2	0	0
Bog Well Car Park	Ceres	46	2	1	0
School Road Car Park	Coaltown of Balgonie	31	1	0	0
Central Park Car Park	Cowdenbeath	91	0	0	2
Foulford Street Car Park*	Cowdenbeath	18	4	0	0
Stenhouse Street Car Park	Cowdenbeath	139	0	2	2
Bridge Street & High Street Car Parks	Cowdenbeath	92	2	1	0
Marketgate South Car Park	Crail	19	2	1	0
King George V Park/King George's Field*	Crossford	Unmarked	1	2	0
East Burnside Car Park	Cupar	247	0	0	2
Bonnygate Car Park	Cupar	166	0	2	0
Dalgety Bay Leisure Centre*	Dalgety Bay and Hillend	116	0	2	0
Dalgety Bay Station Car Park	Dalgety Bay and Hillend	194	0	2	2

Proposed Site			Proposed Charging Mix		
St. Davids Harbour Car Park	Dalgety Bay and Hillend	40	2	0	0
Leys Park Road Car Park	Dunfermline	441	4	2	4
Walmer Drive Car Park	Dunfermline	276	0	6	4
Woodmill Street 1 Car Park	Dunfermline	191	2	4	2
Glen Bridge Car Park	Dunfermline	156	0	4	1
Viewfield Terrace Car Park	Dunfermline	116	0	2	0
Carnegie Birthplace	Dunfermline	40	2	2	0
Woodmill Street 2 Car Park	Dunfermline	28	2	1	0
Hospital Hill Car Park	Dunfermline	24	0	0	2
Pittencrieff Park Car Park	Dunfermline	98	0	4	2
Rolland Avenue - Surfaced Area (Housing)	East Wemyss	4	1	0	0
Main Street Parking Bays opps Kingslaw (Housing)	East Wemyss	4	0	1	0
The Vennel car park*	Elie and Earlsferry	12	1	1	0
Back Wynd Car Park	Falkland	91	0	1	0
Glamis Centre (East & West) Car Park	Glenrothes	N/A	4	0	0
Flemington Road Car Park	Glenrothes	N/A	1	0	0
Queens Street Car Park	Inverkeithing	32	2	0	2
Keltyhill Road Car Park	Kelty	46	3	0	0
Main Road Car Park*	Kelty	26	0	2	1
Walker Street Car Park	Kincardine	67	2	0	2
Nethergate Car Park	Kinghorn	16	2	0	2
Lochty Avenue Car Park*	Kinglassie	16	1	1	0
Church Street	Kingseat	Approx 10 (unmarked)	1	0	0
Whyte Melville Road Car Park	Kirkcaldy & Dysart	444	4	0	2
Oswald Wynd Car Park	Kirkcaldy & Dysart	92	4	0	0
Strathearn Road Car Park	Kirkcaldy & Dysart	72	3	0	2
Victoria Road Car Park	Kirkcaldy & Dysart	64	2	0	0
Brodick Road Car Park	Kirkcaldy & Dysart	61	2	0	2
Mid Street Car Park	Kirkcaldy & Dysart	50	2	0	0
Birnam Road Car Park	Kirkcaldy & Dysart	30	2	0	0
Coal Wynd/Dunnikier Road Car Park*	Kirkcaldy & Dysart	27	2	0	0
Wilson Avenue Car Park	Kirkcaldy & Dysart	20	2	0	0
Kirkcaldy Rail Station - Station Road Car Park	Kirkcaldy & Dysart	132	2	0	0
Nicol Street Car Park	Kirkcaldy & Dysart	67	2	0	0
Greenside Car Park	Leslie	44	1	0	0
Mansfield Road Car Park	Leslie	50	1	0	0

Proposed Site			Proposed Charging Mix		
Leuchars Railway Station Car Park	Leuchars and Guardbridge	151	0	2	0
The Temple Car Park	Lower Largo	50	2	2	2
Betson Street Car Park	Markinch	29	2	0	0
South Street/Viewforth Car Park	Methil, Leven & Buckhaven	113	4	0	1
Wellesley Road Car Park	Methil, Leven & Buckhaven	30	2	0	0
Methil Brae Car Park*	Methil, Leven & Buckhaven	24	2	0	0
Ossian Crescent Car Park	Methil, Leven & Buckhaven	20	2	0	0
Forth Street Car Park	Methil, Leven & Buckhaven	51	2	0	0
North Street Car Park*	Methil, Leven & Buckhaven	31	2	0	0
Cupar Road Car Park	Newburgh (Fife)	49	3	2	0
Battery Road Car Park	North Queensferry	24	1	0	0
Oakley Campus	Oakley, Carnock and Comrie	N/A	1	0	1
High Street Car Park	Pittenweem	10	1	1	0
Aberlour Street 1&2 Car Park	Rosyth	37	2	0	0
Main Street Car Park	Saline	13	1	1	0
Tarvit Terrace (Housing)*	Springfield	19	1	0	0
Argyle Street/Doubledykes Road Car Park	St Andrews	199	4	2	0
Petheram Bridge(A) Car Park	St Andrews	206	0	0	2
Hope Place Car Park*	St Monans	14	1	0	0
The Glebe parking area*	Strathkinness	N/A	1	0	0
Strathore Road Car Park	Thornton	26	1	1	0
Thornton Railway Station	Thornton	49	1	0	0
Milton Institute Car Park	Windygates	N/A	1	0	0

10.3 Power Assessment

The connection costs for the installation of the EV infrastructure have been calculated and provided by SPEN for each of the shortlisted sites. Table 10.4 displays these costs, which consider the cost required to ensure power supply to each of the sites.

The key assumptions around the costs were supplied by SPEN and have been replicated verbatim below for transparency:

- The costings do not include associated CPO costs for items such as the cut-out cabinet and the meter.

- While SPEN has a contract for traffic management on roads up to 40mph with 4-way lights, any traffic management costs for roads exceeding these limits have been omitted.
- Cable routes have been approximated without detailed analysis of the local network so may be subject to change once formal connection requests for the sites are submitted to SPEN.
- Connection requests for >200kVA are likely to require the construction of a secondary substation. These cost c. £80,000, so detailed costings have not been provided for these connections due to the emergence of additional costing factors that require additional network analysis when considering a HV connection.
- Connection requests for <200kVA are unlikely to require the construction of a secondary substation. However, in the event that there is no unavailable capacity on a nearby substation (within ~300m), the customer will be charged for the construction of a new secondary substation.
- Some sites have been provided without coordinates. Where this is the case, an assumption has been made about where the Car Park charge point location is required.

Table 10.4. Connection Costs per site supplied by SPEN

Location	Settlement	Cost (£)
Aberdour - Station Car Park	Aberdour	£6,879
Crail Road Car Park	Anstruther	£4,379
Anstruther Harbour Car Park - East Basin Car Park	Anstruther	£5,022
Station Road (A) Car Park	Auchtermuchty	£5,418
Parking area off Wilson St	Blairhall	£7,419
Beacon Leisure Centre	Burntisland	£2,185
Links Place Car Park	Burntisland	£5,857
Cairneyhill Primary School (Community Use)	Cairneyhill	£4,427
Station Road Car Park	Cardenden	£2,637
Bog Well Car Park	Ceres	£3,357
School Road Car Park	Coaltown of Balgonie	£3,765
Central Park Car Park	Cowdenbeath	£12,190
Foulford Street Car Park*	Cowdenbeath	£5,678
Stenhouse Street Car Park	Cowdenbeath	£4,671
Bridge Street & High Street Car Parks	Cowdenbeath	£4,483
Marketgate South Car Park	Crail	£2,408
King George V Park/King George's Field*	Crossford	£5,874
East Burnside Car Park	Cupar	£2,628
Bonnygate Car Park	Cupar	£3,321
Dalgety Bay Leisure Centre*	Dalgety Bay and Hillend	£11,178
Dalgety Bay Station Car Park	Dalgety Bay and Hillend	£98,298
St. Davids Harbour Car Park	Dalgety Bay and Hillend	£7,449
Leys Park Road Car Park	Dunfermline	£101,825

Location	Settlement	Cost (£)
Walmer Drive Car Park	Dunfermline	£87,498
Woodmill Street 1 Car Park	Dunfermline	£110,308
Glen Bridge Car Park	Dunfermline	£9,430
Viewfield Terrace Car Park	Dunfermline	£2,185
Carnegie Birthplace	Dunfermline	£9,041
Woodmill Street 2 Car Park	Dunfermline	£4,795
Hospital Hill Car Park	Dunfermline	£5,038
Pittencrieff Park Car Park	Dunfermline	£9,426
Rolland Avenue - Surfaced Area (Housing)	East Wemyss	£4,159
Main Street Parking Bays opps Kingslaw (Housing)	East Wemyss	£2,408
The Vennel car park*	Elie and Earlsferry	£2,185
Back Wynd Car Park	Falkland	£2,185
Glamis Centre (East & West) Car Park	Glenrothes	£6,633
Flemington Road Car Park	Glenrothes	£2,185
Queens Street Car Park	Inverkeithing	£8,645
Keltyhill Road Car Park	Kelty	£3,551
Main Road Car Park*	Kelty	£5,614
Walker Street Car Park	Kincardine	£5,813
Nethergate Car Park	Kinghorn	£3,921
Lochty Avenue Car Park*	Kinglassie	£4,041
Church Street	Kingseat	£3,020
Whyte Melville Road Car Park	Kirkcaldy & Dysart	£99,388
Oswald Wynd Car Park	Kirkcaldy & Dysart	£2,790
Strathearn Road Car Park	Kirkcaldy & Dysart	£4,111
Victoria Road Car Park	Kirkcaldy & Dysart	£2,185
Brodick Road Car Park	Kirkcaldy & Dysart	£5,389
Mid Street Car Park	Kirkcaldy & Dysart	£8,243
Birnam Road Car Park	Kirkcaldy & Dysart	£6,629
Coal Wynd/Dunnikier Road Car Park*	Kirkcaldy & Dysart	£2,653
Wilson Avenue Car Park	Kirkcaldy & Dysart	£2,694
Kirkcaldy Rail Station - Station Road Car Park	Kirkcaldy & Dysart	£4,058
Nicol Street Car Park	Kirkcaldy & Dysart	£2,185
Greenside Car Park	Leslie	£3,047
Mansfield Road Car Park	Leslie	£7,061
Leuchars Railway Station Car Park	Leuchars and Guardbridge	£5,004

Location	Settlement	Cost (£)
The Temple Car Park	Lower Largo	£93,916
Betson Street Car Park	Markinch	£2,923
South Street/Viewforth Car Park	Methil, Leven & Buckhaven	£5,220
Wellesley Road Car Park	Methil, Leven & Buckhaven	£6,716
Methil Brae Car Park*	Methil, Leven & Buckhaven	£2,710
Ossian Crescent Car Park	Methil, Leven & Buckhaven	£2,185
Forth Street Car Park	Methil, Leven & Buckhaven	£2,185
North Street Car Park*	Methil, Leven & Buckhaven	£5,618
Cupar Road car park	Newburgh (Fife)	£4,417
Battery Road Car Park	North Queensferry	£2,291
Oakley Campus	Oakley, Carnock and Comrie	£4,122
High Street Car Park	Pittenweem	£5,011
Aberlour Street 1&2 Car Park	Rosyth	£2,449
Main Street Car Park	Saline	£6,247
Tarvit Terrace (Housing)*	Springfield	£2,185
Argyle Street/Doubledykes Road Car Park	St Andrews	£5,898
Petheram Bridge(A) Car Park	St Andrews	£6,029
Hope Place Car Park*	St Monans	£2,185
The Glebe parking area*	Strathkinness	£2,603
Strathore Road Car Park	Thornton	£3,449
Thornton Railway Station	Thornton	£6,851
Greig Institute Car Park, Milton Road	Windygates	£4,827

For most sites, the costing is between £2,185 and £12,190, however there are 6 sites which have a significantly higher cost attached to them:

- Whyte Melville Road Car Park
- Dalgety Bay Station Car Park
- The Temple Car Park
- Woodmill Street 1 Car Park
- Leys Park Road Car Park
- Walmer Drive Car Park

3 of the most expensive sites are located within Dunfermline, which reflects the known power constraints within this settlement, which in turn results in much higher costs. Excluding the Dunfermline sites, the average cost per site is £8,442.

10.4 Short and Medium/Long-Term Recommendations

The following section contains a short to medium/long-term qualitative appraisal of the EV need within Fife on an individual settlement basis. This brings together the existing situation, potential commercial infrastructure, and shortlist assessment to provide recommendations for addressing the short- and longer-term needs. The recommendations are split across three tables which cover the primary centres, secondary centres, and small towns respectively.

The short-term recommendations are focused on making the best use of currently available council owned car parking sites to address the demand estimates taken from the 2026 forecast modelling. The medium/long-term recommendations focus on the further use of council owned car parks as well as possible community owned sites, however it should be noted that there is still a lot of uncertainty within the EV market when looking to the medium to long-term.

10.4.1 Primary Centres

The following table outlines the short to medium/long-terms recommendations for the primary centres located within Fife. Overview is showing both Fife Council eFife network and other public facilities in the areas.

Table 10.5. Recommended Short to Medium-Term Delivery plan (Primary Centres)

Dunfermline	
Overview	The current level of EV infrastructure within Dunfermline is relatively low compared with other primary settlements in Fife with 9 trickle (7kW), 14 fast (22kW) and 4 Rapid (50kW) charging posts. Dunfermline is the main centre within Fife and has the largest population as well as being a major employment, retail and tourism destination and being in close proximity to the M90, A92 and A985. Given these factors there 2026 forecast modelling predicts a significant amount of additional charging posts will be needed to meet demand in 2026. There are 31 council owned car parks in Dunfermline, which could be used to provide additional infrastructure in the short-term as well as a number of supermarkets and petrol stations that provide an opportunity for future commercial destination and on route charging.
Short-Term Recommendations	It is recommended that car parks at Leys Park Road, Walmer Drive, Woodmill Street 1 and 2, Glen Bridge, Viewfield Terrace, New Row/Canmore Street, Carnegie Birthplace, Hospital Hill and Pittencrieff Park Car Parks are used to supply additional trickle (7kW), fast (22kW) and Rapid (50kW) charging infrastructures in line with the predicted forecast 2026 infrastructure requirements. Newly opened St Columba's RC High School and Woodmill High School joint campus has 4 trickle (7kW) and 8 Fast (22kW) chargers.
Medium/Long-Term Recommendations	For longer term requirements, additional charging infrastructure could be added to the recommended council owned car parks for fast (22kW) and Rapid (50kW) infrastructure as well as additional sites at Abbeyview, Carnegie Drive West, Priory Lane, Canmore Street and Buchanan Street. For gaps in residential charging provision in areas without access to off-street parking that can't be served by council owned car parks, on-street charging options should considered.

Glenrothes	
Overview	The existing EV infrastructure in Glenrothes is comparatively good with 9 trickle (7kW),1 fast (22kW) and 4 Rapid (50kW) and 8 above 50kW charging posts. Glenrothes is one of the primary settlements in Fife and has a significant population as well as being an employment, retail, and tourism destination and the A92 passes directly through the East of the settlement. Given these factors there 2026 forecast modelling predicts a significant amount of additional charging post will be needed to meet demand in 2026. There are 13 council owned car parks, which can be used to provide additional infrastructure in the short-term as well as a number of supermarkets and petrol station that provide an opportunity for future commercial destination and on route charging.
Short-Term Recommendations	It is recommended that Glamis Centre (East and West), Flemington Road and Glenwood Centre Car Parks to provide additional trickle (7kW) residential charging infrastructure.
Medium/Long-Term Recommendations	For longer term requirements, additional charging infrastructure could be added to the recommended car parks as well as utilising parking at Lomond Centre Car Park, Fullerton Road Car Park, Cadham Shopping Centre Car Park and Magnus Drive. For gaps in residential charging provision in areas without access to off-street parking that can't be served by council owned car parks, on-street charging may be considered.
Kirkcaldy and Dysart	
Overview	There is some existing EV infrastructure in Kirkcaldy & Dysart with 4 trickle (7kW), 5 fast (22kW) and 6 Rapid (50kW) charging posts. Kirkcaldy & Dysart is one of the primary settlements in Fife and therefore has a significant population as well as being an employment, retail and tourism destination and is close to the A92 and A915. Given these factors there 2026 forecast modelling results highlight that a significant amount of additional infrastructure will likely be needed to meet demand across all use cases. There are 29 council owned car parks, which could be used to provide additional infrastructure in the short-term as well as a large number of supermarkets and 2 petrol station that provide an opportunity for future commercial destination and on route charging.
Short-Term Recommendations	It is advised that Esplanade MSCP, Whyte Melville Road, Esplanade C, Oswald Wynd, Strathearn Road, Victoria Road, Brodick Road, Mid Street, Nether Street, Birnam Road, Coal Wynd/Dunnikier Road and Wilson Avenue Car Parks to provide additional trickle (7kW) residential and rapid (50kW) charging infrastructure.
Medium/Long-Term Recommendations	For longer term requirements, additional charging infrastructure could be added to the recommended car parks as well as utilising the remaining council owned car parks. For gaps in residential charging provision in areas without access to off-street parking that can't be served by council owned car parks, on-street charging may be considered.

10.4.2 Secondary Centres

The following table outlines the short to medium/long-terms recommendations for the secondary centres located within Fife.

Table 10.6. Recommended Short to Medium-Term Delivery plan (Secondary Centres)

Cowdenbeath, Lochgelly and Lumphinnans	
Overview	Cowdenbeath, Lochgelly and Lumphinnans has a population of around 19,330 people. The area currently has a number of existing public chargers including 1 trickle (7kW) and 1 fast (22kW) chargers. Cowdenbeath, Lochgelly and Lumphinnans are located near M90 and A92 and there are seven council owned car parks which have been considered for use. There are also Morrisons, Aldi and Lidl supermarkets as well as an industrial estate, football stadium and golf club. There are no BP/Shell Service Stations in the settlement. The 2026 forecasting suggests that there is likely to be a need for 7 trickle (7kW), 4 fast (22kW) and 2 rapid (50kW) chargers.
Short-Term Recommendations	In the short-term, Central Car Park, Foulford Street, Stenhouse Street and Bridge Street Car Parks are recommended to use to provide the predicted forecast infrastructure.
Medium/Long-Term Recommendations	In the medium to long-term, infrastructure could be introduced at other smaller council owned car parks such as Hall Street. It is also likely that possible provision of future public EV infrastructure at supermarkets and industrial estate.
St Andrews	
Overview	St Andrews has a population of around 18,410 people. The area currently has a number of existing public chargers including 8 trickle, 11fast chargers and 3 rapid chargers, with a lot these based around the university buildings and golf courses. St Andrews is home to one of the UK's major universities as well as an internationally important golf course as well as various other tourist attractions such as historical locations, museums, aquarium, and a botanical garden. There are seven council owned car parks in St Andrews which have been considered for use, there are also Morrisons and LIDL supermarkets. There is a BP/Shell Service Station located on the A915 in the centre of St Andrews. The 2026 forecasting suggests that there is likely to be a need for 7 trickle, 4 fast and 2 rapid chargers.
Short-Term Recommendations	In the short-term, Argyle Street/Doubledykes Road and Petheram Bridge(A) Car Park are recommended to use to provide the predicted forecast infrastructure that is not already covered by existing provision.
Medium/Long-Term Recommendations	In the medium to long-term, infrastructure could be introduced at other smaller council owned car parks such as St Marys Place and Petheram Bridge. It is also likely that possible provision of future public EV infrastructure at services stations, supermarkets, education and tourist sites, the council should liaise with landowners to understand likely future provision and use council car parks to fill any likely gaps.
Cupar	

Overview	Cupar has a population of around 8,960 people. The area currently has provision of 2 trickle chargers located at Bonnygate & Fluthers (East Burnside) council car parks and 1 fast (22kW) at the railway station. The retail park in Cupar has 2 rapid chargers and Fife Council has installed a Rapid charger in Fluthers car park. Cupar has a number of historical landmarks that attract tourism. There are three council owned car parks in Cupar which have been considered for use, there are also Tesco, LIDL and Aldi supermarkets as well as a wider retail park. There are no BP/Shell Service Station located within the settlement but the A91 runs directly through Cupar and there is an industrial estate, garden centre and petrol station to the East. The 2026 forecasting suggests that there is likely to be a need for 6 trickle, 4 fast and 2 rapid chargers.
Short-Term Recommendations	In the short-term, given their relatively large size, additional chargers could be installed in Bonnygate & East Burnside council car parks to provide the predicted forecast infrastructure. Given the possible provision of future infrastructure in supermarket, retail and industrial parks and garden centres, the council should liaise with landowners to understand likely future provision.
Medium/Long-Term Recommendations	In the medium to long-term, residential infrastructure could be introduced at other smaller council owned car parks such as Short Lane. It is also likely that the Aldi, Asda, and Tesco supermarkets will provide some destination charging as well as possible fast/rapid provision at retail and industrial estates and garden centre. Where residential charging can't be fully addressed through council or community sites, options around on-street charging may need to be investigated.
Dalgety Bay and Hillend	
Overview	Dalgety Bay has a population of around 9,710 people. The area currently has provision of 1 trickle and 4 fast chargers. Dalgety Bay is located directly south of the A921 along the Fife Coastal Path and relatively near Dunfermline and the M90. There are four council owned car parks in Dalgety Bay which have been considered for use. There are also Tesco supermarket located further south in the town, the car park of which is managed by Fife Council, as well as Aldi and Asda are located to the north of the town, near the A921. There is also a BP Service Station located to the north of the settlement, just off the A921 which has recently installed 2 ultra rapid chargers. The 2026 forecasting suggests that there is likely to be a need for 9 trickle, 8 fast and 5 rapid chargers.
Short-Term Recommendations	In the short-term Dalgety Bay Leisure Centre, Dalgety Bay Station and St Davids Harbour car parks could be used to provide the predicted forecast infrastructure. With St Davids Harbour car park being located next to a number of recently built blocks of flats. There are now 3 rapid (50kW plus) at Dalgety Bay Gateway retail area, therefore focus should be on trickle charging provision, with some additional fast and rapid as needed.
Medium/Long-Term Recommendations	In the medium to long-term, infrastructure could be introduced at other council owned car parks such as Pentland Rise. It is also likely that the Aldi, Asda, and Tesco supermarkets will provide some destination charging and the BP Petrol station will provide some rapid provision. There may also be some provision at Hillend Industrial Estate and the council should liaise with owners to understand future plans in this area.
Methil, Leven and Buckhaven	

Overview	The existing EV infrastructure in Methil, Leven and Buckhaven consist of 3 trickle (7kW) and 2 fast (22kW) charging posts. Methil, Leven and Buckhaven is located on the Firth of Forth Estuary and has a comparatively large population as well as being a tourism destination, the A915 passes directly to the north of the settlements. 2026 forecast modelling predictions are also comparatively high. There are 19 council owned car parks, which could be used to provide additional infrastructure in the short-term as well as 3 supermarkets and 2 petrol station that provide an opportunity for future commercial destination and on route charging.
Short-Term Recommendations	The available petrol stations and supermarkets have the potential to cover a lot of the predicted fast and rapid charging demand and so use of available council owned car parking should be focused on meeting the predicted trickle residential demand in Methil, Leven and Buckhaven. It is recommended that the South Street/Viewforth car park is used to address some forecast rapid and trickle demand need, with the car parks in Wellesley Road, Methil Brae, Ossian Crescent, Forth Street Car Park and North Street Car Park used to provide more trickle residential infrastructure. There are also 21 new charging units at Leven and Cameron Rail Stations.
Medium/Long-Term Recommendations	For longer term requirements, additional charging infrastructure could be added to the recommended car parks as well as utilising the significant number of remaining council owned Car Parks. For gaps in residential charging provision in areas without access to off-street parking that can't be served by council owned car parks, on-street charging may be considered.

10.4.3 Small Towns

The following table outlines the short to medium/long-terms recommendations for the small towns located within Fife.

Table 10.7. Recommended Short to Medium-Term Delivery plan (Small Towns)

Burntisland	
Overview	Burntisland has a population of around 6,630 people. The area currently has provision of 2 fast chargers and is located directly south of the A921 along the Fife Coastal Path. There are two council car parks in Burntisland which have been considered for use. There are no major supermarkets or BP/Shell petrol stations in the immediate area, however, it does serve as a key tourist destination given its location near the beach and home to a number of historical and cultural locations. The 2026 forecasting suggests that there is likely to be a need for 3 trickle and 1 rapid charger given that fast destination charging is already provided.
Short-Term Recommendations	In the short-term Beacon Leisure Centre and Links car parks could be used to provide the predicted forecast infrastructure, some charging demand may also be catered for nearby in the other smaller towns along the Fife Coastal Path.
Medium/Long-Term Recommendations	In the medium to long-term, community and private sites may be viable options for additional infrastructure such as community's centres, parks, and the rail station. However, agreements would need to be reached with community organisations and private land owners before charge points could be installed in these locations.
Kelty	

Overview	Kelty has a population of around 6,760 people. The area currently has no EV charging provision and is located directly adjacent to the M90 (J4) showing a good possible location for on-route charging. There are two council car parks in Kelty which have been considered for use. There are no major supermarkets or BP/Shell petrol stations in the immediate area, however, there is a football stadium and some community buildings which may lead to some further EV infrastructure provision. The 2026 forecasting suggests that there is likely to be a need for 3 trickle, 2 fast and 1 rapid charger.
Short-Term Recommendations	In the short-term the car parks located at Keltyhill Road and Main Road could be used to provide the forecast infrastructure, some charging demand may also be catered for nearby in Cowdenbeath and Dunfermline.
Medium/Long-Term Recommendations	In the medium to long-term, community and private sites may be viable options for additional infrastructure. However, agreements would need to be reached with community organisations and private land owners before charge points could be installed in these locations.
Leuchars and Guardbridge	
Overview	Leuchars and Guardbridge have a population of around 4,000 people. The area currently has 4 trickle and 2 fast EV chargers and the A91 lies just to the south. There are two council car parks in Leuchars and Guardbridge which have been considered for use. There are no supermarkets or BP/Shell petrol stations in the immediate area, however, there is St Michaels Golf club as well as some buildings connected to St Andrews University which may lead to some private EV infrastructure installation. The 2026 forecasting suggests that there is likely to be a need for 1 trickle and 1 fast charger.
Short-Term Recommendations	In the short-term the car park located at Railway Station car park could be used to provide further infrastructure if required, some charging demand may also be catered for in St Andrews which lies 3 miles to the East.
Medium/Long-Term Recommendations	For further infrastructure in the medium to long-term, the use of additional parking sites such as Guardbridge Car Park could be used, and it may be useful to liaise with community groups to assess other possible additional sites as well as liaising with landowners of the Golf Club and University Buildings.
Lower Largo, Lundin Links and Upper Largo	
Overview	Lower Largo, Lundin Links and Upper Largo have a population of around 3,000 people. The area currently has 2 fast EV chargers. There are two council car parks in Lower Largo which have been considered for use. There are no supermarkets or petrol stations in the area, however, the area is on the coast of the Firth of Forth, with access to beaches and golf courses, this means that there is the potential for the villages to be a destination for tourists.
Short-Term Recommendations	In the short-term the car park located at The Temple could be used to provide the additional recommended infrastructure.
Medium/Long-Term Recommendations	To fulfil potential further medium to long-term demand then there is potential for community sites to be utilised to supply further EV infrastructure if sites could be identified and agreements put in place with land owners.
Ballingry, Lochore and Crosshill	

Overview	Ballingry, Lochore and Crosshill have a population of between 6,000 and 7,000 people. There is an existing fast (22kW) charger at Lochore Meadows. There is one council car park with in Ballingry, but this has been discounted as a potential location as the car park only has 8 spaces and is located close to a nursery, in the middle of a residential area. There are no supermarkets or petrol stations in Ballingry, Lochore or Crosshill. However, there is an activity centre at Loch Ore (close to Crosshill) which could act as a tourist attraction for the area.
Short-Term Recommendations	Due to a lack of suitable council owned parking facilities within Ballingry, Lochore and Crosshill, no short-term locations have been identified. In the short-term demand could be fulfilled nearby in Cowdenbeath and Glenrothes.
Medium/Long-Term Recommendations	Given the lack of council owned car parks outside of Lochore Meadows, a community car park may be a suitable location for additional charge point infrastructure. However, agreements would need to be reached with community organisations before charge points could be installed in these locations. Potential locations include Flockhouse Avenue, the Bragg Centre and Benarty Community Centre and Library. Given the proximity to the M90, there may also be future charging infrastructure supplied by service stations which may fulfil demand.
Cardenden and Auchterderran	
Overview	Cardenden and Auchterderran have a population of approximately 6,000, and currently has one 22kW charger. The town and village are located just to the north of the A92, approximately 7km from the centre of Kirkcaldy. The area has one council car park on station road, with 46 spaces. When considering private provision, there are no petrol stations but there is a Tesco express and train station, both which have small car parks. The 2026 forecasting suggests that there is likely to be a need for 2 trickle chargers, 1 fast charger and 1 rapid charger.
Short-Term Recommendations	Given there is a council car park (Station Road Car Park) in Cardenden, it is expected that this location would be used as a location for new charge points. It has been decided that two trickle chargers will be installed in this location. Some demand may also be catered for nearby in Kirkcaldy.
Medium/Long-Term Recommendations	In the medium to long-term, community and private sites may be viable options for additional infrastructure. However, agreements would need to be reached with community organisations and private land owners before charge points could be installed in these locations.
Newport on Tay and Wormit	
Overview	Newport-on-Tay and Wormit has a population of 4,210 with 2 fast chargers at Tay Bridge Car Park and Waterstone Crooks Sports Centre Car Park and is adjacent to the A92. There are no council owned car parks, major retail centres, supermarkets, or BP/Shell service stations. Given these factors, the 2026 modelling suggests that there will need to be 7 trickle chargers, 4 fast chargers, and 2 rapid chargers.
Short-Term Recommendations	Due to a lack of council owned parking facilities within Newport-on-Tay and Wormit, no short-term locations have been identified, however given the proximity of this area to Dundee, it is likely some of the charging demand could be covered within this city. There may also be scope to increase the chargers at the Sports Centre and the facility owners should be liaised with on this basis.

Medium/Long-Term Recommendations	Given the lack of council owned car parks, a community or other owned car park may be a viable option for the additional infrastructure such as the Parking area Riverside Rd, Wormit Tennis Club and Kinbrae Park Gardens. There is also a Shell service station on the A92 which may see an introduction of EV charging infrastructure.
Oakley, Carnock and Comrie	
Overview	Oakley, Carnock and Comrie has a population of 3,860 with 1 fast charger and the A907 runs through the town. There are no council owned car parks, major retail centres, BP/Shell service stations, or tourism. Given these factors, the 2026 modelling suggests that there will need to be 1 trickle charger, 1 fast charger, and 1 rapid charger.
Short-Term Recommendations	While there is no council owned car park in Oakley, Carnock or Comrie, Fife Council operates the Oakley Campus which has private parking. This site is suitable for the installation of charge points, as the site already has a library which is open to the public. 1 trickle and 1 rapid charger are to be installed at the location, satisfying local predicted demand.
Medium/Long-Term Recommendations	For the medium to long-term, community owned car parks and spaces may be a suitable location for additional infrastructure, but agreement will need to be gained from these community organisations. Potential sites for medium to long-term development include at the Comrie and Carnock Community Centres. If the installation of charge points at these locations is not deemed appropriate, additional facilities are available in Dunfermline which is 7km away.
High Valleyfield	
Overview	High Valleyfield has a population of 3,310 and currently has no chargers, however there is a nearby fast charger located in close proximity approx. 1-2 km away in Culross. The town has no major tourism, BP Shell service stations, major retail centres or council car parks (although two council owned car parks are located in nearby Culross). A985 runs to the north of the town which has a direct connection to the town. Given these factors, the 2026 modelling suggests that there will need to be 4 trickle chargers, 2 fast chargers, and 1 rapid charger.
Short-Term Recommendations	Due to a lack of council owned parking facilities within the town itself, no short-term locations have been identified. Nearby charging facilities at Torryburn, Kincardine and Cairneyhill could fulfil some demand.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, a community owned car park may be a suitable location for additional infrastructure in the medium to long-term, but agreement will need to be gained from these community organisations. A potential site for medium to long-term development is the Chapel Terrace Parking Area. If the installation of charge points at community locations is not viable then on-street parking may need to be considered.
Tayport	
Overview	Tayport has a population of 3,750 with no council owned car parks, BP/Shell service stations or major retail centres. Tourism may be attracted via the golf club, the harbour, a local football club, or the caravan park with the town currently having 1 fast charger. Given these factors, the 2026 forecast modelling suggest that there will be a need for 3 trickle chargers, 2 fast chargers, and 1 rapid charger.

Short-Term Recommendations	Due to a lack of council owned parking facilities, no short-term locations have been identified. In the short-term, the nearest charge points will be located in Newport-on-Tay and Wormit, this area is also relatively close to Dundee, it is likely some of the charging demand could be covered within this city.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, a community owned car park may be a suitable location for additional infrastructure in the medium to long-term, but agreement will need to be gained from these community organisations. Potential sites include the area adjacent to Top Park or the car park on Inn Street next to the public toilets.
Anstruther	
Overview	Anstruther has a population of 3,950 with 7 council owned car parks, 1 trickle charger, and 1 fast charger. Anstruther has no BP/Shell service stations or major retail centres, but it does have a golf club and a harbour which may act as tourist attractors. The Fife Coastal Path is also here. In neighbouring Cellardyke there are caravan parks which would add additional tourism to the area. Given these factors, the 2026 forecast modelling suggests that there will need to be 5 additional trickle chargers, 2 additional fast chargers, and 1 rapid charger.
Short-Term Recommendations	Given the presence of council owned car parks it would be expected the additional chargers would be accommodated in these locations. Crail Road Car Park (2 trickle chargers) and Anstruther Harbour Car Park - East Basin Car Park (1 fast and 1 rapid charger), will accommodate the additional need for chargers.
Medium/Long-Term Recommendations	For further infrastructure in the medium to long-term, the use of additional council parking locations, such as Station Road Car Park, could be used to provide additional EVI capacity. It may also be useful to liaise with community groups to assess other possible additional sites as well as liaising with landowners at golf courses, caravan parks and the harbour.
Kinghorn	
Overview	Kinghorn has a population of 2,950 with 2 council owned car parks, 2 fast chargers, and the A921 runs through the town. Kinghorn has no BP/Shell service stations or major retail centres, but it does have tourist attractions in the form of multiple caravan parks, a harbour, a golf course, and forms part of the Fife Coastal Path. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers and 1 additional rapid charger.
Short-Term Recommendations	In the short-term the car park located at Nethergate Car Park could be used to provide infrastructure, some charging demand may also be catered for in Burntisland which lies a short distance directly to the West
Medium/Long-Term Recommendations	For further infrastructure in the medium to long-term, the use of additional parking sites such as Pettycur Road car park could be used and it may be useful to liaise with community groups to assess other possible additional sites as well as liaising with landowners at golf courses, caravan parks and the harbour.
Kincardine	

Overview	Kincardine has a population of 2,940 with one council owned car park and 1 fast charger. The town is adjacent to the Kincardine bridge which forms a main route into Fife and the town acts as an intersection between the A985, A876, and the A977. Kincardine has no BP/Shell service stations or major retail centres. A golf club is present which may act as a tourist attractor and the town has the Tulliallan Police College on its outskirts which will act as a major attractor. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers, 1 additional fast charger, and 1 additional rapid charger.
Short-Term Recommendations	In the short-term the car park located at Walker Street could be used to provide infrastructure, rapid charging has potential to be catered in the future from BP services stations on the M876.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Walker Street to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites, there may also be some infrastructure introduced at the golf club
East Wemyss	
Overview	East Wemyss has a population of 1,930 with no council owned car parks, charging infrastructure, BP/Shell service stations, major retail centres or tourist attractions. The A955 goes through the town and the town also forms part of the Fife Coastal Path which may act as a minor trip attractor. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	In the short-term, residential and potential destination charging infrastructure could be installed within Rolland Avenue - surfaced area and Main Street parking bays opposite Kingslaw to address the predicted need forecast for 2026.
Medium/Long-Term Recommendations	Given the small nature of the available car parks, for future infrastructure discussions with community groups could be one way to locate suitable locations for the additional chargers such as the car parks on the beach front at Back Dykes. Some demand may also be catered for 4km away in Methil, Leven and Buckhaven.
Limekilns and Charlestown	
Overview	Limekilns and Charlestown has a population of 1,450 with no council owned car parks, charging infrastructure, BP/Shell service stations, or major retail centres. The town is 1km south of the A985. The town has a harbour and a cricket club, both of which may act as tourist attractors. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers, 1 additional fast charger, and 1 additional rapid charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for fast and trickle charging, however there are currently no suitable council owned car parking for immediate use. There is nearby charging availability 5km away in Dunfermline.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community and other groups may be a solution to enable more parking sites for infrastructure such as locations at Promenade car park and the Grass area at The Cairns or The Green. It may also be worthwhile liaising with landowners of sites at the Harbour and the Cricket Club and discuss potential future infrastructure.

Aberdour	
Overview	Aberdour has a population of 1,710 with 2 council owned car parks and 1 trickle charger. There are no BP/Shell service stations or major retail centres and the A921 runs through the town. Considering tourist attractors there is a golf course, a castle, a harbour, and the town also has a coastal path. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers, 1 additional fast charger, and 1 additional rapid charger.
Short-Term Recommendations	Charging infrastructure to be included in the Station Car Park site in the short-term due to better number of spaces, better access, and better security.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Station Car Park to meet future demand, if additional infrastructure is required then there is also an option of installing chargers at Livingstone Lane car park.
Crossford	
Overview	Crossford has a population of 2,320 with no council owned car parks, BP/Shell service stations, or major retail centres. The A994 cuts through the town centre and there is a golf club and a health club which may both act as tourist attractors. There is a rapid charger based in the bakery car park and a trickle charger at the hotel. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger, 2 additional fast chargers, and 1 additional rapid charger.
Short-Term Recommendations	In the short-term the car park located at King George V Park/ King George's Field could be used to provide infrastructure, other charging can likely be catered in other nearby major settlements e.g. 3km in Dunfermline.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at King George V Park/ King George's Field to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites, such as at the Crossford Scout Group hall. There may also be some infrastructure introduced at the golf and health clubs.
Crail	
Overview	Crail has a population of 1,640 with 2 council owned car parks, 1 trickle charger, and the A917 running through the town. It has no major retail centres or BP/Shell service stations, but it does have a harbour, a nature reserve, and a number of holiday homes plus a caravan site. The town also forms part of the Fife Coastal Path and all of which would act as tourist attractors. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers and 1 additional fast charger. EV charging is available at nearby Crail golf club.
Short-Term Recommendations	Charging infrastructure to be included in the site Marketgate Car Park in the short-term.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Marketgate Car Park to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites.
Auchtermuchty	

Overview	Auchtermuchty has a population of 2,070 with 2 council owned car parks and 1 fast charger. Auchtermuchty has no BP/Shell service stations, major retail centres or tourist attractions but it does contain a health centre which may act as a trip generator and destination. Given these factors, the 2026 forecast modelling suggests that there will need to be 3 additional trickle chargers, 1 additional fast charger, and 1 additional rapid charger.
Short-Term Recommendations	In the short-term, charging infrastructure should be introduced at the site Station Road (A) Car Park due to good location and security.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at the A and B Station Car Parks to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites.
Cairneyhill	
Overview	Cairneyhill has a population of 2,500 with no council owned car parks, charging infrastructure, or BP/Shell service stations. A moderately sized garden centre may act as a tourist attractor or major retail centre and the A994 runs through the town with the A985 running along the western edge of the town. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers, 2 additional fast chargers, and 1 additional rapid charger.
Short-Term Recommendations	Charging infrastructure could be introduced to the site at Cairneyhill Primary School Car Park in the Short-Term. Rapid and Fast infrastructure demand may be catered for on service stations on the A985 as well as 5km away in Dunfermline.
Medium/Long-Term Recommendations	For additional infrastructure in the medium and long-term then it may be useful to liaise with community groups to assess possible additional sites such as at that adjacent to the Cairneyhill Scout Group hall. It may also be likely that further infrastructure is introduced in the garden centre car park.
North Queensferry	
Overview	North Queensferry has a population of 1,050 with 1 council owned car park and has a major tourist attraction in the form of Deep Sea World and a minor attraction of the Forth Rail Bridge although this is more of a monument infrastructure rather than an active destination. North Queensferry has no BP/Shell service stations, charging infrastructure, or major retail centres.
Short-Term Recommendations	Charging infrastructure could be introduced to the site at Battery Road Car Park in the Short-Term.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Battery Road Car Park to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites.
Newburgh	
Overview	Newburgh (Fife) has a population of 2,110 with 1 council car park and 1 existing rapid charger with the A913 running through the centre of town. Newburgh (Fife) has no BP/Shell service stations, major retail centres or tourist attractions. Given these factors, the 2026 forecast modelling suggests that there will need to be 3 additional trickle chargers and 1 additional fast charger.

Short-Term Recommendations	Charging infrastructure could be introduced to the site at Cupar Road Car Park in the Short-Term.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Cupar Road Car Park to meet future demand, if additional infrastructure is required in future, then the car park at Mugdrum Park could be suitable, especially in terms of residential charging.
Balmullo	
Overview	Balmullo has a population of 1,320 with no council owned car parks, charging infrastructure, BP/Shell service stations, major retail centres or tourist attractions and the A914 runs along the eastern edge of the town. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger, 1 additional fast charger, and 1 additional rapid charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for trickle, fast and rapid charging, however there are currently no suitable council owned car parking for immediate use, in the short-term demand may be catered for 3km away in Leuchars and Guardbridge. There may also be rapid infrastructure introduced on service stations on the A91.
Medium/Long-Term Recommendations	Given the lack of council owned car parks then available community and other car park may be suitable locations for the additional infrastructure in the medium-term such as residential parking at Dunedin House and the Medical Centre car park for destination infrastructure.
Elie and Earlsferry	
Overview	Elie and Earlsferry has a population of 640 with no council owned car parks, charging infrastructure, BP/Shell service stations, or major retail centres. Elie and Earlsferry do have a golf club, a harbour and is part of the Fife Coastal Path, all of which may act as tourist attractors with the A917 running through the town. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger.
Short-Term Recommendations	Short-Term Charging infrastructure requirements could be addressed via installation at the Vennel Car Park.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at The Vennel Car Park to meet future demand, if additional infrastructure is required in future, then other sites such as Ruby Bay car park which is owned by the Countryside Trust, however it is likely further work would be needed to make this car park suitable.
Thornton	
Overview	Thornton has a population of 2,040 with 2 council owned car parks but no existing charging infrastructure with the A92 running to the east of the town. Thornton also has no BP/Shell service stations, tourist attractions, or major retail centres. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.

Short-Term Recommendations	Short-Term Charging infrastructure requirements could be addressed via installation at Strathore Road and Thornton Rail Halt Car Park.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Strathore Road and Thornton Rail Halt Car Park to meet future demand, if additional infrastructure is required in future, then other sites such as Memorial Park Car Park can be assessed.
Ladybank	
Overview	Ladybank has a population of 1,430 with no council owned car parks, charging infrastructure, BP/Shell service stations, major retail centres or tourist attractions. The A92 runs to the west of the town and the town has a golf club which may act as a minor attractor. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for trickle and fast charging provision, however there are currently no suitable council owned car parking for immediate use. There is infrastructure available in the surrounding area via Glenrothes, Cupar and Auchtermuchty. Given its location directly on the A92, there may also be some charging provision nearby provided at service stations such as the BP Station near Freuchie.
Medium/Long-Term Recommendations	Given the lack of council owned car park, a community car park may be a viable location for the additional infrastructure such as the car park at the Ladybank Youth Club or there may be some provision introduced at the Station Car park owned by Network Rail/Scotrail.
Saline	
Overview	Saline has a population of 1,370 with no council owned car parks, charging infrastructure, BP/Shell service stations, major retail centres or tourist attractions although it does have a golf club which may act as an attractor. The town is located 3km north of the A907. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	Short-Term Charging infrastructure requirements could be addressed via installation at Main Street Car Park.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Main Street Car Park to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites.
Kinglassie	
Overview	Kinglassie has a population of 1,900 and 1 council owned car park but has no BP/Shell service stations, tourist attractions, or major retail centres. It does have an amateur football club with a local playing field that may act as an attractor. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.

Short-Term Recommendations	Short-Term Charging infrastructure requirements could be addressed via installation at Lochty Avenue Car Park, although Rapid has been identified in the 2026 modelling, taking into account the location, trickle and rapid provision should be prioritised.
Medium/Long-Term Recommendations	There is potential for additional chargers to be introduced at Lochty Avenue Car Park to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites.
Ceres	
Overview	Ceres has a population of 930 with 1 council owned car park and 1 fast charger but no BP/Shell service stations or major retail centres. The local Fife Folk Museum may act as a tourist attractor. Given these factors, the 2026 forecast modelling suggests that there will need to be 2 additional trickle chargers and 1 additional fast charger.
Short-Term Recommendations	Trickle and Fast charging infrastructure requirements could be addressed via new infrastructure at Bog Well Car Park.
Medium/Long-Term Recommendations	There is potential for additional infrastructure to be introduced at Bog Well Car Park to meet future demand, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites.
Pittenweem	
Overview	Pittenweem has a population of 1,450 with 1 council owned car park but no existing infrastructure, BP/Shell service stations, or major retail centres. The A917 runs through the town, with town having a harbour and is part of the Fife Coastal Path, both of which could act as tourist attractors. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	Trickle and Fast charging infrastructure requirements could be addressed via new infrastructure at High Street Car Park.
Medium/Long-Term Recommendations	Given the relatively small size of the available car park at High Street, if additional infrastructure is required in future, then it may be useful to liaise with community groups to assess possible additional sites, charging infrastructure will also be available nearby in Anstruther.
Falkland	
Overview	Falkland has a population of 1,120 with 2 council owned car parks and 1 trickle charger, but it has no BP/Shell service stations. Falkland Palace is a tourist attraction. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional fast charger.
Short-Term Recommendations	Fast charging infrastructure requirements could be addressed via new infrastructure at Back Wynd Car Park.
Medium/Long-Term Recommendations	Depending on the future requirements past 2026, there are other council owned car parks within Falkland such as Cross Wynd which could be used to respond to user need and provide more EV infrastructure.
Gauldry	

Overview	Gauldry has a population of 650 with no council owned car parks or BP/Shell service stations but it does have 1 fast charger. Gauldry has no tourist attractions or major retail centres and no direct link to the A92 which lies 2km south of the town. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for trickle charging, however there are currently no suitable council owned car parking for immediate use. There is nearby charging availability within Newport-on-Tay and Wormit.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community groups and non-council owned sites may be a solution to enable more parking sites to address residential need, such as at Bridieswell Gardens.
Freuchie	
Overview	Freuchie has a population of 1,250 with no council owned car parks or charging infrastructure. Freuchie has no tourist attractions or major retail centres although it has a cricket club with a playing field which may act as an attraction and a BP garage nearby on the A92 and a garden centre. The town has the A92 running along its edge. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for fast and trickle charging, there is a council owned car park in Lomond Car Park, which could be used to host infrastructure. There is also nearby charging availability within Glenrothes.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community groups and non-council owned sites may be a solution to enable more parking sites for infrastructure such as locations at Lomond Road car park.
Strathmiglo	
Overview	Strathmiglo has a population of 1,130 with no council owned car parks, BP/Shell service stations, or charging infrastructure. Strathmiglo also has no tourist attractions or major retail centres although it has an amateur football club with a local playing field that may act as an attraction. The town lies adjacent to the A91. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for fast and trickle charging, however there are currently no suitable council owned car parking for immediate use. There is nearby charging availability within Auchtermuchty.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community groups and non-council owned sites may be a solution to enable more parking sites for infrastructure such as locations at Bankwell Crescent.
St Monans	
Overview	St. Monans has a population of 1,130 with 3 council owned car parks, 1 fast charger and 1 trickle but no BP/Shell service stations. St Monans has a harbour and is part of the Fife Coastal Path, both of which act as a tourist attractor and the A917 runs along the norther edge of the town. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger.

Short-Term Recommendations	Trickle charging infrastructure requirements could be addressed via infrastructure at the Hope Place Car Park.
Medium/Long-Term Recommendations	Depending on the future requirements past 2026, there are other council owned car parks within St Monans such as East Street and The Common which could be used to respond to user need and provide more EV infrastructure.
Kingskettle and Kettlebridge	
Overview	Kingskettle and Kettlebridge has a population of 1,020 with no council owned car parks, BP/Shell service stations, or charging infrastructure. Kingskettle and Kettlebridge also has no tourist attractions or major retail centres although it has an amateur football club with a local playing field that may act as an attraction. The area is also adjacent to the A914. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger.
Short-Term Recommendations	The 2026 forecast modelling has indicated potential need for fast and trickle charging, however there are currently no suitable council owned car parking for immediate use. There is nearby charging availability within Glenrothes.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community groups and non-council owned sites may be a solution to enable more parking sites for infrastructure such as locations at Cathel Square and Rumdewan Crescent parking area.
Blairhall	
Overview	Blairhall has a population of 930 with no BP/Shell service stations, and one trickle charger. Blairhall also has no tourist attractions or major retail centres, but it is adjacent to the A907. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger to mainly cover residential demand.
Short-Term Recommendations	It is recommended that the Parking near Wilson Avenue is used to address predicted trickle residential charging infrastructure needs.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community groups may be a solution to enable more parking sites for infrastructure or ensure that surrounding areas have capacity to service this town such as 2km away in Oakley, Carnock and Comrie.
Springfield	
Overview	Springfield has a population of 1,100 with no council owned car parks, BP/Shell service stations, or charging infrastructure. Springfield also has no tourist attractions or major retail centres, but it is 1.5km south of the A91. Given these factors, the 2026 forecast modelling predicts that no additional chargers will be required to be implemented.
Short-Term Recommendations	No immediate need has been indicated by the forecast modelling, however the availability of council owned car parking at Tarvit Terrace could be utilised to provide some residential charging to encourage uptake of EV.

Medium/Long-Term Recommendations	Engagement with community groups may be a solution to enable more parking sites for infrastructure such as at Crawley Crescent or ensure that surrounding areas have capacity to also service this town such as 4.5km away in Cupar which currently has charging infrastructure.
Strathkinness	
Overview	Strathkinness has a population of 790 with no council owned car parks, BP/Shell service stations, or charging infrastructure. Strathkinness also has no tourist attractions or major retail centres, but it has a direct road link to St Andrews. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger. Demand may be catered for 5km away in St. Andrews which currently has charging infrastructure.
Short-Term Recommendations	It is recommended that the Glebe car park is used to address predicted trickle charging infrastructure needs.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, engagement with community groups may be a solution to enable more parking sites for infrastructure or ensure that surrounding areas have capacity to service this town.
Townhill	
Overview	Townhill has a population of 1,160 and is part of the wider Dunfermline area. It has no council owned car parks, BP/Shell service stations, or charging infrastructure. There is a Watersports centre and large park but no major retail centres. Given these factors, the 2026 forecast modelling suggests that there will need to be 1 additional trickle charger and 1 additional fast charger. If these are not viable then it may be required to explore the option of on-street charging. If neither of these are suitable then demand may be catered for 2km away in Dunfermline which currently has charging infrastructure and modelling suggests there should be additional chargers.
Short-Term Recommendations	There are no council owned car parks are available, some charging needs can be covered with nearby Dunfermline.
Medium/Long-Term Recommendations	Given the lack of council owned car parks, a community car park may be a suitable location such as at the Townhill Recreation Ground or the Townhill Country Park. There is also a Watersports Centre which would be suitable location for destination charging.
Kingseat	
Overview	Kingseat has a population of 860 with no council owned car parks, BP/Shell service stations, or charging infrastructure. Kingseat (Fife) has no tourist attractions or major retail centres, but it is adjacent to the M90 although it has no direct connection. Given these factors, the 2026 forecast modelling predicts that there will need to be 1 additional trickle charger. Given the lack of council owned car parks, a community car park may be a suitable location such as at the Kingseat Community Centre. If the Community Centre is not viable then it may be required to explore the option of on-street charging. Other charging use case requirements may be catered for 4km away in Dunfermline.

Short-Term Recommendations	There is some short to medium-term need for trickle (7kW) residential charging identified in the 2026 modelling and it is recommended that Church Street Car Park is used to provide this.
Medium/Long-Term Recommendations	For longer term requirements, the options of utilising community owned car parks or on-street parking should be considered.
Coaltown of Wemyss	
Overview	Coaltown of Wemyss has a population of 710 with no council owned car parks, BP/Shell service stations, or existing charging infrastructure. Coaltown of Wemyss also has no tourist attractions or major retail centres but it is close to the A915. Given these factors, the 2026 forecast modelling predicts that no additional chargers will be required to be implemented. Any residual demand could be catered for 5km away in Kirkcaldy and Dysart.
Short-Term Recommendations	No available council owned infrastructure and no immediate need indicated by 2026 forecast modelling.
Medium/Long-Term Recommendations	For longer term requirements, the options of utilising community owned car parks or on-street parking should be considered, notably the parking at South Row/Plantation Row.

10.5 Gap Analysis

This section outlines the settlements within Fife which do not currently contain any existing public EV infrastructure, any council owned car parks or any commercial sites that have the possibility of providing infrastructure. A review has then been undertaken considering the need for public EV infrastructure in these locations and possible solutions.

Table 10.8. Fife EV Gap Analysis

Location	Off-Steet Parking %	Need for Public Infrastructure	Possible Community/Other Locations
High Valleyfield	77.10%	Predicted forecast demand of 4 trickle, 1 fast and 1 rapid in 2026. Small number of properties without off-street parking.	Chapel Terrace Parking Area
Limekilns and Charlestown	77.80%	Predicted forecast demand of 2 trickle, 1 fast and 1 rapid in 2026. Small number of properties without off-street parking.	Promenade car park and the Grass area at The Cairns or The Green
Balmullo	78.10%	Predicted forecast demand of 1 trickle, 1 fast and 1 rapid in 2026. Small number of properties without off-street parking.	Dunedin House and the Medical Centre
Gauldry	77.60%	Predicted forecast demand of 1 trickle in 2026. Small number of properties without off-street parking.	Bridieswell Gardens
Strathmiglo	77.60%	Predicted forecast demand of 1 trickle and 1 fast in 2026. Small number of properties without off-street parking.	Bankwell Crescent
Kingskettle and Kettlebridge	77.60%	Predicted forecast demand of 1 trickle and 1 fast in 2026. Small number of properties without off-street parking.	Cathel Square and Rumdewan Crescent

Townhill	77.50%	Predicted forecast demand of 1 trickle and 1 fast in 2026. Small number of properties without off-street parking.	Townhill Recreation Ground or the Townhill Country Park.
Coaltown of Wemyss	77.60%	None Forecast in 2026. Some may be needed in medium/long-term	South Row/Plantation Row

11. Commercial Approach

This section details potential options for how charging infrastructure can be purchased, installed, and maintained with Fife, including funding opportunities and other considerations at delivery stage.

The long-term financial business model for recharging services relies fundamentally on the demand generated by the number of EVs in the marketplace. A successful model needs to create value both to the charge point owner (to help them make a return on their investment), and to the driver (who wishes to use the service at a price they believe is reasonable). The challenge therefore lies in balancing supply and demand to achieve an acceptable return on public investment, as well as achieving local emission reduction objectives.

Much of the Scotland's charging infrastructure has been supported historically by capital grants from Government. These grants provided free-to-use infrastructure to drivers to encourage the conversion to EV. However, public funding is becoming less readily available and there is more emphasis on securing private funding for future expansion of the EV infrastructure. Private investors require an acceptable return on their investment, which can be difficult to define in this evolving market.

Since there have been examples of difficulties in the change from 'free-to-use' to fee-based charging services in some areas of the UK, it is recommended that new charging facilities have a fee applied from the outset. A fee encourages consumers to recognise the value of the service and provides revenue for ongoing maintenance and operation. However, if fees are considered to be too high, this limits demand for charging services and could slow-down EV uptake, ultimately limiting emissions reduction.

11.1 Current Tariff Structure

Fife Council's eFife project supports the EV network in Fife, including setting the cost for the use of public charging points in Fife. The original tariff, set in November 2020 and in place to cover the connections to and use of all public charging points in Fife, was:

- Connection fee of £1.60 per charging session; and
- Electricity charged at 15p/kWh.

This tariff was changed in August 2024 to cover the increasing cost of electricity to Fife Council and to align with Transport Scotland guidance, Transport Scotland wants to see Local Authority tariffs more competitively viable, in line with commercial operators i.e. covering the full costs of the operation.
The new tariff is:

- On 7kW and 22kW charge points – electricity charged at 40p/kWh
- On all cables of rapid charge points – electricity charged at 60p/kWh with a £10 overstay fee after 1 hour.

The existing contract with ChargePlace Scotland will not be renewed by Transport Scotland (this has now been extended to Dec 2025). In light of this Fife Council are in discussions with Swarco as the main supplier to explore the cost of keeping all current units on the system.

Transport Scotland wants to see Local Authority tariffs more competitively viable, in line with commercial operators i.e. covering the full costs of the operation.

There is a continuous spectrum of differing commercial models that could be followed in delivering or expanding an EV charging network. Table 11.1 outlines the key features of three models, setting out how they work and the risk implications for a Local Authority.

It is important to note that although a particular commercial model might be preferred, it cannot be known if a specific model is possible in a specific area until market research and/ or an actual procurement process has been carried out.

In reality, multiple commercial models could co-exist in a single Local Authority area. For instance, existing charging posts from an early pilot project might remain in operation under the direct management of a Local Authority (model 1 'In-House Management' below), while new charging posts

might be 'purchased' or implemented in partnership with a newly procured private sector charging network operator (model 2 'Partnership' below). Meanwhile, using private land without the approval or even the awareness of the Local Authority, multiple private-sector network operators could build up charging networks of their own (model 3 'Commercially-Led' below).

Table 11.1. Summary of EV Charging Commercial Models – UK

1. Model		2. Description	3. Features/ Risk
1	In-House Management	A Local Authority selects locations, purchases charging posts and keeps any revenue.	Purchase could include installation and ongoing maintenance. Office for Zero Emission Vehicles (OZEV) grant funding could be used for residential on-street charging posts. Potential to ensure equity through providing in areas of market failure. Appropriate for workplace and fleet installations where demand is assured. Income for the Local Authority. *If under-utilised, financial risk for the operation and maintenance falls on the Local Authority. Inter-operability with other provision needs to be factored in.*
2	Partnership/ Concession	A Local Authority leases public highway or off-street parking bays to private suppliers/ operators.	Annual permit price plus possible up-front charge. Operator selects own locations and Local Authority consults/ approves/ makes traffic order. Local Authority may receive a small share of revenue from each charging post annually. Likely to be more suitable for rapid/ fast charging posts near key destinations. Publicly-owned car parks/ land could be considered under this model. *Financial risk divested to suppliers/ operators but interested operators may be limited in some areas.*
3	Commercially-Led	Private-sector suppliers use private land with limited or no Local Authority involvement.	Rapid/ ultra-rapid charging posts purchased and installed on private property (such as petrol station forecourts, private car parks, supermarkets, highway services, etc). Requires sufficient capacity in the electricity network. *No financial risk to Local Authority. However, this approach will likely lead to gaps in provision where locations are less commercially attractive.*

11.2 Procurement Options

The procurement process is an opportunity to secure the most suitable chargers for each location, customer, and function. For instance:

- Bollard chargers may be adequate for many residents;
- Fast chargers will help customers in and around town centres; and
- Ultra-rapid chargers may be required on movement corridors.

This section sets out options for selecting a charge point provider or set of providers.

11.2.1 Work within a Framework Contract

One possibility is to utilise a framework contract to allow local authorities to source charge points. These options are worth exploring, as the time and resource requirement of in-house procurement may be avoidable if the offers available from providers through these frameworks are acceptable to Fife Council. It would also require the relevant bidders to be willing to extend their provision to an additional buyer/ partner.

A hybrid approach would comprise a mini-competition between those suppliers named on one of these contracts, which may lead to further benefits being offered by bidders particularly keen to be appointed.

11.2.1.1 Benefits

- Provides access to market leading suppliers with a verified track-record in the industry.
- Offers optional elements and full turnkey solutions.
- Ensures compliance with UK procurement legislation.
- Has direct call-off options.
- Is suitable for lease or purchase of single or high-volume quantities.
- Is likely to save time and financial resource compared to carrying out in-house procurement.

11.2.1.2 Disbenefits

- Less ability to tailor specifications and requirements.
- May not secure better preferential rates than full market testing.

11.2.2 Undertake In-House Procurement

As part of conducting a procurement process, documentation from other past procurements by neighbouring or other similar local authorities could be used and amended for local circumstances where necessary. This would involve conducting market sounding and then a full open market procurement exercise. Rather than excluding some suppliers through a procurement process, interest may be invited from any supplier who wishes to operate a charge point in Fife Council.

A revenue-sharing agreement could be negotiated, with lower risk for both authorities. The authorities might be asked to commit to allowing the operator to use the site for several years, with the parking space likely to be devoted to EV charging. Where exclusive charge point parking spaces are used, firms could be charged a form of rent for parking spaces used, or operate on a peppercorn lease with an arranged revenue share agreement (this latter agreement may be more encouraging to private firms).

11.2.2.1 Benefits

- Enables tailoring of specifications and requirements to local situation and client preferences.
- By conducting market sounding, the procurement strategy could be tailored to take full advantage of the appetite expressed by commercial operators to invest funds and the likely conditions attached.
- Enables setting up a call off framework and avoiding the need to conduct further procurement exercises for a defined period of time. This means funding secured from the UK Government in the future could be deployed quickly and efficiently.

11.2.2.2 Disbenefits

- Timescales for this approach can be lengthy.
- Significant requirement for officer resource to conduct procurement process.
- Detailed technical knowledge required to develop specifications for infrastructure (although this can be sourced on a short-term basis from consultancy if not held internally).

11.2.3 Seek Exclusive Operators for Each Charger Type

Firms offering different types of charger can be invited to tender for exclusive operating contracts for their chosen type of charger. Fife Council could request firms to offer prices for:

- Installation (or combined installation, operation, and maintenance) of new charge points; or
- Contracts where the provider will fund, install, operate, and maintain new charge points.

11.2.3.1 Benefits

- Firms could be invited to choose the locations where they would like to install charge points, which effectively pushes the risk of choosing a poor location onto the operator (e.g. failing to secure planning permission or failing to achieve sufficient demand for installed chargers).
- Ability to procure specialist providers for each type of charging infrastructure.

11.2.3.2 Disbenefits

- By compartmentalising revenue generation opportunities, this would likely decrease the attractiveness of the opportunity to the market. This would be particularly relevant for areas where low levels of infrastructure are required in the short-term.

11.3 Choosing Locations or Leaving This to Provider(s)

It is possible for the local authorities to choose the locations where its charge points would be installed in some of the commercial models, whereas other procurement and management models require this choice to be left at least partially in the hands of the operator.

If operators/ suppliers choose where they would like to place chargers, subject to approval and other guidelines to be stated in the procurement documentation, this pushes the risk onto the operator. However, it reduces the opportunity to meet policy aims in Fife Council such as delivering an equitable and balanced network. Alternatively, local authorities can choose to select all specific locations and prescribe these to the providers.

The risk of the latter approach is that some providers may not be willing to take the risk of Local Authority selected sites providing enough revenue. Alternatively, they may insist on only installing and charging for the maintenance of charge points.

A hybrid approach would be to package up a number of busier (more attractive) sites alongside a number of less desirable sites so that the more popular locations help to cross-subsidise the less popular ones.

11.4 Integration of Modelling Results with Commercial Models

11.4.1 Commercial Modelling Introduction

Integrating the modelling results with potential commercial models introduces a wide range of uncertainties. In addition to the underlying potential variation in EV uptake, the commercial viability of any model will be determined by the:

- Broadly unknowable behavioural change for future EV users; and
- Price of electricity and installation/ maintenance costs.

Whilst it is possible to determine the broad range within which such parameters may fall, there is an inherent uncertainty.

However, as an indicative exercise three separate commercial models for the installation of 10 charge points across Fife Council was considered. The charge points are not in specified locations; but are drawn from the population charging potential at evenly spaced percentile intervals (i.e., the least commercially viable charge point to be considered would be in position 90 out of 100 charge points, the next at position 80 and so on).

It is unlikely that the charge points would be so evenly distributed across the charge potential, but in some ways, this simulates the need for local authorities to provide charging infrastructure based on equality of access rather than a purely commercial assessment.

The base level of usage for a single charge point in 2021 has been derived from the usage stats provided for 2021. The average charge recorded per day, for a single site, was 4.1 kWh. This is the value that will be scaled using the predicted EV uptake values.

4.1 kWh of charge per day, sold over the course of a year at a price of £0.15/ kWh and over the cost of purchasing the electricity, would create a revenue of £225 per year. Whilst this is substantially under the cost of installing a charge point (typically at around £5,000 including scoping etc.), it is the expected growth in EVs which may make this a potentially viable revenue stream.

The total number of charge points to be installed at each site is determined through assuming that the total charging demand will scale with the expected growth in EVs, and each charge point will be able to serve a total demand determined by:

$$Total\ Energy = Charge\ Point\ Power \times 24 \times Max\ Utilisation$$

The Charge Point Power is determined by the power rating of the charge point (e.g. 7 kWh). 24 is the number of hours in the day and the Max Utilisation is a ratio specifying the actual number of hours which the charge point could realistically be expected to charge. For example, a charge point with a Max Utilisation of 50%, would be expected to be in use for no more than 12 hours in a day.

11.4.2 Commercial Models

Three distinct examples of different commercial models have been chosen for this preliminary examination:

- Model 1: Fife Council installs all ten charge points across the ten sites. It is responsible for the maintenance, operating and installation costs but retains all revenue.
- Model 2: Private Companies install at the five best charge points whilst Fife Council installs the other five. Each operator is responsible for their own costs, but the Private Companies pay a commission of 10% on all profits generated from the charge points.
- Model 3: Private Companies install all ten charge points but pay a relatively modest fixed rent.

There are many other models which could be proposed. However, these three models are considered to represent a reasonable balance between Public and Private installation. The basic structure of each model is that a series of charge points are installed with the total number determined by the charging demand at each site. For this basic model, the costs are assumed to be linear with little to no efficiencies of scale in the delivery of charge points.

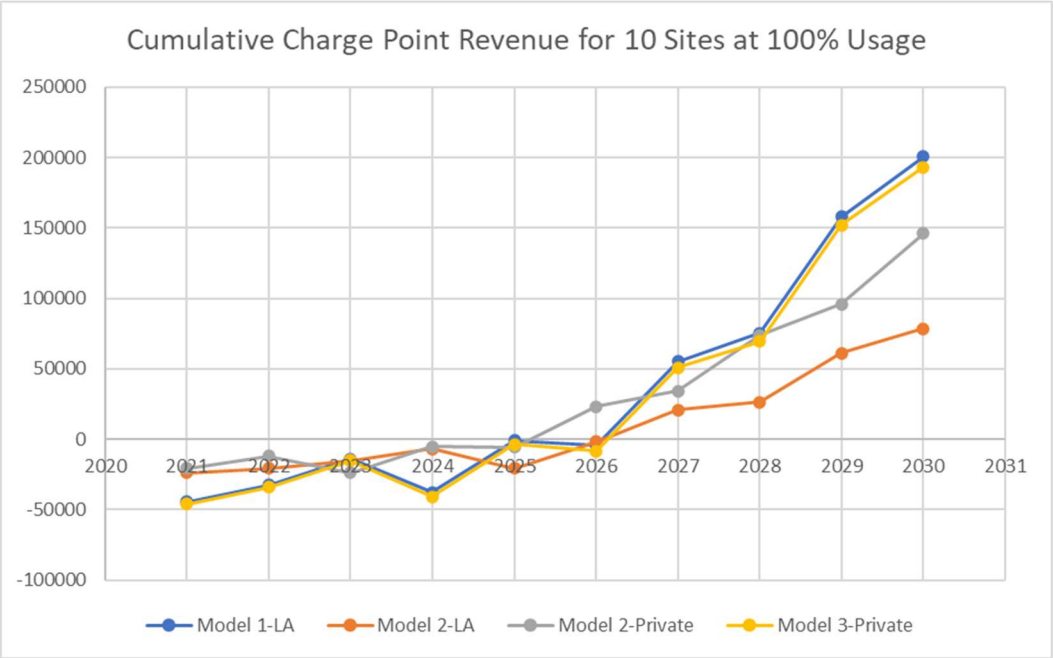
The cost of each charge point, and the subsequent revenue, is borne by the installing party. The exception is Model 2 where a commission is paid to Fife Council from the private installers. The price per kWh (£0.15) is assumed to be constant throughout each model.

Figure 11-1 illustrates the fundamental risks involved in funding extensive EV infrastructure. Under the standard charging demand no models break even before 2025. After this point, both Model 1 and Model 3 begin to generate increasing revenue fuelled by the increasing uptake of EVs.

However, both Model 1 and Model 3 show a large initial outlay. Whilst it is expected that this will eventually be recouped, there is the risk external events may lead to a substantially reduced charging demand.

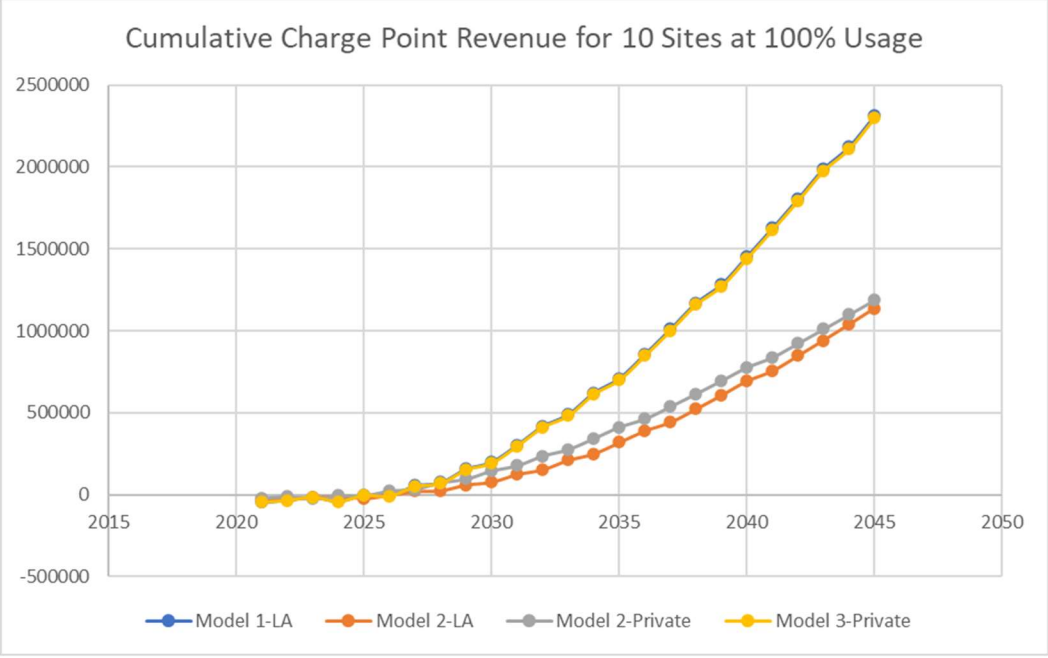
Model 2, a blended model between private and public installation, shows a much flatter revenue curve. Both private and public spend far less in the first five years, but also generate less income as the EV demand increases.

Figure 11-1. Cumulative revenue at standard EV charging demand (2021 – 2030)



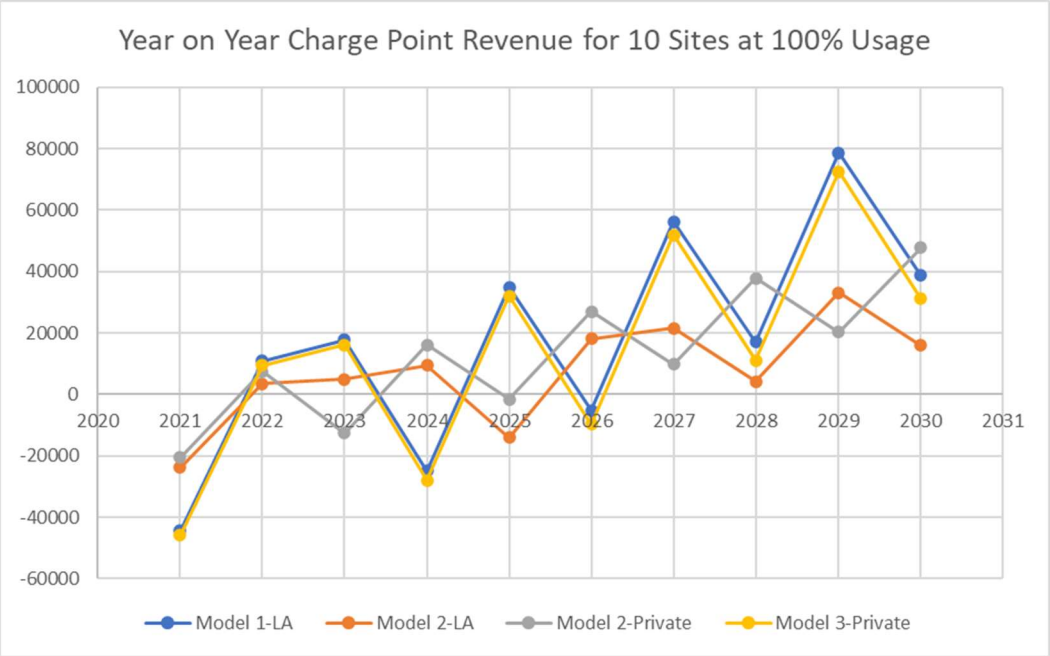
In Figure 11-2, the future outlook has been expanded through to 2045. At this point, the cumulative net revenue generated across the 10 different sites has increased much more steeply, leading to each site generating a healthy profit. However, it is important to note that this is based on multiple assumptions, specifically that each site may continually install charge points to keep up with demand.

Figure 11-2. Cumulative revenue between 2021 and 2045 (100% usage)



In contrast, the annual revenue between 2021 and 2031 in Figure 11-3 shows major fluctuations in revenue (and hence the reduction in total cumulative revenue). This is caused by the purchase and installation of charge points.

Figure 11-3. Annual Revenue



The figures in this section have all shown potential futures for revenue. However, these results are based on a series of assumptions and different values for each parameter could lead to higher/ lower revenues reported in this section.

11.5 Review of Viable Funding Models

The Scottish Government's early grants to kick-start charging deployment have reduced in recent years to encourage private investors into the market. There are several funding opportunities in both Scotland and the wider UK that can be considered, as outlined below:

11.5.1 Electric Vehicle Infrastructure Fund (EVIF)

This is a new funding stream launched in 2022 on behalf of Transport Scotland and supported by Scottish Futures Trust (SFT). This is a £60 million fund for local authorities over the next four years with approximately half of this funding anticipated to be invested from the private sector but with £30 million of the programme funded by Transport Scotland. This is designed to meet specific objectives around:

- Consumers benefit from a seamless network of public electric vehicle charging posts that anyone can access safely and intuitively.
- Private motorists and businesses in every part of Scotland have access to reliable network coverage to meet daily and seasonal demands.
- Scotland has crowded in private sector investment, while maintaining the benefits of an integrated, consumer focused network.
- The network and consumers are benefiting from advancements in energy storage, SMART tariffs, and local network design.
- The location of electric vehicle charging points actively encouraging public transport and active travel choices.

To apply, councils need to provide a business case using the Strategy and Expansion Plan pro forma provided by SFT to set out the baseline, vision and forecast EV infrastructure needed as well as the proposed approach to funding and procurement in order to provide the case for a proportion of government funding.

11.5.2 OZEV's On-Street Residential Charging Scheme

This grant offers local authorities 75% funding towards the capital costs of procuring and installing charging posts for residential areas, which must be available 24/7 and have dedicated parking bays covered by Traffic Regulation Orders (TROs). The Council (or commercial partner) must provide 25% match funding and cover the ongoing operating and maintenance costs. This presents an opportunity for local authorities wishing to provide charging facilities in areas where off-street parking is limited.

11.5.3 OZEV's Workplace Grant

This grant is a voucher-based scheme designed to provide eligible applicants with support towards the upfront costs of the purchase and installation of EV charging posts. The contribution is limited to 75% of the purchase and installation costs, up to a maximum of £350 for each socket. It also restricts each application to a maximum of 40 sockets across all sites for each applicant.

Although this grant cannot be directly accessed by a Local Authority, promotion of this grant scheme to employers within the region could help to complement the public charging network with workplace-based charging posts. This could help to increase charging provision and EV uptake.

11.6 Recommended Commercial Approach for Fife

The exact level of expected private sector investment capital is currently unknown, however given the balance of infrastructure required to provide suitable coverage in both the more populated/urban and more rural areas of Fife, it is likely that will be a need to secure grant funding to complement private sector capital investment and also a requirement to subsidise operations of the network for a number of years in order to fully address the forecast EV infrastructure requirements in Fife.

Fife Council does not expect to have the money to fund/continue funding and subsidise charging post infrastructure due to various financial pressures, likewise the council does not want to take on a lot of risk with regarding to infrastructure funding and revenue, therefore the most appropriate approach is a concession commercial model which will transfer the short to medium-term risk to the private sector and with grant funding to support the upfront capital costs.

For this reason, a joint venture approach is also not recommended as this will require a certain level of upfront funding as well as technical input. This approach can provide more leverage and influence but is a lot of work.

It is recommended that as part of a concession approach, a portfolio of the required use cases is set out and the more commercially attractive locations, for example, Dunfermline, Glenrothes and St Andrews are used to leverage commercial funding in some of the more rural areas. Contract terms should be agreed along this basis in order to encourage investment from CPO's by offering a balanced package of high demand on-routes sites near the M90 and A92 and the more rural less lucrative sites. Contract terms such as the length of contract and the associated KPI's can be used to provide some influence and help enforce a more balanced portfolio.

Initial engagement with charging posts operators has indicated that there is interest in operating within Fife and that there is the potential for a portfolio-based approach to a concession model, mixing high and low utilisation sites. There is potential for grant funding to be used for this by reducing upfront costs to charging post providers to ensure more low utilisation sites can be covered.

11.7 SFT Feasibility Assessment

The EVI Feasibility Model (Version 4.1), as developed and provided by SFT, has been used to undertake a financial assessment of the portfolio of sites identified to meet the forecasted short-term future EV charging needs in Fife. The infrastructure identified within the site assessment and their forecast utilisation levels, calculated using the geospatial modelling, have been input into the SFT EVI Feasibility Model.

Assumptions around the key inputs into the feasibility spreadsheet have been formulated to provide a balanced, realistic scenario for future funding. Assumptions have been agreed with SFT and Fife Council. Through this process the optimum mix of tariff structure, operating period, and capital subsidy has been identified and is summarised below:

Table 11.2. Summary of SFT Feasibility Model Assumptions

Cost heading	Assumption planning
Tariffs	AC 47p/kWh DC 62p/kWh (including VAT)
EVCP Transaction Costs	7kW - £146/yr 22kW - £146/yr 50kW - £365/yr
EVCP Planned Maintenance Costs	7kW - £400/yr 22kW - £400/yr 50kW - £1,800/yr
EVCP Capital Enabling Costs (ex VAT)	7kW AC - £2,200 22kW AC - £2,200 50kW DC - £4,000
EVCP Capital EVI + Installation Costs (ex VAT)	7kW AC - £5,650 22kW AC - £6,000 50kW DC - £33,400
Capital Cost Contingency	15%
EVCP Useful Asset Life	10 years
Capital contingency	£50,000 per year
Concession fee	£5,000 per year

These assumptions, along with the DNO connection costs supplied by SPEN result in the SFT EVI Feasibility Model indicating a planned investment cost of £4,217,386 for the identified infrastructure.

The total upfront investment cost is the total cost associated with enabling costs, cost of EVI infrastructure including installation costs and the DNO connection costs specified for each proposed EVCP sites. Tariff income is calculated using the tariffs and utilisation figures specified for each site. Net operating income is the total tariff income minus operating costs for all existing and proposed sites.

Based on the inputs into the SFT EVI Feasibility Model, it is expected that capital funding of £3,046,142 will be required to deliver the full suite of planned EV infrastructure within identified car parks within Fife. Figure 11-4 and Figure 11-5 provide further breakdown of the required funding.

Figure 11-4. Existing and Planned Investment Costs (Source SFT EVI Feasibility Model for Fife)

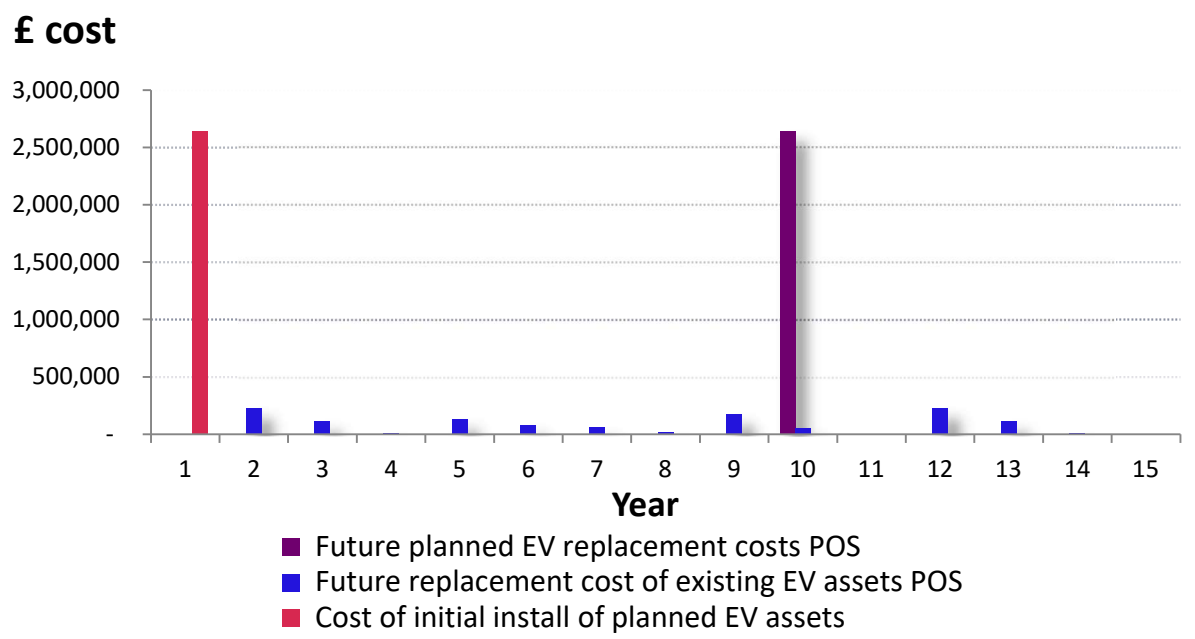
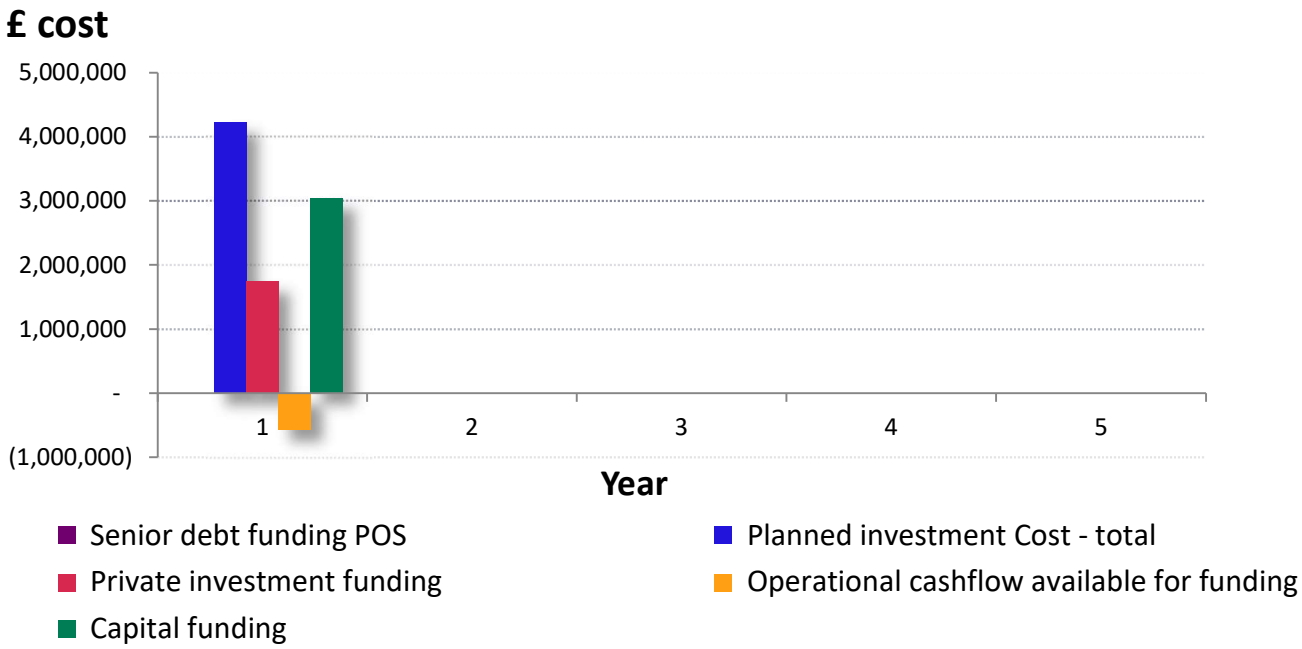


Figure 11-4 displays the existing and planned reinvestment costs, detailing the cost of the initial installation of planned EV assets, as well as the cost of replacing both existing and future planned EV assets. The largest cost instalments are in year 1 and year 10. Similarly, Figure 11-5 shows the planned capital spend and funding during the construction period. The planned investment cost is the highest, followed by capital funding and private investment.

Figure 11-5. Profile of planned capital spend and funding during construction (Source SFT EVI Feasibility Model for Fife)



12. Summary

This report was commissioned by Fife Council to provide an evidence base and strategy for the future expansion of Electric Vehicle (EV) infrastructure in Fife. It will also provide a focus on decarbonising the Council's fleet of vehicles.

The policies and strategies at a UK, Scotland, regional and local level have been reviewed to highlight that an increasingly supportive framework for the transition to EV. Alongside this a review of the current and possible future EV charging technology has also been outlined.

The baseline situation for EV charging infrastructure has been analysed and trends have been identified. The current infrastructure in comparison with surrounding Scottish Councils has been outlined. This highlights that at an overall level, the current EV infrastructure provision in Fife is relatively good when compared to other parts of Scotland.

Stakeholder engagement exercises have been undertaken as part of the Fife EV Strategy development to explore the future of Fife's EV infrastructure and its place in the wider transport and environmental strategy.

A forecast modelling exercise has been undertaken to provide future predictions around charging behaviour and subsequent infrastructure requirements. This is using Jacobs' in-house EV geospatial forecasting tool which has been used successfully in other areas of Scotland. This provides an estimate of the 2026 forecast EV demand by EV charging use case (trickle, fast, rapid) at a settlement level of disaggregation within Fife to give more context for the wider EV strategy and predicted infrastructure requirements.

Based on the evidence and analysis provided within the report, a range of measures that could contribute towards an EV strategy for Fife has been provided, alongside an assessment of whether these measures are most appropriate to be taken forward in the short, medium, and long-term.

A site assessment has been undertaken to estimate the most efficient use of the council owned car parks throughout Fife in order to meet future EV charging demand. An initial long list of 165 available council owned car parks was identified, which was then narrowed down to a shortened list of sites using the 2026 EV charging demand at a settlement level, qualitative assessments and detailed feedback from Fife Council.

SPEN have also provided connection costs for supplying power to each of the identified sites in the short list. This has identified that there are a number of sites which would require a significant reinforcement cost to enable EV infrastructure to be installed, with majority of these in Dunfermline.

The current commercial models typically used when procuring EV infrastructure in the UK have been outlined along with potential sources of funding available to Fife Council. The recommended approach is for Fife Council to work with a Charge Point Operator to develop a commercial concession operating model to attract investment interest, allowing the expansion and development of a network of accessible EV chargers across all settlements in Fife.

Using the geospatial modelling, forecast utilisations have also been estimated for the proposed EV infrastructure and this has been used to populate the EVI Feasibility Model (version 4.1) as provided by SFT.

The provided SPEN costs have also been included to give a realistic indication of the cost for the portfolio of sites within Fife, this results in a total planned investment cost of £4,217,386, with the EVI

Feasibility Model indicating a capital funding required to install all the outlined infrastructure in Fife of £3,046,142.

Appendix A: Technology Roadmaps by Vehicle Type

The UK Automotive Council has developed long-term technology roadmaps for electric passenger car, bus, and commercial vehicle technology, representing the vision of vehicle manufacturers to 2040. These roadmaps show electric drivetrain technology as a focus area for passenger cars and light vans to 2050, given the drivers towards reducing emissions. Ignoring early teething issues in terms of specific vehicle types being brought to market, it is likely that charging infrastructure will be required for the majority of vehicles in the overall fleet for the next several decades. The roadmap nuances across the different vehicle types are described in more detail below.

Cars

The passenger car technology roadmap applies to private consumer vehicles, taxi and private hire fleets, car share, individual business, and pool cars. Many EVs are now available to support these use cases with many more models scheduled for release by manufacturers in the coming years. However, this increasing model choice must be widely promoted to encourage consumers to consider adoption due to various concerns outlined later in this strategy.

Although the quoted range on a full battery varies by EV plug-in model, and in practice also varies with driving style and conditions, the examples in Table A.1 below provide some context regarding range for some currently popular EVs.

Table A.1. Current EV Market - Cars

EV Model	Battery Capacity (kWh)	Range (miles)
Renault Zoe R110 ZE40	41/50	160/200
Nissan Leaf	40/62	140/250
Hyundai Kona	39	155
BMW i3 120 Ah	37.9	145
Tesla	60/100	300/400

Source: Jacobs and Zero Carbon Futures

Vans

Light vans can also make use of EV and hybrid technologies, providing an important opportunity for reducing urban emissions from local delivery solutions and business vans. New van sales have a higher average emission target than cars, of 147g CO2/km by 2020. (to be reduced by 15% by 2025 and 37.4% by 2030 at which point ICE vans will no longer be sold in the UK). For a long time, there were relatively few EV van models available in the UK and then only in very low volumes. Manufacturers such as Nissan, Renault and Citroen offer EV vans and have recently been joined by new models from LDV and Mercedes, with Ford, Volkswagen and LEVC announcing models coming soon to the UK. Table A.2 below shows the current market range.

Table A.2. Current EV Market - Vans

Make	Price	Mileage	Rapid Charge	Capacity (m3)
Peugeot Partner/ Citroen Berlingo	£23,030	106 (NEDC)		3.3-3.7
Peugeot e-Expert/Citroen e-Dispatch/ Vauxhall Vivaro-e	£49,465	205 (75kWh) 143 (50kWh)		>6.6
Peugeot e-Boxer/Citroen e-Relay	£49,335	>169 (62kWh)		8
Fiat E-Ducato	£59,699	>224 (79kWh)	No	10-17
Ford Transit (PHEV)	£24,395	35 (EV)		6
LEVC van (PHEV)	£46,500	58 (EV)		5

Maxus EV80	£24,614	119		11.6
Maxus e Deliver 3	£22,800	150		6.3
Mercedes e Sprinter	£51,950	71		10.5
Mercedes e Vito	£39,895	93	No	6.6
Nissan Env200	£20,005	124		4.2
Renault Kangoo ZE	£24,480	143		4.6
Renault Master	£57,040	124		13
VW Abte-Transporter	£42,060	82		6.7

Source: Jacobs and Zero Carbon Futures

Heavy Duty Commercial Vehicles

Heavy duty commercial vehicles remain a challenge for EV technology primarily due to their weight, payload, and range requirements. Several companies are now investing in alternative technology solutions to reduce emissions from heavy freight, with some focussing on creating all-electric powertrains while others are adding self-driving features and new fleet logistics systems to standard rigs to improve efficiencies and emissions.

Buses

A variety of EV technologies are already used on buses, including battery electric, hybrid, plug-in hybrid, hydrogen fuel cell and biomethane models, enabling operators to choose appropriate low carbon technology solutions to meet their needs. The UK Government has provided funding towards the deployment of low emission buses through the Department for Transport's Low Emission Bus schemes and Clean Bus Technology fund. There are two main types of electric bus – those that take power continuously from a source outside of the bus whilst travelling (e.g. overhead wires), and those that use energy stored on-board (usually in batteries). Hybrid electric buses use a combination of ICE and electric propulsion. It now seems that there are two options for urban buses which is BEV or FCEV. Rural buses could be different due to very isolated routes in terms of grid capacity.

Appendix B: Battery Charging Further Details

Battery Charging Capabilities

EV charging technology is evolving rapidly. Prior to 2016, most EVs charged at 3kW AC (called trickle charging), which was adequate to fully recharge most batteries (typically up to 24 kWh) overnight. Then with the development of vehicles with 7kW on-board chargers came fast 7kW AC charging, and with the introduction of higher capacity batteries, the 22kW AC fast charging technology has since come to market.

This figure demonstrates the low power charging capabilities of PHEVs. When combined with the fact that PHEVs also have lower capacity batteries, along with the lack of new PHEV models due to arrive on the market, the implication is that PHEVs do not appear likely to contribute heavily towards demand for public charging facilities in the near future compared to BEVs.

Rapid charging DC technology has developed much faster than AC technology, giving consumers a faster method to recharge. However, only some plug-in models were equipped with this capability prior to 2016. In contrast, all new plug-in models due to be available in UK to 2021 are rapid charge capable. Most vehicle manufacturers now use the CCS or CHAdeMO DC socket/plug for rapid charging. Only legacy Renault Zoe cars now use the 43kW AC rapid charging system, and Renault has recently changed to CCS DC rapid charging for future plug-in models. In parallel, Tesla developed its own Supercharger technology to suit their bespoke battery solution, charging their vehicles at 120kW power. Tesla superchargers were the first examples of high-power chargers to appear in the UK, but they can only be used by Tesla vehicles.

The latest development in charging technology introduces charging at powers between 100kW and 350kW DC, referred to as 'high-power charging' – but few such plug-in vehicles are currently available in the UK, and most of these are currently high-priced executive cars. The majority of high-power charging solutions use the CCS DC socket/plug; however, a few have maintained the CHAdeMO socket/plug. Nissan, who have up to now remained with CHAdeMO, are leaving it for CCS in the future, however, many thousands of drivers still need CHAdeMO access.

The roll-out of high-power chargers at 150kW+ for public use is now beginning in the UK, and most are designed to also deliver 50kW DC charges to rapid chargeable vehicles to combat the current lack of high-power charging demand. Trickle and fast AC charging solutions will continue to be required in the UK to support the recharging needs of the existing EV fleet. Of those rapid chargeable plug-in vehicles currently on UK roads, approximately 50% require the CHAdeMO connector, so new rapid chargers installed over the next 5 years will require both DC CCS and CHAdeMO connectors. However, it appears the rapid 43kW AC connector will have very low and declining demand going forward.

This improvement in battery capacity, together with reduced charging times, means that consumers are unlikely to charge their EV daily (more potential to be once a week). Therefore, demand for public charging may reduce in the medium-term.

PIV Supply Constraints

Consumers currently report long waiting times for plug-in vehicle (PIV) purchases, and there have been instances of models removed from sale for periods in the UK due to an excess of demand over supply. These unconfirmed reports further reduce consumer confidence in this nascent market where many consumers still perceive plug-in vehicles to be inferior to ICE vehicles in terms of price and utility. They also hamper the effects of efforts to raise awareness of the benefits of PIVs, and speculation and negativity in the press further hinders the transition from ICE to lower emission vehicles.

The lack of production capacity is a global issue, originating in vehicle production plants and battery production facilities across the world. Vehicle manufacturers are in unprecedented territory, facing a demand for product transition at global government level based on emission reduction requirements.

Indeed, the EU has set increasingly stringent regulations and associated fines to drive vehicle manufacturers to reduce the emissions of new car and van sales in Europe. However, the technology trajectory is still uncertain, the associated costs and plant changeover timelines are high, and both battery technology and supply are a key determinant. This presents major financial and reputational risks for vehicle manufacturers since one of the key constraints (batteries) is out of their control.

The UK Government is also concerned about the strength of the automotive industry, as it is an important contributor to UK employment, exports, and GDP. Nissan introduced the Leaf to the UK in 2011, manufacturing all European volumes of battery and vehicle at its UK plant since 2013. The first model had a limited 24 kWh battery, which was a risk with the limited charging infrastructure available at that time. However, this led the way in Europe and was soon followed by Renault, Mitsubishi, BMW, Volkswagen and Tesla, and higher battery capacities are now becoming the norm. These market leaders are only now beginning to increase PIV model range but have yet to make significant volumes to satisfy the potential demand across the whole of Europe. Many vehicle manufacturers have made little or no significant impact on EV availability to date, although there is much talk in the press about new models to come with little evidence of significant production volumes for the UK. The Nissan announcement is significant but some of the volume is substitution.

The current lack of production volume is posing a problem for both legislators and supporting businesses. The UK government has responded by offering purchase incentives for ULEVs since 2011; however, these have been reduced over the last three years and now apply only to the cleanest PIVs available. More favourable incentives in countries such as Norway have driven PIV demand to such an extent that vehicle manufacturers could be confident to redirect large percentages of European PIV production volumes there. Norwegian vehicle incentives include exemptions from the country's 25% Value-Added Tax (VAT) on vehicle purchase, free parking and ferry use, as well as use of bus lanes. These were complemented by the introduction of municipal charging facilities and a national network of rapid chargers. The UK does not at present hold such an incentive-based allure for the limited PIV supply, even though it is the second largest vehicle market in Europe. In addition, the use of incentives would have limited effect if there were a supply constraint.

The availability and cost (though less so than a few years ago) of Lithium-ion (Li-ion) batteries are limiting factors in PIV supply. Consequently, vehicle manufacturers are considering whether to make or buy the batteries for their models. Tesla has chosen to manufacture its own batteries and has launched associated energy business opportunities. Nissan set up its own European battery manufacturing facility to guarantee early supply for its vehicle production, but this has recently been sold. Most PIV manufacturers chose to rely on battery suppliers; however, battery manufacturing capacity within Europe is currently a small proportion of global volume, and Chinese companies own the majority.

Li-ion technology is the preferred choice for this decade due to the capital cost and reliability. Alternative volume-ready technologies are not forecast to reach the PIV market until 2028 to 2030, and many new battery manufacturing plants will then be required to supply the PIV volumes required to meet European targets, requiring significant investment and long-range planning. There is therefore still a substantial risk that PIV supply will stand in the way of achieving transport emission reduction targets in the UK. Recent activity has shown a rush to build battery plants across Europe. The recent announcement of the Britishvolt, plus the Envision AESC battery factories, both within the northeast of England, will help address the shortage. As too will the AMTE power announcement to build a Megafactory in Dundee

Regions and LAs have little or no control over vehicle manufacturers' PIV allocations and compete against major cities such as London and Paris. However, meaningful incentives such as grants supported by public charging facilities and financial dis-incentives such as Low Emission Zones have been shown to increase demand in some countries, leading to increased proportion of PIV volumes produced by manufacturers such as Tesla and Nissan. In Norway, for example, incentives were very significant initially however this level of incentive has not been matched anywhere else.

Appendix C: Charging Technology Further Details

Charging Rates Overview

The most significant advance in BEV is the emergence of 800V electrical systems which achieve much faster charging and reduced weight, allowing them to travel further between charges. Porsche fitted an 800V system in their full-electric Taycan sports car, which was launched last year. Such systems enable greatly reduced charging times, as long as they are using fast chargers capable of working at up to 270kW. "If the charger provides 800V and a minimum of 300A, the Taycan can charge from five to 80 per cent in 22.5 minutes. 400V chargers typically provide 50kW only. The same charging capacity would need 90 minutes," said Otmar Bitsche, director of e-mobility at Porsche.

Hyundai cars based on the E-GMP platform will offer a maximum range of more than 310 miles per charge, with standard high-speed 800V charging capability (so far available only on the Porsche Taycan), allowing an 80% charge in as little as 18 minutes from a 350kW rapid-charger. These models are significant as they are more representative of the family car.

800V systems also allow a greater retention of power; a higher voltage allows a lower current to be used when charging the battery, which reduces overheating and allows better power retention. This contributes towards a greater driving range.

Charge Point manufacturers and charge point operators are now preparing for demands for higher charging infrastructure.

The top picture (Figure C-1 below) shows 50kW rapid chargers at a motorway station of which there are normally 2, being replaced by 12 x 350kW. These charge points have the capability of adding around 100 miles of range in less than five minutes. The lower picture shows a similar progression by Shell from a single 50kW rapid charger to now a forecourt of 10 x 175kW rapid chargers.

Figure C-1. Examples of Charging Forecourts

Source: Jacobs and Zero Carbon Futures

Miles per kWh

In theory, electric car economy can be calculated by using a car's battery capacity and its official range. For example, an electric car with a 40-kW battery pack and a 100-mile range would have an economy/consumption figure of 2.5 miles/kWh. The actual range of an EV is dependent on a number of variables, for example: to what level the battery is charged, the capacity of the battery (kWh), the weather (windscreen wipers, aircon, heater active or not), time of day (headlamps on or off), driving style (aggressive or gentle). All of these will affect the range at a given time.

Currently the average car kWh per mile (kWh/mi) is around 4 miles/kWh depending on the vehicle.

With the average UK electricity price sitting at around 28p per kWh (August 2022) and if you assume an electric car will travel 4 miles per kWh on average, to travel 100 miles would cost around £7.00 or £0.07p/mile. (The cost to drive an ICE car is around £0.40p per mile, which is calculated by dividing average annual car running costs of £3,049 by average car mileage of 7,600 miles per year).

Fully charging a 60kW electric car will cost around £18.00 (depending on where you live) and give you about 180 -240 miles of range depending on time of year/day etc.

Charging Connectors

The International Electrotechnical Commission (IEC) standard 62196 specifies the plugs, sockets and outlets required for conductive recharging, covering charging modes, connection configurations and safety requirements for the operation of EV and recharging facilities. EV recharging connectors are specialised for automotive use.

PIV cars and light vans are supplied with a charging cable used to connect the vehicle to trickle or fast charge points. This cable has a plug specific to the vehicle on one end, and a suitable plug on the other

end to connect to trickle/fast charge points in the UK. Some vehicles have separate charging sockets for trickle/fast and rapid charging solutions, whilst some manufacturers have standardised around one vehicle-side socket for all charging solutions.

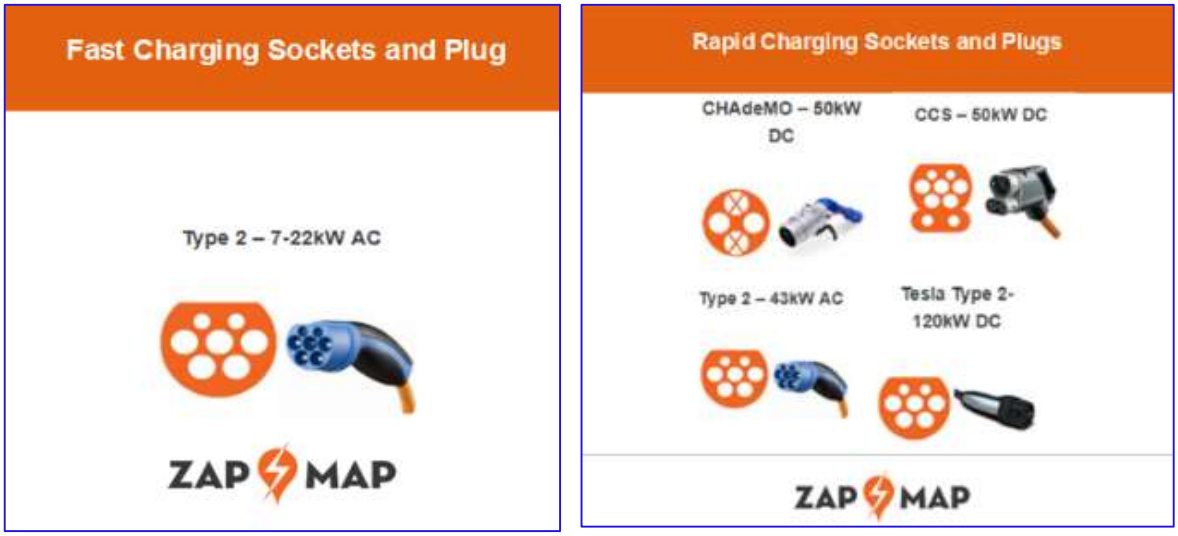
Charging cables are typically supplied with a Type 2 plug to connect to trickle and fast charge points in the UK.

Charging cables are also available fitted with standard UK 3-pin plugs intended for infrequent use where Type 2 charging solutions are not available, incorporating power protection limiting delivery to 3kW due to the risk of 3-pin plugs overheating when delivering power over prolonged periods.

Rapid and high-power chargers do not use the cable supplied with the vehicle. Instead, these chargers are fitted with tethered cables and connectors that plug directly into the vehicle due to the high power being delivered. There are four socket/plug formats used for rapid and high-power charging in the UK. Most vehicle manufacturers use the CHAdeMO or CCS DC socket/plug for rapid and high-power charging. Only Renault retains the 43kW AC system.

Tesla's 120kW supercharger socket/plug was designed to suit their bespoke battery solution. Tesla provides superchargers for public use and have now opened up their charging network to some non-Tesla vehicles.

Figure C-2. Type 2 Socket and Plugs for Trickle / Fast and Rapid Charging in the UK (Source: Zap-Map, final figure to be improved)



Source: Jacobs and Zero Carbon Futures

Charging Protocols

The charging protocol governs how the vehicle communicates with the recharging equipment, and potentially through the charge point with a wider network of equipment and services such as payment systems, energy, communications, and other services. The use of the Open Charge Point Protocol (OCPP) is promoted as the best way to enable the functionality required for widely available and accessible recharging networks of the future. If all vehicle and charging manufacturers adopt the same communications protocol, then the global recharging network will become accessible by all PIV drivers, be flexible to needs of various stakeholders and cost less to run as new developments are shared easily and quickly. The use of a common protocol can enable communication between any recharging equipment and any wider system in the future.

The latest version available for use is OCPP 2.0.1, but version 1.6 (which can also be certified) is most commonly specified in procurement exercises in the UK currently and has been adopted across most of

Europe, the USA and Asia. Most trickle and fast chargers intended for public use in the UK are now OCPP compatible, but some old charge point models are not upgradeable and therefore risk becoming obsolete. This highlights the need to consider future proofing in recharging infrastructure deployment plans.

A further development, the Open Smart Charging Protocol (OSCP), could enable direct communication between the electrical grid operator and the charge point. This potential functionality is highly valued by grid operators who need to monitor and control peak loading and timing implications for peak demand management, in order to maintain electricity provision for all.

Furthermore, mandatory regulations have now been introduced (June 2022) for newly installed private charge points setting out the following smart functionality requirements.

Table C.1. The Electric Vehicles (Smart charge Points) Regulations

Item	Purpose
Smart Functionality	Able to send and receive data and **increase/decrease rate of electricity** and **shift time** at which electricity flows. Must support Demand Side Response services (Grid Balancing).
Cyber and Data Security	Basic security measures for **resilience to cyber-attack** and robust against physical damage.
Randomised Delay Function	
Assurance	Any person / organisation selling a CP must provide **a statement of conformity and a technical file**, at the request of the regulator.
Supplier Interoperability	CPs must not be designed in a way that means they lose functionality when a consumer **switches supplier**.
Monitoring and Recording Energy Usage	
Safety	CPs should operate in a way that prioritises safety smart charging behaviour.

Source: Jacobs and Zero Carbon Futures

The smart charging regulations recognises the potential that smart functionality within charge points brings to help manage peak grid demands.

Upgrading Existing Charging Infrastructure

In some instances, it may not be possible to upgrade existing charging infrastructure to be OCPP compliant. In these cases, depending on age, utilisation and cost of ongoing maintenance, older stock will eventually need to be replaced with new OCPP compatible infrastructure. Ensuring all stock is OCPP compliant would improve functionality, reduce maintenance costs, and improve the customer experience. More importantly, it would allow an easier transfer of assets to any new charge point operators' OCPP supported operating platform should there be a need to change suppliers in future.

Existing charging infrastructure should be reviewed and any non-OCPP compatible infrastructure identified. Where possible, this should include the cost to upgrade or noted for either future replacement or alternatively removal (if not well utilised / a 'stranded asset'). In the long-term, Fife Council can choose to pay for the upgrades or enter into a contractual agreement with a supplier who may be willing to pay for any necessary upgrades. These options depend on:

- The expectation for the network;
- Available investment funding; and
- The available timeline including disposal of assets, physical upgrade where possible, or replacement of stock.

Smart Charging

Electric mobility will become an integral part of the UK's smart energy environment because the electrification of transport is key to decarbonising the economy. So, smart charging solutions are a key enabler of a sustainable recharging market in the UK. Smart charging could benefit both consumers and electricity networks by incentivising consumers to shift recharging demand to less expensive periods when there is plentiful clean, renewable electricity available, in turn reducing the need for expensive electricity network reinforcement.

Regular (non-smart) charging commences as soon as the PIV is plugged in, drawing the maximum amount of power available from the supply until the battery is fully charged. For large fleets, this could overload the available power supply causing practical power outages on-site and financial penalties from the energy supplier. Alternatively, smart charging allows the monitoring and management of the charging session to enable remote control of when, for how long and how rapidly the PIV recharges. Smart charging uses the OCPP charging protocol (v1.6 and beyond) to maximise charging flexibility and to mitigate the need for high-cost power supply upgrades. Although smart charging increases recharging infrastructure cost somewhat, it can provide multiple benefits:

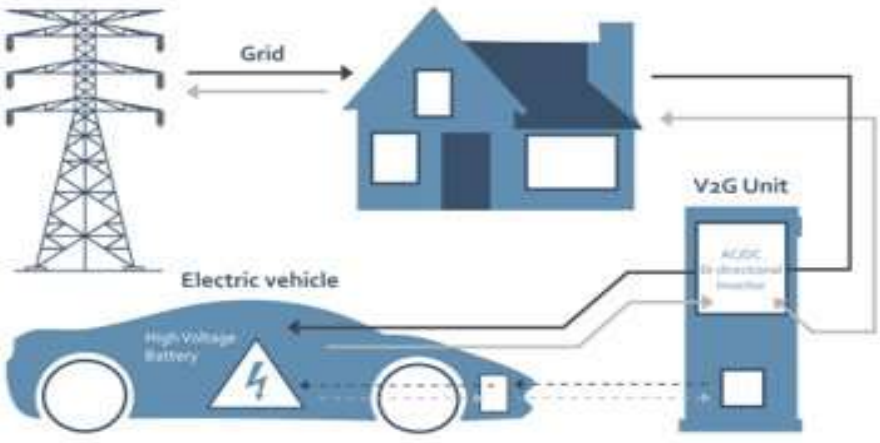
- Power peak reduction: schedule and automatically control each vehicles' charging cycle to avoid peak power demand times and avoid exceeding maximum power supply capacity.
- Reduce investment costs: make optimal use of the existing power supply by controlling the charging speed of each charge point to prioritise specific vehicles and balance the available power across chargers to ensure each vehicle is fully charged ready for the next shift's activity.
- Energy cost reduction: cost-effectively schedule charging times to take advantage of time-of-use energy tariffs to reduce operating costs.
- Increase flexibility: use prioritised load balancing to deliver only the energy required to suit each vehicles' next shift requirement, and allow for extended shifts, increased range, late start/finish times, etc.
- Demand response: respond instantly to dynamic energy pricing and accelerate or reduce the energy consumption of the fleet accordingly to reduce operating costs.
- Integration of batteries and renewable energy sources: use stationary batteries as energy stores, charging them from renewable generation sources and/or when energy cost is low, and subsequently use that stored energy to recharge vehicles when energy costs are high.
- Reduce manual labour: removes the time-consuming and error-prone need to manually plug/un-plug vehicles at specific times.

- Improve PIV battery health: smart charging results in slower charging over the battery's life cycle, preserving its state of health and reducing long-term operating costs and environmental impacts.
- There are currently three levels of smart charging available:
- Basic load balancing distributes the available power capacity equally between all charge points to prevent overloading and high energy costs at peak times.
- Scheduled/static load balancing can also optimize charging schedules to take financial benefit from time of use energy tariffs.
- Dynamic load balancing can combine both static and dynamic data such as bus routes, next day plans and dynamic energy pricing to ensure the entire fleet is charged in time for individual departure at the lowest cost.

Vehicle to Everything

Furthermore, Vehicle to Everything (V2X) has emerged as a further innovation that could bring significant benefit to both the Consumer (in terms of energy savings/payments) and the Grid (through cost avoidance of building out heavy infrastructure to support mono-directional charging.

Figure C-3. Vehicle to Everything Schematic

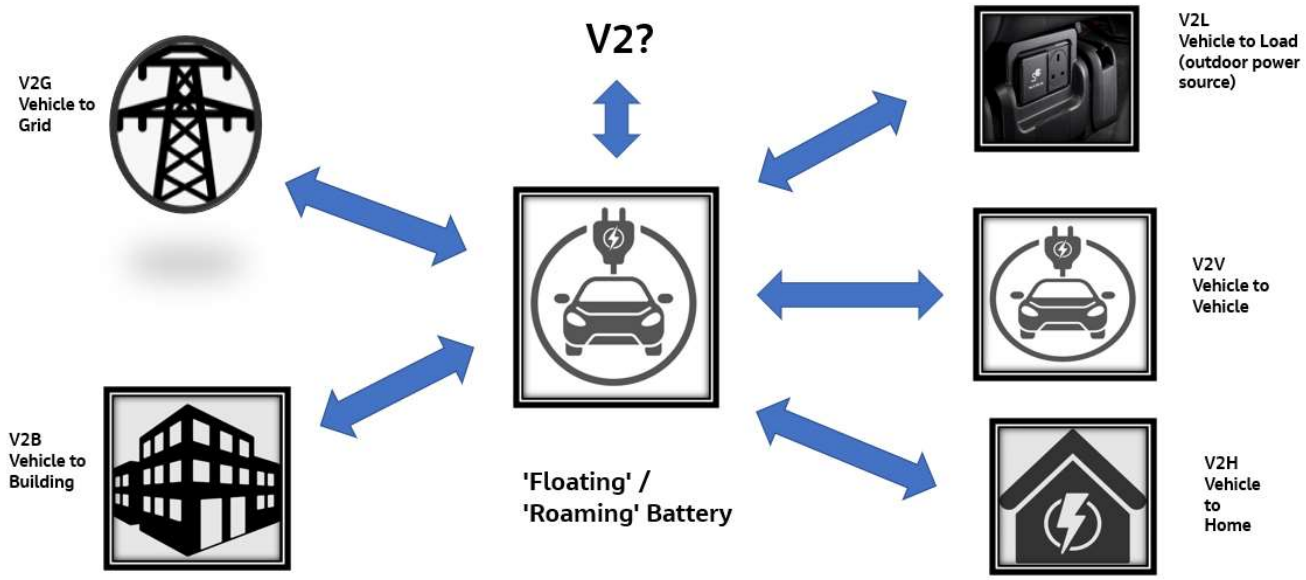


Source: Jacobs and Zero Carbon Futures

The most commonly referred to V2X use case is Vehicle to Grid (V2G) wherein a V2X enabled vehicle is connected to a V2G charging unit with energy discharged in reverse from the battery to the grid via a charger. In return there is potential for a customer to be paid for sharing energy back to the grid in particular to support peak grid demand.

The following image sets out further potential V2X use cases:

Figure C-4. further potential V2X use cases



Source: Jacobs and Zero Carbon Futures

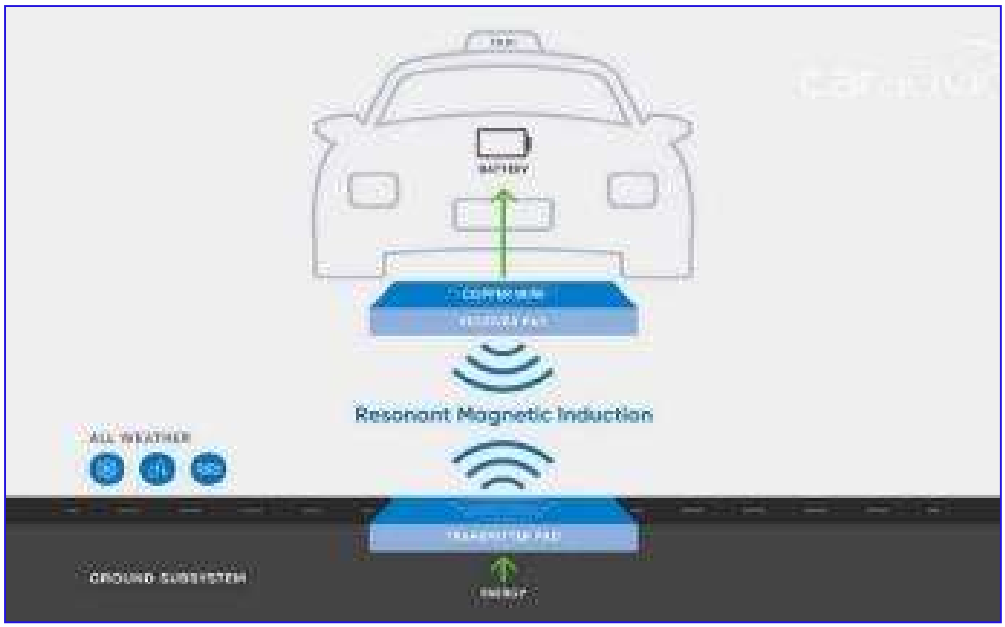
This shows further V2X potential including - V2G (discharging spare energy from the EV battery back to the grid in return for a payment), Vehicle to Building V2B – discharging to a building for the consumption of the building (i.e. could be via workplace/visitor parking) in exchange for a payment, Vehicle to Home V2H where a consumer uses spare stored energy within the EV battery for home energy consumption (i.e. a resident could charge the vehicle overnight when energy is cheaper and discharge from the battery back to the home during the day, avoiding higher energy payments. The cost savings are increased when combined with solar and other renewable energy sources). Vehicle to Vehicle V2V where an EV could provide charge to another EV where their battery might have run low and Vehicle to Load V2L where the EV becomes an outdoor power source for a multitude of uses. It is still early in the V2X market with more automotive companies committing to developing V2X models, more charge point manufacturers developing V2X products and commercial use cases and new business models are still in development. Various V2X pilots have already demonstrated promising results showing significant savings for consumer and for grid (cost avoidance of grid reinforcement and heavy development thereof).

Appendix D: Induction Charging

Overview

It is clear that the EV industry has seen substantial technological development in recent years. Another advancement already in train is induction, or wireless, EV charging. Induction charging is fairly simple – electricity is transferred through an air gap from one magnetic coil in a transmitter pad to a second magnetic coil fitted to a receiver pad on the vehicle. All that is required is that the vehicle is positioned in the right place so that the coils are aligned, and charging will begin.

Figure D-1. Induction Charging



Source: Jacobs and Zero Carbon Futures

Wireless EV charging via magnetic resonance technology delivers the same power, efficiency levels and charge speeds as conventional plug-in charging methods. Charging can be done through water, snow, ice, concrete, granite, etc, without any concerns regarding cable connections. Most Level 1 or 2 consumer plug-in EV chargers operate in the 88% to 95% efficiency range end-to-end, from grid to the battery. Leading wireless EV charging technologies today operate in that same range, at 90% to 93% efficiency.

Wireless charging also makes always-available bi-directional charging possible. Making EVs available as local on-demand energy storage is critical as utility companies look for an increased mix of renewables in the electrical grid. Bi-directional charging, otherwise known as vehicle-to-grid (V2G) technology, can help utilities handle increasing peak demand. For V2G to work seamlessly, the cars need to always be available on demand, and the reality is that most owners don't plug in when their battery is well-charged. Wireless V2G solves that as whenever the vehicles are parked, that stored power is available, and provides a new source of value for the EV owner. Wireless charging will be crucial for the successful introduction of autonomous vehicles.

Induction Trials

A number of trials of induction charging are currently underway:

- England, Nottingham: Wireless charging for electric taxis waiting in their rank is to be trialled in Nottingham. The UK Government is putting £3.4m towards fitting five charging plates outside the city's railway station. The six-month pilot project will see 10 electric taxis fitted with the necessary hardware, and the scheme could be rolled out more widely if successful. Officials said electric vehicles

were 'vital' to improving city air quality and making charging convenient was key. The Department for Transport said wireless charging was more convenient and avoided the clutter of cable charging points. (Source: BBC News online)

- Scotland, Edinburgh: Heriot-Watt University, located near Edinburgh, Scotland, is planning a trial of wireless charging using electric delivery vans. It is a joint project with the City of Edinburgh Council and Flexible Power Systems (FPS), and will involve specially adapted vans, with charging equipment from Momentum Dynamics. Innovate UK provided funding for the trial. The trial will also explore the concept of charging hubs, which could be shared among multiple fleet operators. "The project is testing the sharing of charging hubs among logistics, retailers, local government and university-owned commercial vehicles," said FPS Managing Director Michael Ayres. "These charging hubs require high use to be economically viable. The project uses powerful wireless charging to shorten the time vehicles need to be in the charging hubs." (Source: The Scotsman)
- Germany, Cologne: In the German city of Cologne, an inductive (wireless) charging project for taxis is being set up called the Taxi Charging Concept for Public Spaces (TALAKO, based on the German title). This is part of the SMATA feasibility project, launched in October 2020. For the new TALAKO project, six LEVC (London Electric Vehicle Company) electric taxis are to be converted for inductive charging. LEVC is responsible for making the famous London electric taxi cabs specially developed for the taxi industry. The vehicle has an electric range of 130 km and a range extender on board to extend the range by 500 km if necessary. When the Cologne project is in operation, six vehicles will be able to charge simultaneously. (Source: electrive.com)
- Norway, Oslo: Jaguar Land Rover will provide 25 Jaguar I-PACE models to Cabonline, the largest taxi network in the Nordics. The brand's performance SUV has been designed to enable Momentum Dynamic's wireless charging technology, making it the ideal vehicle to drive the initiative. A team of engineers and technicians from both Momentum Dynamics and Jaguar Land Rover were engaged to help in testing the solution, and Cabonline signed up to operate the fleet as part of Oslo's ElectriCity programme. Taxi drivers need a charging system that does not take them off route during their working hours. Multiple charging plates rated at 50-75 kilowatts each are installed in the ground in series at pick-up-drop-off points. This allows each equipped taxi to charge while queuing for the next fare. The system, which uses no cables and is situated below ground, requires no physical connection between charger and vehicle, engages automatically and provides on average 6-8 minutes of energy per charge up to 50kW. (Source: jaguarlandrover.com)

It is not clear at this time how the COVID-19 pandemic may have affected the progress of these trials.

Wireless Induction Charging Capability of EVs

Most, if not all, of the top vehicle manufacturers have stated that they are likely to offer wireless charging capability in the future. However, wireless charging is yet to be built into any model of PIV to date. BMW had planned to offer this technology on its 530e plug-in hybrid saloon back in 2018, but this decision was reversed, and the current generation battery does not support it. In Germany, it was a €3205 (£2700) option for consumers.

It is difficult at this time to ascertain when this technology would be likely to be introduced. Availability of relevant infrastructure will surely play a major role in determining possible introduction.

Further thoughts to be answered or considered regarding wireless / induction charging:

- If wireless charging is initially offered as an aftermarket add-on, then the required vehicle retrofit may have an impact on both vehicle warranty and insurance. The cost of installing the required infrastructure may suggest that installation will only be feasible as a hub consisting of multiple charging bays rather than single charge points in and around cities.
- Will car manufacturers want to introduce this option on vehicles if insufficient infrastructure exists? Likewise, will anyone want to introduce the infrastructure if no vehicles exist to use it? The vehicle manufacturers had to 'invest' in the current EV charging infrastructure, so are they likely to want to do it again?
- To go mainstream, wireless charging will need international standards. The Society of Automotive Engineers (SAE) recently announced the first global standard for wireless EV charging, which could help accelerate the technology's rollout. The standard, SAE J2954, applies to inductive charging systems up to 11 kilowatts. As with existing SAE standards for other charging methods, J2954 will

harmonise new systems, allowing for increased interoperability between hardware and vehicles from different manufacturers.

Note: Only BMW offer induction charging as an option on a 5 series hybrid.

Appendix E: On-Street Charging

Introduction

Fife Council wishes to further investigate charging options for EV on-street parking across Fife, specifically for those that do not have access to private off-street parking.

Transport Scotland has published a new vision for EV charging infrastructure in Scotland which has the potential to double the size of public charging network. A new public EV charging fund will be launched in Scotland, providing up to £60 million to Local Authorities over the next four years, with half of this funding to be invested from the private sector. However, it has not been identified as to whether this funding will be for on-street or off-street EV charging, or both.

However, the process of installing an on-street charge post for residents involves several challenges that need to be considered. This section reviews the opportunities and challenges of different charging options as well as the alternatives to on-street provision to ensure that no options are dismissed without consideration.

It should be noted from the outset that lamp columns within Fife cannot support EV charging and therefore this option is not suitable. This has been confirmed through discussions with the Fife Street Lighting team (outlined in Section 6.15) who note significant challenges to implementing this technology and therefore do not recommend it as an approach for consideration. This has been noted in the initial outline of possible options and is therefore not included within the subsequent detailed assessments of technology options within these appendices.

It has also been noted through discussion with CPO's that indicating that there is a move away from marked bays and TRO's for on-street charging.

This section of the report covers the following:

- Approaches to EV on-street parking: what is/isn't working across the UK;
- Case study examples including Milton Keynes and Oxfordshire which have offered to install on-street charge posts outside residential properties;
- Challenges of installing and operating on-street posts; and
- Current and emerging technological solutions within the market.

Challenges and Opportunities

In looking at EV On-Street options for Fife, it was important to note the key challenges that exist, including:

- **Lack of on-street existing charging infrastructure –** Disincentivises EV purchases, particularly for those who cannot charge at home;
- **Chicken and egg –** Investors (and highway authorities) need capital to provide infrastructure, but this depends on EV uptake, which requires infrastructure;
- **Charging point speed –** Trickle 3kW chargers can require up to 12 hours to fully charge an EV, greater rollout of faster chargers that can charge in shorter time periods are required at some locations;
- **Range anxiety –** Range anxiety is the worry of a person driving an EV that the battery will run out of power before the destination/suitable charging point is reached. Raising awareness of the recent successes of newer vehicles is key to overcoming this;
- **Housing stock / land use design** – Approximately 6.6 million households in the UK do not have access to off-street parking for at home-charging, making up nearly 25% of households[22];
- **Existing street furniture and utilities –** Narrow footways, underground utilities and streetscape 'clutter' can limit the opportunities to safely install charging points;

[22] https://uk.mer.eco/news/ev-charging-with-no-driveway-whats-the-solution/

- **Power requirements** – Although less of an issue with slower chargers running on existing infrastructure, rapid and ultra-rapid chargers can often require extensive works to reinforce the local electricity grid, costing time and money;
- **Setting of precedence** – There is an apparent expectation (evident in media reporting) that households with no off-street parking should be able to charge outside their home via dedicated household provision. However, this has cost implications both during install and for highway maintenance and would have impacts on accessibility and street scene. The extent to which each household will have dedicated provision must therefore be addressed while EV uptake is relatively low, to establish the acceptable level of provision for the future; and
- **Conservation areas** – Locations of this nature often have mandatory design guides when implementing new infrastructure or manipulating current infrastructure. These guides are in place to retain local sense of place, being sensitive to the existing built environment.

Opportunities also arise when investing in EV charging infrastructure:

- **Emersion in a quickly evolving industry** – EV charging options, are being invented and innovated to accelerate the process of vehicle electrification;
- **Education** - The EV industry is global and allows for Fife Council to tap into the learnings from trials being conducted around the world and use these to shape the area's charging network without having to financially invest;
- **Revenue generation** – by providing more charging infrastructure, there is an opportunity for Fife Council to both effectively manage the development of the charging network and, depending on the commercial model adopted, to also take advantage of the revenue generated by EV charging. This can be managed in a way that helps to address perceived inequality for those with and without off-street parking, which creates a price differential in charging; and

- **Promotion of the environmental agenda** – reducing carbon emissions in the transport sector is a significant step towards meeting local and national targets to improve the environment. Promotion and facilitation of EV uptake across Fife, and for those visiting the area, will help to support this wider agenda.

The effectiveness of provision for those without off-street parking will depend in part on other decisions and events globally, for instance if broader trends help to create a stronger market and greater demand for EVs over the next decade, including in Fife. However, the most significant element of provision will be choosing the right strategy for Fife and being able to deliver that flexibly based on emerging demands and technology.

Evidence Base

UK Wide EV Approach Success

The UK government, devolved nations, and local authorities are looking to find a practicable solution to the challenge of EV charging for residents with no off-street parking, with the private sector supporting in both strategy development and practical solutions. The cost of installing one charger outside every residential property, based on 8million properties and an average cost of £5,000 per installation, would be approximately £40bn. In addition to the cost, the impact of a large amount of on-street infrastructure makes this a relatively extreme solution. Our team's experience of working with a range of local authorities confirms many councils are reluctant to adopt full scale on-street rollout.

Technology developments and availability of options is developing fast, which is influencing the behaviour of drivers. In addition to technology, behaviours are changing in response to other factors such as pricing, accessibility, and parking fees. This makes establishing a viable infrastructure solution more challenging.

From a modelling aspect the challenge is to forecast the future charging behaviours of millions of drivers based on the current charging behaviours of 500,000 Plug-in Hybrid Electric Vehicle (PHEV) and Battery Electric Vehicle (BEV) drivers. In many cases the drivers are using vehicle technology that is becoming obsolete, and they do not have the experience of the new options. For example:

- High power chargers have moved from 50kW to a possible 350kW;
- Car range has moved from 80/90 miles maximum to a minimum of 200 miles;
- Charging times on trickle chargers have halved;
- High power charging of 30 minutes to 80% is now 15 minutes with new 800V systems;
- In 2012 there were 12 public 50kW DC chargers and now there are 4,000 ranging from 50kW to 350kW; and
- High power forecourts are now opening to replicate the current behaviour of filling up at a petrol station.

Case Studies

This section presents the key findings from the work undertaken by Jacobs' partner Zero Carbon Futures in Milton Keynes and the North East of England regarding on-street charging options and behaviours, and draws on projects in Oxfordshire, London, and Hertfordshire.

Milton Keynes

Milton Keynes Council is geographically smaller and more densely populated than Fife. It secured significant Government funding through the Plugged in Places project that sought to deliver EV charging for households without off-street parking.

Household Charging

The initial approach, MK Promise, was to provide on-street charging infrastructure to households with no access to off-street parking. Residents were invited to apply for a charge point to be installed near to them. The resident could request that a charger be installed within approx. five-minute walk from their home. Application was via the EVEC website then a partner organisation (ZCF) would instruct a survey of the area to see, 1) if there was a suitable parking spot and, 2) that power could be supplied. However, these installs proved to be extremely difficult to deliver because of:

- Staff shortages;
- Time taken to implement;
- Response times from DNOs meant that installations over-ran the funding window;
- Site selection proved difficult in constrained residential neighbourhoods;
- Existing street clutter and the challenge of compounding this with charge points;
- Installation works: Requirements for on-street works and permits for closing footpaths or temporarily rerouting pedestrians has the potential to increase installation time; and
- Organisational barriers: confusing about where EVs can park, where to charge, the availability of charging bays, permitted periods of stay (whilst charging and not), enforcement penalties, charging fees and parking payments.

To guarantee charge points being installed in areas that residents could access it was agreed to introduce the MK Hubs scheme. This was devised to take advantage of willing landowners who were prepared to have multiple chargers installed on their land in or close to a residential area, to allow residents access to publicly available charge points. The focus was on residential areas to compensate for the lack of success in rolling out the MK Promise. One of the main landowners that were targeted was Milton Keynes Council (MKC), which owns a lot of land in and around MK and is willing to support the installation of EV charging equipment where feasible. The project also carried out a gap analysis to identify any gaps in the current network. Throughout the duration of the program there have been lessons from the experiences in dealing with landowners, residents, DNOs, wider stakeholders and installation partners.

To change the function of an existing parking bay to EV charging the Local Authority must follow the Traffic Regulation Order (TRO) process. This is a lengthy process taking between 8-12 weeks to complete and involves publicising the details of proposed new charging bay(s) and inviting comments from residents. It became apparent that MKC TRO team had resource constraints and associated costs to consider, which caused significant delays and prevented effective deployment for all MK Promise sites. This resulted in poor customer feedback. The timescales were an issue, since DNO quotes expired before the TRO process could be completed and re-quotes were required. The TRO process was the biggest hurdle to the deployment process and caused delays to many applications.

Lesson for Fife Council:

Do not underestimate the time and resource required for TROs and ensure it is in place as part of the project set up. Additional resources may be needed.

Workplace Scheme Fully Funded to 50% Funded

As a result of the popular take up of the workplace scheme, the numbers of charge points being installed in workplaces was far higher than in all other schemes combined. The WP scheme was over-subscribed and by February 2020 the project has installed circa 180 charging outlets in local businesses, far exceeding the original target. The success of the scheme is unclear because it relies on the participating businesses reporting on the success or otherwise of the scheme. It was unclear whether the fully funded nature of the scheme was delivering on the overarching objective of increasing ULEV uptake.

Lesson for Fife Council:

A financial contribution encourages the applicant s commitment to the project and seems to reduce spurious requests.

The scheme was amended to apply a 50% funding approach to the Workplace Charging scheme to ensure that organisations who were applying for support were motived to do so for the right reasons.

It should be noted that businesses can now apply directly to OZEV for funding and the Fife Council role will be to promote this opportunity with businesses.

North East Combined Authority – Charging Behaviour

To understand charging behaviour, a survey was completed on behalf of the North East Combined Authority (NECA), which was one of the very first Plugged in Places projects along with Milton Keynes. A total of 21 drivers were interviewed prior to the COVID-19 pandemic.

Lesson for Fife Council:

Even with lower range electric cars, daily charging is usually not required. This reduces the need for dense residential charger provision.

71% of respondents travelled by car every day with a further 7% stating every weekday. 50% of respondents were driving under 100 miles a week showing that even with some of the lower range electric cars, one charge per week would be adequate. An additional 26% of all respondents were driving under 200 miles each week. Only 24% of drivers were driving over 200 miles each week. These mileages should be considered alongside the business model for the need for EV charging. Even when a weekly commute is over 100 miles, this demonstrates that daily EV charging is not required.

The results recorded that 90% of respondents preferred to charge at home. This is significant because only 76% had access to off-street parking. The next most popular options were in public car parks (74%) and at work (71%). Transport interchanges scored the lowest with only 27% choosing this option, showing that multi-modal forms of charging linking to other transport methods is not featuring highly in people's minds.

Despite average daily mileage being well within the range of an EV, NE EV drivers seem to like the reassurance of frequent charging top-ups. The majority (41%) of respondents charged their car a few times each week, however 27% charged most days and a further 25% said they charged every day.

Lesson for Fife Council:

Although a large proportion of people can charge at home, many choose not to. However, they value the reassurance of frequent top ups at public charging facilities.

Lesson for Fife Council:

There is a preference for diversity in charge location options, not reliance on charging at home. A varied public charging network will be required to meet different needs.

Responses indicated that 24% of charging took place using trickle /fast public chargers and 20% using rapid chargers. This seems to suggest that people are knowledgeable and comfortable using the public network which provides an opportunity for revenue generation. It's likely that the need for public charging will grow as drivers without off-street parking at home adopt EVs.

The survey found that 42% of respondents said that they were charging their car on the public network over 50% of the time. One EV driver reported driving 30,000 miles in 2 years without home charging facilities.

Although lamp-post charging was discussed, no participants believed that was the answer. Reasons ranged from: "There's no guarantee that everyone could have a charge point in front of their house, I think there'd be fights", "it's musical chairs to try and get a parking space on my street." and "there's only 3 or 4 lamp posts on this street". Respondents charging in residential areas stated that there was already competition for charging bays. Community charging hubs were seen as the answer to this.

Lesson for Fife Council:

Lamp column charging does not appear to be popular with EV owners. Charging hubs appear to be a more popular option where private off street charging is not available.

North East Drivers Survey Outcomes

- Incorporating charging into a routine has been important to many drivers with destinations such as supermarkets and leisure facilities offering charging facilities were noted.
- The preference for drivers without access to home charging was to charge in the evening, using a fast charge point, close to home.
- The replacement of 7kW charge points with a rapid charge point was a particular issue with some drivers in this group. Respondents feel that a mix of charge point types is required.
- Parking time restrictions (often in place at locations such as supermarkets) were a problem for drivers without home charging who needed a much longer time to gain a full charge.
- Drivers also resented paying for parking in residential areas where their rationale for parking was driven by charging alone.
- Lamp column charging was not believed to be viable because of challenges securing a space.
- Community car parks in residential locations with banks of fast chargers were seen as a potential solution for this group.

Ox Gul-e

Oxfordshire County Council and Oxford Direct Services (ODS: Oxford's Local Authority trading company) were awarded £160,000 in funding by Innovate UK and are currently collaborating to developing and

trialling a cable gully to enable residents to charge electric vehicles at home. This concept is also known as a cable channel. The team is building on the cable gully pilot, which was a part of Go Ultra Low Oxford, led by Oxford City Council in partnership with Oxfordshire County Council, which trialled five different charging technologies for 18 residents in Oxford. Phase 1 of the trial found that a 'one size fits all' solution for on-street charging does not work. However, the combination of a home charger and a cable gully solution was the cheapest, most used solution, as well as the one least likely to incur complaints from neighbours.

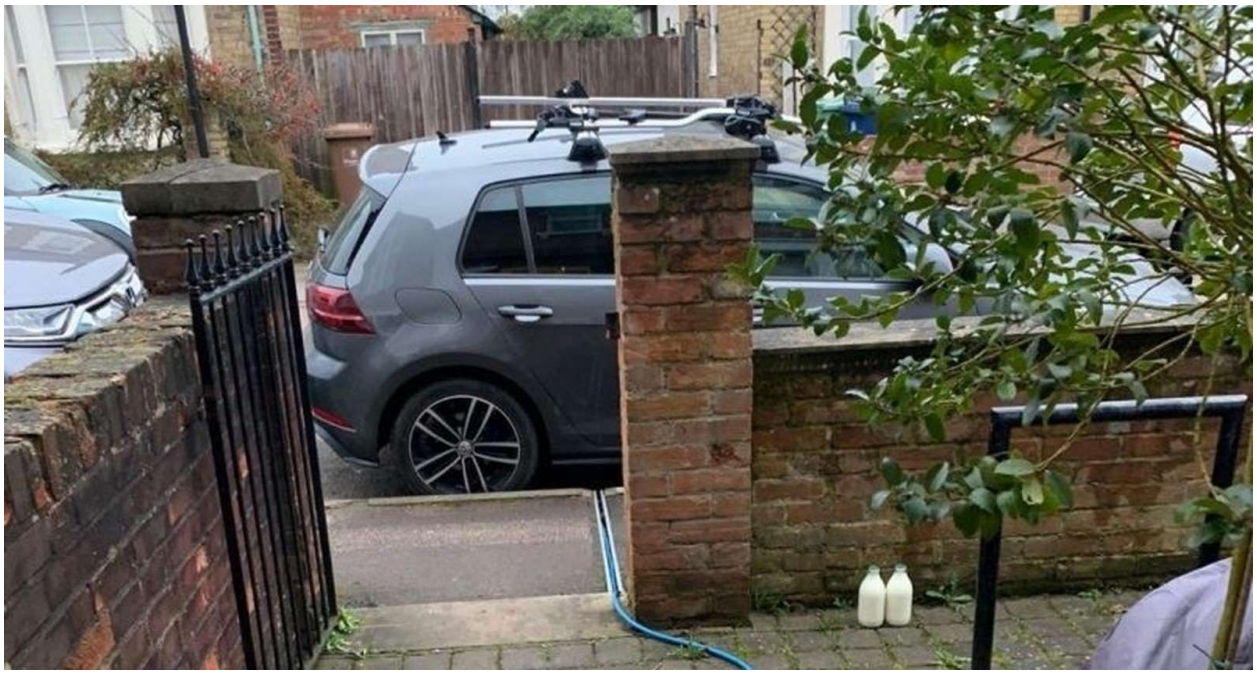
Lesson for Fife Council:

Experience confirms that no single solution is appropriate in all locations.

To date Oxfordshire County Council have implemented 26 Gul-e, with a further roll-out planned. These are installed by the council, with the cost met by the resident. As such, there is precedent for this type of infrastructure within Fife.

An example of the cable gully is shown in the figure below. It offers a discrete route for charging cables to pass from the property to the roadside, limiting tripping hazards and street clutter. Furthermore, connecting to the property's electricity supply allows for a cheaper way of charging, and one that is considered by some as more convenient than using an on-street charge point. The charge time for 0-100% battery level typically takes 4-6 hours, offering a fast-charging solution.

Figure E-1. Cable Gulley Example



Source: Jacobs and Zero Carbon Futures

Go Ultra Low City Scheme – London

The National Policy Planning Framework (NPPF) allows local authorities to introduce policies for EV charging to reflect local circumstance. London Boroughs therefore own the rights to the development of on-street charging infrastructure. However, they must comply with the standards laid out in the London Plan (2021). The plan states:

"Where electric vehicle charging points are provided on-street, physical infrastructure should not negatively affect pedestrian

Lesson for Fife Council:

Where electric vehicle charging points are provided on street, physical infrastructure should not negatively affect pedestrian amenity.

amenity and should ideally be located off the footway. Where charging points are located on the footway, it must remain accessible to all those using it including disabled people."

Charge points in London are either government funded, privately funded, or a combination of the two. Boroughs can choose a commercial model that suits their charging infrastructure plans. London's Go Ultra Low City Scheme uses a concession framework, (see Table E.1). A concession contract means the operational costs and risks are shared between the borough and the charge point operator. Frameworks of this nature have the greatest chance of success when operators can ensure a high chance of profitability. Collaboratively selecting locations and offering long-term contract agreements is often required to attract the investment of charge point operators.

Table E.1. GULCS Concession Breakdown

Approach	GULCS
Infrastructure Type	On-street charge points, up to 7kWh
Charge point Network Ownership	Borough
Funding Source for Charge points	75% Central Government Grant, 25% Boroughs funds
Responsibility for maintenance	Charge point supplier
Revenue Arrangements	Most to supplier, with a share to the borough
Risk Liabilities	Transferred to the supplier
Framework and Contract Length	Framework: 3+1 years Contracts: 10 years
Procurement Complexity	Invested resources to set up framework but will reduce costs and assist many boroughs

Source: Jacobs and Zero Carbon Futures

A concession framework is most appropriate when the primary motivation is to minimise the costs and risks to the Local Authority, while providing a functional charging infrastructure network. Challenges of this approach include reduced revenue for the authority, reduced power in deciding charge point locations, and lengthy contractual discussions.

The inclusive nature of the planning standards set out in the London plan should also be taken into consideration when planning the type of infrastructure to be implemented in Fife.

Hertfordshire EV Charging Infrastructure Strategy

To enable EV charging infrastructure, Hertfordshire County Council (HCC) have focussed on four key areas:

- Public Highway EV charge points (on-street)
- Local Authority EV charging hubs (off-street)
- New-residential building expectations
- New non-residential building expectations

Lesson for Fife Council:

The need to support EV charging should not be at the expense of the wider transport agenda to promote active modes and improve streetscene.

The provision of residential on-street charging points does not align with HCC's User Hierarchy Policy; Whilst EVs are powered by a cleaner fuel, they will still largely be used as private vehicles and do not enable a reduction in car trips or congestion. Although EVs help to reduce emissions for essential journeys, there is a risk that they may reduce levels of active travel, particularly for short journeys due to the reduced cost per mile (compared to petrol/diesel vehicles) and perceived green credentials.

HCC's position on Public Highway EV charge points is to avoid implementing a large scale roll out of on-street EV chargers (except for limited users/ limited circumstances). However, HCC will support the installation of fast chargers on the highway network where the following circumstances are met:

- Residents without access to a home EV charger and without suitable access to alternative local current or planned future EV charging bays (e.g. car parks, workplaces, rapid charging stations).
- Public transport, taxis, shared e-clubs.
- Destination locations without off-street provision.
- Blue badge holders.

Residents who do not have access to off-street parking but do have access to local public charging hubs (Hertfordshire have defined this as within a 5-minute walk) will not be eligible to apply for an on-street charge point outside their properties. These residents will be supported to access electric charge point services through public and private car parks, rapid charging stations and workplaces. Contracts for on-street charge points will be packaged with contracts for off-street charge points in local public car parks to improve the commercial viability.

HCC's position on EV charging hubs is to work alongside districts and boroughs to increase the provision of off-street EV charging infrastructure. For new-residential and new non-residential building expectations, developers are required to meet standards for EV charge point provision (passive and active) in all new developments.

Current and Emerging Options

Charge Points

The most well-known element of EVSE is the charge point – also referred to as charging post, charging point or charging station. There are many specifications of charge point in the marketplace, differentiated by power output, communication protocol, type, and number of charging outlets. They can typically be installed mounted onto a wall or as free-standing units installed in the ground. Most ground mounted charge points can be installed with retention sockets to ease swap out for future maintenance, repair, or replacement. Table E.2 provides a summary of the different types of charge point currently available in the marketplace.

Table E.2. Charge Point Speed

Common Charge Point Names	Power Output (kW)	Current / Supply Type	Socket / Plugs	Charging Duration (40kW battery)	Use Cases
Trickle	<7	AC	Type 2 Socket	13 hours	Destinations
Fast	7 – 22	AC	Type 2 Socket	2 to 5 hours	Destinations
Rapid	43 -50	AC	AC – Type 2	30 minutes to 80%	On-route
		DC	DC – CHAdeMO		
		DC	DC – CCS Captive cables with plugs attached		
High Power	100	DC	Tesla 120kW	TBC depending upon vehicle	On-route
		DC	CCS 150kW+		

Source: Jacobs and Zero Carbon Futures

Charge point technology continues to develop, with some manufacturers now promoting a full charge for any electric car in as little as 15 minutes [3].

800 Volt Battery Systems

The most significant advance in BEV is the emergence of 800V electrical systems which achieve much faster charging and reduced weight, allowing them to travel further between charges. Porsche fitted an 800V system in their full-electric Taycan sports car, which was launched last year. Such systems enable greatly reduced charging times if they are using fast chargers capable of working at up to 270kW. "If the charger provides 800V and a minimum of 300A, the Taycan can charge from five to 80 per cent in 22.5

minutes. 400V chargers typically provide 50kW only. The same charging capacity would need 90 minutes," said Otmar Bitsche, director of e-mobility at Porsche.

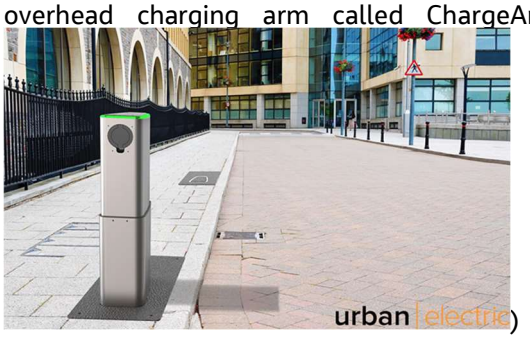
Hyundai cars based on the E-GMP platform will offer a maximum range of more than 310 miles per charge, with standard high-speed 800V charging capability (so far available only on the Porsche Taycan), allowing an 80% charge in as little as 18 minutes from a 350kW rapid-charger. These models are significant as they are more representative of the family car.

800V systems also allow a greater retention of power; a higher voltage allows a lower current to be used when charging the battery, which reduces overheating and allows better power retention. This contributes towards a greater driving range. The charging operators are now preparing for the higher charging.

Alternatives to On-Street Charging

If residential on-street parking is not available, then alternative options could be:

- Use destination charging at local charge points, to incorporate charging into a weekly routine such as at work and when doing the shopping etc.
- Kerbside home charging via 32amp mains connection from the home. Care must be taken to avoid creating hazards with trailing cables. A company from the Netherlands has developed a new overhead charging arm called ChargeArm that avoids creating this type of hazard (



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Overhead charging arm

The examples in the images below show the rising bollard and the Connected Kerb charger at ground level. The actual street situation will have to be evaluated as both photographs show either no parked vehicles or a very wide pavement.

Rising bollard

Connected Kerb charger

The image below shows a solution for the 2 wheels on the pavement scenario, but concerns have been raised regarding the negative impact on footway users.

Wheels on the Pavement Scenario

The full range of EV charging options are provided in the section below.

Location types and charger options

Location Types

Table E.3 outlines the main types of locations at which on-street charging may be required. These were chosen to represent the main types of housing that potentially do not have access to off-street parking.

Table E.3. Location types for this study

Type	Description
Pre-War Terraced	Generally located in urban centres and high-density streets with limited off-street parking and front doors that generally border the public pavements. Mixed housing streets have a mix of off-street parking/on road parking.
Pre- War Semi Detached/Mixed	Generally located in outer-urban/suburban areas. The housing is predominantly older semi-detached/council or private built housing. Parking is available where land has been available i.e. converted front gardens. Other areas may have on-street parking only. Included because private off-street is not always likely to be available.
Conservation Area - Mixed	The conservation area is a group of buildings whose character, interest and history make them worthy of special protection and enhancement. The main attributes that define the special character of an area are its physical appearance and history, including the form and features of buildings and the spaces between them, their former uses and historical development. Houses within a conservation area may vary however are generally limited in terms of parking infrastructure due to the age of the properties. They tend to mirror terraced areas in some cases but have few modern properties. The area is usually supported as a conservation area by restrictions in development.
Village/(Semi) Rural	Generally located in rural/semi-rural areas. The area usually has a low housing density. Housing is large with ample parking space on driveways. Some locations will not have off-street parking, with southern locations of Fife such as rural terraced cottages an example of this, where provision of highway infrastructure such as footpaths may be limited.

Source: Jacobs and Zero Carbon Futures

EV Charger Options

Table E.4 presents the EV charger options available and a review of their characteristics.

Table E.4. EV Charging Options

Example	Type	Comments
	On-street charging posts	• Potential high level of maintenance required to keep posts operational (e.g. vandalism / struck by vehicle) • Clashes with buried services may limit locations • Reliant on posts being immediately adjacent to the carriageway edge to prevent cables trailing across/along the footway • Often footways are narrow and regular provision of posts may limit the available space and cause access issues for wheelchair users, etc. • General 'street clutter' issues with large number of installations • Maintenance responsibility: Local Authority/equipment owner
	Wall mounted chargers (often located on wall of private property)	Suitable only where vehicles can gain convenient access to the charger without blocking footways etc. Maintenance responsibility: Equipment owner
	Cable channel	The channel will require regular cleaning to remove leaves and general detritus, which is likely to require specialised equipment as regular road/footway sweepers would not clear the channel. Reliant on users feeding the cable into the channel – which may be undesirable if wet / dirty May not be suited to footway with paving flags or setts as these will require cutting to fit the channel, leaving small sections of paving which may then be more prone to dislodging

Example	Type	Comments
		Potential to be damaged during works by others in the footway e.g. Statutory Undertakers Maintenance responsibility: Local Authority (channel only)
	Bolt on cable cover	• Trip hazard • Undesirable for pushchairs / wheelchairs / cycles / people with mobility challenges • Reliant on users feeding the cable into the channel – which may be undesirable if it has to be opened by hand in the wet • Would need to be removed to enable other to undertake works in the footway e.g. Statutory Undertakers • Lifespan of the bolt on cable cover may be limited if subject to frequent overrunning by vehicles, requiring regular inspection and replacement (bolt fixings breaking / top section breaking or become detached & missing) • Maintenance responsibility: Local Authority (bolt on cable cover only) • A further alternative is a removable cable cover, with many of the same characteristics. Although it could be removed when not in use, it may be a greater trip hazard because it is not secured to the footway or highway and may move when in use because of the movement across it. There is also a greater risk of it being stolen.
	Lamp column	• Only suitable where lamp columns are at the kerb side and are suitable for changing to a type that includes charging equipment • Not suited to settings where there is no street lighting • Typical spacing of lamp columns limits number of chargers available in a street • Requires agreement from third parties where LA is not the owner of the lamp columns, e.g. many villages

Example	Type	Comments
		• Maintenance responsibility: Local Authority (column)/equipment owner(charger) • Lamp columns are not suitable for use within Fife and cannot support EV charging
	Rising bollard	• Same as fixed bollards except: • Footway width is not compromised when bollards are not in use • Clashes with buried services are likely to be more problematic than fixed bollards as these require a space clear of services/drains/pipes for the bollard to retrato20ct into • Likely to need additional maintenance to ensure the raise/lower function operates properly • Maintenance responsibility: Local Authority/equipment owner

Example	Type	Comments
	Removable lance	• Reliant on users having a lance [from that manufacturer] • Bases likely to need regular maintenance/cleaning to ensure lances can connect to the base • Clashes with buried services may limit locations • Maintenance responsibility: Local Authority/equipment owner for base, vehicle owner for lance

Example	Type	Comments
	Overhead boom	• Only suited where space is available in or behind the footway to install the mast • General 'street clutter' issues with large number of installations • *Does the boom return back to the edge of footway when not in use?* If so, reliant on users doing this. Otherwise boom liable to be struck by high sided vehicles mounting the footway to park/deliver. • High vandalism potential to the boom, requiring regular repair • Maintenance responsibility: Local Authority if installed in footway. Equipment owner if installed on private property (liability for equipment when overhanging the public footway would need resolving).
	Connected kerb charger	• Less visually intrusive but may cause problems for visually impaired • Potential high level of maintenance required to keep charger operational (e.g. vandalism / struck by vehicle) • Clashes with buried services may limit locations • Reliant on charger being immediately adjacent to the carriageway edge to prevent cables trailing across/along the footway • Often footways are narrow and regular provision of chargers may limit the available space and cause access issues for wheelchair users, etc. • Maintenance responsibility: Local Authority/equipment owner

Example	Type	Comments
	Post to enable footway parking	Footway parking will need clear signage / markings to indicate where it is permitted Posts in the centre of the footway may cause problems for visually impaired Potential high level of maintenance required to keep posts operational (e.g. vandalism / struck by vehicle when mounting the footway) Clashes with buried services may limit locations (but less so than other bulkier chargers) Maintenance responsibility: Local Authority/equipment owner

Source: Jacobs and Zero Carbon Futures

Review of different location types and options

This section captures the input from technical specialist reviews into the challenges and opportunities of different location types and charger options.

Liability

This commentary on liability should not be considered legal advice or guidance. However, it does provide an appreciation of liability from a legal perspective.

Negligence law is likely to be the over-riding guide to liability for EV charging infrastructure, coming back to who the duty of care sits with. This means that there will be subtle differences depending on who:

Installs the hardware;

Owns the hardware; and

Is responsible for the upkeep of the hardware.

The owner of any infrastructure will be liable unless this is contractually passed on to another entity. This means that where hardware is installed on behalf of Fife Council, the Council will be legally responsible, but if the supplier retains ownership of the hardware, it is anticipated that that they would be obliged to maintain it. This may be most likely to apply in concessionary or partnership type commercial models.

Where a homeowner is the owner of the hardware, they would be responsible for it. However, if ownership of the property changed it is unlikely that liability could be passed on to the next homeowner.

In cases where hardware is owned by one party but used by another, there would be a responsibility on the user to do so safely. For example, if a channel is installed in the footway a resident would be expected to ensure that any cables were not trailing on the carriageway in an unsafe manner and that any covers on the channel are kept in place. If unsafe use were to cause an accident it is expected that the duty of care required by a user means that they could be held liable.

Related to liability for the installation, operation and use of EV charging hardware is the impact that it may have on other users of the transport network. Where the hardware renders the footway unusable this could give rise to claims against the highway authority. This could, for example, be caused by narrowing of the footway because or bollards or other equipment, or by a cable channel or cover that means the footway becomes impassable. This could occur with bolt on type cable cover if the gradient is impractical.

Planning

The Town and Country Planning (General Permitted Development) (Scotland) Order 2014 (as amended) states that planning permission is not required for the installation, alteration or replacement of a wall mounted electrical outlet for recharging of electric vehicles if the area is lawfully used for off–street parking. For installation to be classed as permitted development, the electrical outlet (and its casing) must not:

- Exceed 0.5 cubic metres
- Face onto and be within 2 metres of a road
- Be within a site designated of archaeological interest, national scenic area, designated landscape, historic battlefield, conservation area, a National Park or World Heritage Site.
- Be within the curtilage of a listed building.

Furthermore, where an upstand is to be installed with a mounted electrical charging outlet, additional requirements are that the upstand and outlet must not:

- Exceed 1.6 metres in height from the level of the surface used for the parking of vehicles.
- Be within 2 metres of a road.
- Be within a site designated of archaeological interest, national scenic area, designated landscape, historic battlefield, conservation area, a National Park, or World Heritage Site.

The requirement for planning permission may also mean that where off-street parking is available, but the equipment is to be installed within 2 metres of the highway, planning permission will also be required. If it constitutes development, planning permission may also be required for a cable channel across the footway to facilitate charging from a dwelling.

Road Safety

General observations relating to road safety are captured in Table E.5. The process of rolling out on-street charging infrastructure should take vehicle variation into consideration. To achieve a holistic transition to electric mobility, vans, taxis, and motorbikes will also require charging infrastructure. In addition, supporting electric micro-mobility modes, such as e-bikes, will also be paramount in ensuring businesses can achieve electrification. Local shops or outlets that frequently use e-bikes for delivery services should be targeted for infrastructure that can support this. Charging infrastructure should also not reduce storage space for conventional bikes; active travel will be key in achieving net-zero, therefore the needs of cyclists must be respected.

Table E.5. General safety points to consider for all charge points and street types.

Charge point element	Safety Considerations
Carriageway	• Speed of road and traffic volume. • Potential risks for cyclists being hit when car doors open. • Potential for drivers to park in cycle lanes forcing cyclists out into main carriageway. • Potential for drivers to be in the road while accessing a charge point, increasing the risk of collisions with passing vehicles.
Footway	• There is a need to maintain a minimum footway width as per *Inclusive Mobility*[6] • Footway material must be considered: surface have the potential to experience future degradation due to the build-up of debris around chargers, cables, channels etc. • Potential for operational hazards: grass verges may impact installation choices as trailing cables may be severed during grass cutting. • Charge points or signage have the potential to create pinch points. • The distance from the property to the charging point is a key consideration, particularly if exposed wires are involved. • Street lighting: unlit streets may make it more difficult for the user to see what they are doing. Pedestrians may not see hazards in the footway (bollards,

Charge point element	Safety Considerations
	cables). Additionally, in lit streets, larger infrastructure may cast shadows on footway creating pools of darkness. • Footfall: how busy a through route is a key consideration. Cyclists may need to use the footway. Close proximity to a school/hospital may mean a high number of vulnerable users. Repeated passage of pushchairs (e.g. near a primary school) or wheelchairs (e.g. near a hospital) over a cable cover may cause wear and expose electric cables/ allow rainwater into the channel. • Headroom: cyclists, window cleaners, people carrying umbrellas in wet weather (also risk of electricity arching to metal umbrella tip in damp atmosphere) are all impacted by low headroom. • Achieving a balance between visually obtrusive but need to be seen. There is a potential for confusion for pedestrians with dementia. Visually impaired people will need to detect any obstacles and navigate around them. • Impacts of the charging unit and/or cable protection on future footway surfacing works must be assessed. • Trailing cables across private front gardens/driveways or over front garden walls increases the risk to the resident and pedestrians. • Inquisitive dogs may sniff/paw/urinate around the infrastructure.
Cable	• Single coloured cables will be more conspicuous than striped/patterned/black cables. • Cable length: longer cable encourages driver to park further away increasing risk of trip hazard.
Vehicle	• Charge point positioning: consider whether it will be used on the front, rear or side of the vehicle and whether this varies between models?
Parking	• Consider whether to use dedicated bays/enforcement/signage. • Consider whether to use single or multiple bays and whether one charge point charge two adjacent vehicles. • Consider whether the charge point will be placed on a build out. In this scenario, there will be no loss of room on the footway but there will be a loss of parking space. • A procedure for when a non-resident parks in bay or tries to use charger must be considered. • Loss of on-street parking provision may encourage drivers to park inappropriately elsewhere.

Charge point element	Safety Considerations
	• On quiet streets, a car may double park and block the road if the bay is occupied. • Signage for the bay and its positioning/visibility. • TRO signage: consider whether the bay will be only used for charging vehicles. Some areas are Resident Permit bays so anyone permit holder can park there. The charging bays may create problem with bays being 'reserved' by the e-charging vehicles – may create conflict amongst residents in the street. • Warning signs for the charge point hazard. • Perpendicular or parallel parking.
Charge point	• The distance to next charging point and how many intervals will exist along the street. • Consider how to report faults, difficulties, and complaints. Confirm who is liable to act in the case of an emergency. Consider displaying contact details on some types of infrastructure but not on others. • Disabled access to the charge point on the footway and to the vehicle charge point. Consider whether a drop kerb required to facilitate this. Perhaps this drop kerb could also be used by pedestrians to cross the road (maybe no different to vehicle crossover). • Vandalism. • Consider whether the driver may drive away while vehicle is still plugged in. E-cars probably have safety device to prevent this. • Charge point resistance to rain induced hazards. • Understand where the charge point on the vehicle is located: the side furthest from footway means the user has to stand in the road to access the charge point on the car. This can be a particular issue on one-way streets. • Consider who will do periodic safety reviews of the whole installation.

Source: Jacobs and Zero Carbon Futures

Table E.6 provides a safety review of the characteristics of the various housing types, with respect to on-street EV charging. Such characteristics are key in developing a series of likely best options tailored to contrasting housing stock.

Table E.6. Review of housing types

Housing Type	Review
Pre-War Terraced	• Narrow footways may restrict/prevent use of physical upright posts in footway. • Addition of buildout to house the post will result in lost parking. • Parking is at a premium so vehicles may not be able to park immediately adjacent to the charging point. • Continuous parking bays rather than individually marked bays may make it difficult for the driver to park the vehicle adjacent to the charge point. • Front doors that border the highway may create a trip hazard if the cable trails down the doorstep.
Pre-War Semi Detached / Mixed	• Narrow roads may result in 2 wheels parked on the footway. This may lead to damaged charge point. • Narrow footways may restrict/prevent use of physical upright posts in. • Parking is at a premium so vehicle may not be able to park immediately adjacent the charging point. • Parking needs to be managed, balancing needs of pedestrians, emergency vehicle access, one or two-way motor traffic and damage to wing mirrors.
Conservation Areas	• Visual obtrusion may need special approval and may need specially designed charging infrastructure which is in keeping with the heritage features. Bright colours to make infrastructure visible to pedestrians may conflict with the conservation area requirements.
Village/ (Semi) Rural	• Streets may have grass verges which may make grass cutting difficult. • Distinction between public highway and private land is not clear. • Potential for horses to be alarmed by cables or overhead installations. • Must position charge points carefully so as not to block access to fields, Public Footpaths, bus stops etc.
Communal parking	• Drivers may not be able to see the charge point from their property. • If charging points are located at the front or side of the bay, it will be difficult to park but if charging point at back of bay next to hedge. Drivers will need to leave space to access charge point so vehicle may stick out front of bay. • Must carefully review parking restrictions.

Housing Type	Review
	• Could use wall mounted chargers for exterior flats above ground level but many of the issues for Overhead Boom would apply.

Source: Jacobs and Zero Carbon Futures

Safety observations of the different charger types are captured in Table E.7:

Table E.7. Review of Charging Types

Type	Network Safety Problems	Benefits
On-street charging posts	• Posts can be trip hazards. • Cables are not conspicuous and pose trip hazards. • A post should be set back from the carriageway at least 450mm, however should maintain at least 1m clear footway width. • Cable hazard for drivers or pedestrians that may cross between vehicles. • Drivers may not see the low post which could result in damage	On wide footways, clear passage for pedestrians etc should be available (if drivers do not trail cables there).
Wall mounted chargers	• Cable will trail across footway unprotected, causing trip hazard. • Driver may try to park close to charging unit, blocking footway. • Integrity of a private wall must be questioned. • Potential for the unit to have a door that can snag a passing pedestrian.	No post to cause trip hazard.
Cable channel	• If cable can be easily removed, it can be vandalised to create trip hazard. • Potential for the cable to be vulnerable to deterioration where it enters cable channel, risking fault or electrocution. • Potential issues with water ponding. • Heels can get caught in channels, causing pedestrians to trip. • Drivers may leave the cable slightly proud of the footway surface. • Footway surfacing and impact on future surfacing works. • Over time the channel may fill up with silt making it hard to use properly.	Tidy arrangement on footway.
Bolt on cable cover	Still creates a trip hazard, especially for small-wheeled scooters, wheel chairs and visually impaired. Cables still trailing in the carriageway causes a trip hazard. • Rainwater run-off will be redirected from its normal course which may cause drainage issues. • May cause detritus to accumulate, causing slipping hazards.	Bolted down may prevent vandalism. Conspicuous.

Type	Network Safety Problems	Benefits
	• Susceptible to being moved. • Potential for the cable to be vulnerable to deterioration where it enters cable cover, risking fault or electrocution.	
Rising bollard	• A post is a trip hazard when in an upright position. • Cables are not conspicuous, also trip hazard. • Posts causes pinch points albeit small. • Cars may not park beside posts so cables will trail footway or carriageway.	Footway clear when not in use.
Removable Lance	• Potential for the post to be removed by a vandal while charging and thrown, posing risk of electrocution. • If the parking bay is not marked and the vehicle is slightly too far away, the cable can be pulled and damaged. • The lance may be too heavy for some drivers to carry.	Footway clear when not in use. Can be installed at regular intervals along the street. No trailing cable
Overhead boom	• Poses hazards for cyclists, people carrying umbrellas and tradespeople. • Potential for vandalism with people trying to swing on the pole. • Vertical trailing cable if vehicle can't park close enough. • There will be significant blocking of the footway if the post is damaged. • Risk of vandalism to boom structure	Footway clear when not in use.
Connected kerb charger	• Low profile poses a tripping hazard. • Cars may not be able to park beside posts so cables will trail footway or carriageway. • Low profile means users have to bend down to access, which is not inclusive. • If perpendicular parking, the driver will not see the low post and may overhang footway and damage post.	On wide footways, could maybe provide seating (facing away from the carriageway) to prevent pedestrians tripping over it.
Post to enable footway parking	• This example is virtually in the centre of the footway, causing obstruction that pedestrians may walk into especially as it is below eye-level).	

Type	Network Safety Problems	Benefits
	• The cable is not conspicuous, posing a trip hazard. • Cars may not park beside post so cables will trail footway or carriageway. • A post can cause a pinch point albeit small. • If perpendicular parking, the driver will not see the low post and may overhang footway and damage post, which can then cause hazard to pedestrians.	

Source: Jacobs and Zero Carbon Futures

Potential Options for Conservation Areas

Currently there seems to be no rules or regulations with specific regard to the installation of EV charge points in conservation areas. Discussions with a number of charge point installers and Local Authorities have resulted in the same response. Each case is usually considered on an individual basis, however ultimately it is the local planning authorities who make the final decision.

Trojan Energy

This technology uses a 'lance' which connects the electric vehicle to a flat-and-flush charging point in the street, charging at the roadside. The flat-and-flush design means the pavement is clear of clutter and fully accessible to other pavement users. The charging points are connected via underground ducts to cabinets, located discreetly up to 100m away, which can send power to 15 charging units at any one time.

Step Trial[23]

STEP stands for Subsurface Technology for Electric Pathways. It is a trial installation of Trojan Energy's Electric Vehicle charging technology. The trial is funded by the Office for Zero Emission Vehicles (OZEV) which is an organisation working across several government departments to support deployment of ultra-low emission vehicles (ULEVs). The project is delivered through Innovate UK, part of UK Research and Innovation (UKRI) – the Government backed national funding agency investing in science and research in the UK.

The trial will involve deploying 150 Trojan Energy charge points across the London Boroughs of Brent and Camden. Trojan will then begin to install the network of pavement flush on-street EV chargers in both boroughs, with the equipment going live and the trial beginning in both Camden and Brent towards the end of 2021. The trial is expected to last for 9 months from start the start date.

Pop-up Pavement Chargers

Another innovation that could reduce street clutter is pop-up EV chargers, which rise out of the pavement when activated remotely using a smartphone app. London-based EV charging company Urban Electric Networks has developed the UEone on-street devices, which retract into the ground when not in use like bollards as shown in the image below.

[23] https://www.trojanenergyltd.com/projects/step

Figure E-2. UEone by Urban Electric Networks (Credit: Urban Electric Networks)

Six pop-up chargers, offering fast charging measuring up to seven kilowatts (kW), were installed in Oxford in November 2019 as part of a trial and the company plans to begin commercial production in 2021. It claims they will be zero cost to councils for supply, installation, operation, and maintenance. Installations will be in clusters rather than individual charge points to limit the number of pavements that need to be dug up to fit them.

Maintenance

The different options for on-street charging options were considered in turn for maintenance implications. This is summarised in Table E.8.

Common and key points relating to maintenance are:

- Statutory services are generally a minimum of 300mm to 400mm deep in the footway. Most options would require a power supply to be installed beneath the footway and would require hardware to be installed into the footway. This would particularly be the case for rising bollards that are likely to need a deeper installation than other options.

- Vandalism is a risk for all options, with some being more vulnerable to it than others. If private property (i.e. belonging to a home owner) were vandalised effective repair or making safe may take longer or be difficult to enforce compared with hardware that is council owned or commercially operated and that may be subject to responsibilities covered by legislation such as Section 50 of the New Roads and Street Works Act 1991.

Table E.8. Charger Options Maintenance Review

Type	Comments
On-street charging posts	**Assumed maintenance responsibility: Local Authority/equipment owner**
	• Potential high level of maintenance required to keep posts operational (e.g. vandalism / struck by vehicle) • Clashes with buried services may limit locations • Reliant on posts being immediately adjacent to the carriageway edge to prevent cables trailing across/ along the footway • Often footways are narrow and regular provision of posts may limit the available space and cause access issues for wheelchair users, etc.

Type	Comments
	• General 'street clutter' issues with large number of installations
Wall mounted chargers	**Assumed maintenance responsibility: Equipment owner**
	Suitable only where vehicles can gain convenient access to the charger without blocking footways etc. Vulnerable to vandalism if installed on the side of a property that fronts immediately onto the highway
Cable channel	**Assumed maintenance responsibility: Local Authority (channel only)**
	• The channel will require regular cleaning to remove leaves and general detritus, which is likely to require specialised equipment as regular road/ footway sweepers would not clear the channel • Reliant on users feeding the cable into the channel which may be undesirable if wet/ dirty • May not be suited to footway with paving flags or setts as these will require cutting to fit the channel, leaving small sections of paving which may then be more prone to dislodging • Potential to be damaged during works by others in the footway e.g. Statutory Undertakers
Bolt on cover	**Assumed maintenance responsibility: Local Authority (bolt on cable cover only)**
	• Trip hazard • Undesirable for pushchairs/ wheelchairs/ cycles • Reliant on users feeding the cable into the channel – which may be undesirable if it must be opened by hand in the wet • Would need to be removed to enable other to undertake works in the footway e.g. Statutory Undertakers • Lifespan of bolt on cable cover may be limited if subject to frequent overrunning by vehicles, requiring regular inspection and replacement (bolt fixings breaking/ top section breaking or become detached & missing)
Rising bollard	**Assumed maintenance responsibility: Local Authority/equipment owner**
	• Same as fixed bollards except: • Footway width is not compromised when bollards are not in use • Clashes with buried services are likely to be more problematic than fixed bollards as these require a space clear of services/ drains/ pipes for the bollard to retract into. • Likely to need additional maintenance to ensure the raise/lower function operates properly

Type	Comments
Removable lance	**Assumed maintenance responsibility: Local Authority/equipment owner for base, vehicle owner for lance**
	• Reliant on users having a specific lance (unlikely to be interchangeable across suppliers) • Bases likely to need regular maintenance/cleaning to ensure lances can connect to the base • Clashes with buried services may limit locations
Overhead boom	**Assumed maintenance responsibility: Local Authority if installed in footway. Equipment owner if installed on private property (liability for equipment when overhanging the public footway would need resolving).**
	• Only suited where space is available in or behind the footway to install the mast • General 'street clutter' issues with large number of installations • Does the boom return to the edge of footway when not in use? If so, reliant on users doing this. Otherwise boom liable to be struck by high sided vehicles mounting the footway to park/ deliver. • High vandalism potential to the boom, requiring regular repair
Connected kerb	**Assumed maintenance responsibility: Local Authority/equipment owner**
	• May cause problems for visually impaired • Potential high level of maintenance required to keep charger operational (e.g. vandalism/ struck by vehicle) • Clashes with buried services may limit locations • Reliant on charger being immediately adjacent to the carriageway edge to prevent cables trailing across/ along the footway • Often footways are narrow and regular provision of chargers may limit the available space and cause access issues for wheelchair users, etc.
Post enabling footway charging	**Assumed maintenance responsibility: Local Authority/equipment owner**
	• Footway parking will need clear signage/ markings to indicate where it is permitted, likely to need a TRO) • Posts in the centre of the footway may cause problems for visually impaired • Potential high level of maintenance required to keep posts operational (e.g. vandalism/ struck by vehicle when mounting the footway)

Type	Comments
	• Clashes with buried services may limit locations (but less so than other bulkier chargers)

Source: Jacobs and Zero Carbon Futures

Comparison of different charging options

To determine the relative benefits of each option, they have been assessed to provide a strategic comparison. This is not a scoring exercise, but a relative rating was used to help determine which options are considered more or less suitable.

The approach adopted to compare options is an assessment based on likely **effectiveness** and how **workable** it is. Effectiveness considers how successful the option is likely to be in providing EV charging for households without off-street parking. Workability considers:

- Installation burden on the householder and Fife Council;
- Ongoing maintenance burden; and
- Challenges and opportunities that are likely to be present over the life of the option, for example maintenance.

Both effectiveness and workability were rated using a four-point scale shown in Table E.9. A Five-point scale was considered to incorporate a neutral rating. However, in the context of this study a neutral rating is likely to be less helpful than one that defines effectiveness and workability by clear distinctions of likelihood of relatively better or worse.

Table E.9. Four Point Scale used to rate options

Rating	Definition
A	Likely to be the most effective/ workable options
B	Likely to be effective/ workable, but is not likely to be optimal
C	Likely to be somewhat effective/ workable, but may still not be satisfactory compared with other options
D	Likely to be the least effective/ workable options

Source: Jacobs and Zero Carbon Futures

The assessment and rating for the representative options is presented in Table E.10 with a strategic comparison of the options provided in the subsequent figure.

Table E.10. Assessment and Rating for the Representative Options

Option	Consideration	Assessment	Rating
On-street charging posts	Effectiveness	• Can be used by multiple vehicles at one time • Available for any member of the public to use	A
	Workability	• Posts and cables post trip hazards • Relatively low maintenance burden • General 'street clutter' issues with large number of installations • Potential for implied allocated parking	B

Option	Consideration	Assessment	Rating
		• Often footways are narrow and regular provision of posts may limit the available space and cause access issues for wheelchair users. Build outs may be required • On wide footways, clear passage for pedestrians etc should be available • Relatively straight forward installation • May need build-out to minimise impact narrow on footway	
Wall mounted chargers	Effectiveness	• Direct access to charger for householder • Access to the charger may be blocked by other parked vehicles • May result in parked vehicles against the flow of traffic, which is a safety risk • User benefits from residential cost of electricity • Not available to all members of the public	C
	Workability	• Cable will be a trip hazard, only likely to be suitable where there is no footway with EV parked immediately adjacent to property • Planning permission required • No maintenance liability if no supporting infrastructure in the highway is required • Implies an allocated space with a 'right to park on the highway'	C
Cable channel	Effectiveness	• Direct access to the EV for householder • Allows charging without any other infrastructure (i.e. cable connected to a standard household socket) • User benefits from residential cost of electricity (assuming combined with charging from a household) • Potential for damage to the cable, and use may be undesirable when channel is wet or dirty • Risk of people tampering with the cable across the footway, not evident in other options. Potential risk to user duty of care in demonstrating liability	D

Option	Consideration	Assessment	Rating
		• Likely to be difficult to use for people with limited mobility • Requires a channel for every household	
	Workability	Significant cost of Section 50 in addition to the install cost Likely that planning permission also required for EV charger, incurring further costs. Planning permission for the channel may be required if it constitutes development. Likely to be a significant maintenance burden Because allocation to more than one household is likely to be impractical a channel would imply allocated parking with a 'right to park on the highway' Trip hazard, anecdotal evidence from trials elsewhere that this is a significant risk	D
Bolt on cable cover	Effectiveness	Direct access to the EV for householder Trip hazard, anecdotal evidence from trials elsewhere that this is a significant risk Greater potential for misuse because of the need to repeatedly cover over the bolt on cable cover when laying the cable Risk of people tampering with the cable across the footway, not evident in other options. Potential risk to user duty of care in demonstrating liability. Likely to be difficult to use for people with limited mobility Obstacle to use for those with impaired mobility with potential for legal challenge Allows charging without any other infrastructure (i.e. cable connected to a standard household socket) User benefits from residential cost of electricity (assuming combined with charging from a household)	D
	Workability	Significant cost of Section 50 in addition to the install cost Likely that planning permission also required for EV charger, incurring further costs Likely to be a significant maintenance burden	D

Option	Consideration	Assessment	Rating
		Because allocation to more than one household is likely to be impractical a bolt on cable cover would imply allocated parking with a 'right to park on the highway' which does not exist	
	Workability	• No implied allocation of spaces – available to be used by any member of the public and likely to minimise disagreements regarding parking • Would be subject to structural assessments • May need to be supported by a TRO to prohibit blocking of EV charging infrastructure or trailing cables along the kerb • Because most lamp columns are at the back of the footway this would often need to be combined with cable management, e.g. a cable channel	D
Rising bollard	Effectiveness	• Footway clear when not in use • Cars may not park beside posts so cables will trail footway or carriageway • Available to any member of the public • No street clutter issues when not in use	B
	Workability	• Post causes pinch points albeit small • Clashes with buried services are likely to be more problematic than fixed bollards as these require a space clear of services/ drains/ pipes for the bollard to retract into • Likely to need additional maintenance to ensure the raise/lower function operates properly	C
Removable lance	Effectiveness	• Footway clear when not in use • Can be installed at regular intervals along the street • Less likelihood of a trailing cable • The lance may be too heavy for some drivers to carry • If the parking bay is not marked and the vehicle is slightly too far away, the cable can be pulled and damaged	C
	Workability	• Reliant on users having a specific lance (unlikely to be interchangeable across suppliers)	D

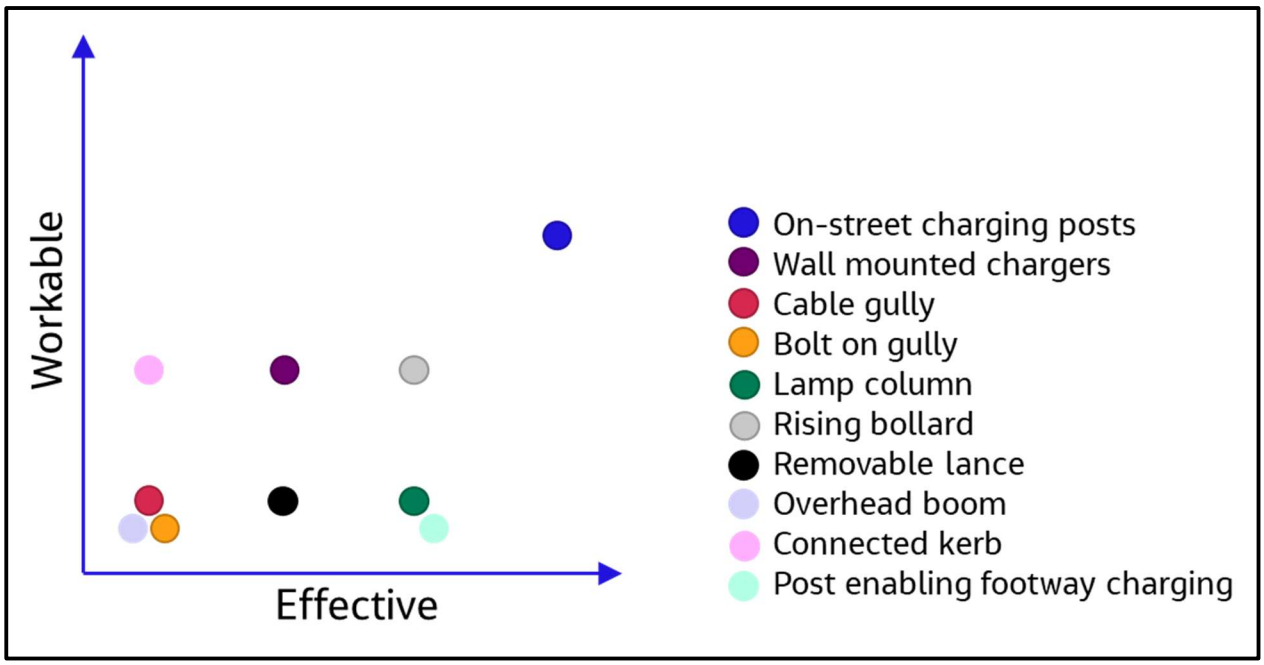
Option	Consideration	Assessment	Rating
		• Bases likely to need regular maintenance/cleaning to ensure lances can connect to the base • Clashes with buried services may limit locations • Potential for the post to be removed by a vandal	
Overhead boom	Effectiveness	• Footway clear when not in use • General 'street clutter' issues with large number of installations • Not available to all EV users	D
	Workability	• Poses hazards for cyclists, people carrying umbrellas and tradespeople • Potential for vandalism with people trying to swing on the pole • Vertical trailing cable if vehicle can't park close enough • There will be significant blocking of the footway if the post is damaged • Reliant on users returning the boom back to the edge of footway when not in use • Requires planning permission due to being within 2m of the highway • Property would require a front garden • Implies allocated parking	D
Connected Kerb	Effectiveness	• May cause problems for visually impaired • Reliant on charger being immediately adjacent to the carriageway edge to prevent cables trailing across/ along the footway • On wide footways, could maybe provide seating (facing away from the carriageway) to prevent pedestrians tripping over it • Cars may not be able to park beside posts so cables will trail footway or carriageway • Low profile means users have to bend down to access, which is not inclusive	D

Option	Consideration	Assessment	Rating
		• If perpendicular parking, the driver will not see the low post and may overhang footway and damage post • Available to all members of the public	
	Workability	• Potential high level of maintenance required to keep charger operational (e.g. vandalism/ struck by vehicle) • Often footways are narrow and regular provision of chargers may limit the available space and cause access issues for wheelchair users, etc. • Low profile poses a tripping hazard	C
Post enabling footway charging	Effectiveness	Cars may not park beside post so cables will trail footway or carriageway Reduces roadside congestion from parked vehicles Available to all members of the public	B
	Workability	Causes obstruction as pedestrians may walk into the infrastructure especially as it is below eye-level) A post can cause a pinch point albeit small If perpendicular parking, the driver will not see the low post and may overhang footway and damage post, which can then cause hazard to pedestrians Footway parking will need clear signage/ markings to indicate where it is permitted, likely to need a TRO) Potential high level of maintenance required to keep posts operational (e.g. vandalism/ struck by vehicle when mounting the footway)	D

Source: Jacobs and Zero Carbon Futures

The comparison of options is shown in the figure below. Where an option that is further to the right (effectiveness) and higher (workable) is rated as being a more suitable option before being considered for a specific location type. Overhead boom, cable channel and bolt on cover were rated particularly low on both elements, whilst Connected Kerb was rated low on workability, and removable lance, lamp column and post enabling footway charging were rated low on effectiveness, ruling these methods out of being selected as likely best on-street options. Wall mounted chargers, rising bollards and on-street charging posts were rated higher on both axes and therefore have been selected as likely to be better options for the varying location types. Options are considered by location type in Section 6.9.1.

Figure E-3. Comparison of Options



Source: Jacobs and Zero Carbon Futures

Recommended Overall Approach

With current technologies, it is unlikely to be appropriate or efficient to provide dense on-street charging networks. This is primarily due to the street clutter they bring about, the fact that they do not reflect emerging charging habits, and that they are likely to leave a legacy of obsolete equipment.

Because of this, the most suitable approach in the short-term is for charging for all EV users at this time, supported by the evidence collated through this study, is for charging hubs. These would provide a network of publicly available chargers at key locations with the intention that those without off-street parking can charge at a nearby convenient location. On-street hubs are relatively simple to install and manage and are likely to play an important part in the provision of charging infrastructure which will aid local accessibility and help fill in charging blackspots. Hubs are also more likely to maintain higher rates of use than household specific chargers.

Destination opportunities for charging also exist. These will likely be at locations such as council facilities (libraries and leisure centres) and local centres where parking exists or can be made available for the local community to access charging. Where an off-street hub is not appropriate, it will be necessary to consider small on-street hubs. These hubs will need to be designed carefully to ensure highway safety, reduce the implication of allocated parking, and manage under-utilisation because chargers are blocked by vehicles that are fully charged.

There will be justifiable exceptions to the hub approach. An example of this is when the charger is required by someone with impaired mobility who may struggle to use a hub because it is too far from their home or the destination they are visiting. Fife Council will need to agree the set of criteria that will qualify for such exceptions to ensure transparency in decision making.

A challenge with limiting on-street provision for individual house holders is that charging at commercially operated locations is more expensive than charging at home. This means that part of the Council's consideration of criteria for householder charging should include the extent to which it will address this disparity for homes with and without off-street parking tackle social and economic disparities that may exist.

This approach will help to provide flexibility as EV use continues to grow. To retain this flexibility there will need to be some adaptability to the decision making, at times on a case-by-case basis. It will also be important to keep this approach under review, particularly at times when there are significant developments in charging technology. Examples of this could be when there are developments in kerbside charging technology that may offer additional benefits or greater ease of use with improved workability compared with existing options.

Considering options at each location type

The consideration of suitable charger types at different locations provides a guide based on the evidence considered. However, specific circumstances at each location means that alternative options may be more appropriate. Fife Council will need to decide which charge option bet meets the circumstances of each installation that is needed. Capacity of the electricity network has not been mentioned for any location because, to a greater or lesser extent, it would be a consideration for all locations and is likely to be a constraint regardless of whether the EV charger is located on a householder's property or on highway.

Table E.11 summarises the potential charger types for different locations/housing.

Table E.11. Charger types for different locations/housing

Location Type	Suitability for different charger types
Pre-war terraced	Wall mounted box and cable channel – may require planning permission, the cable channel would reduce the trip hazard of the cables. Planning application could be costly. Bollard on terraced streets – if footways are wide enough, bollards can be used by multiple households and act as a local hub. It can be easier to manage safety concerns and for visitors to use. However, this would require management by Fife Council.
Pre-war semi-detached	Options in line with pre-war terraced with the exception of the overhead boom, which becomes possible for houses with front gardens that it can be placed in. Although a boom option would mean that there is no fixed installation on the highway, there are significant safety considerations and concerns relating to vandalism and upkeep. The boom has an impact on-street clutter.
Conservation area	Rising bollards provide an option for areas with limited parking infrastructure. They will provide an unobtrusive charging solution that limits street clutter and ensures a clear footway when not in use, allowing any member of the public to use them without implying allocated parking. However, they are likely to require additional maintenance to ensure that they continue to raise and lower properly. Fixed bollards could also be an option but are more visually intrusive and take up footway space. Chargers mounted to lamp columns (where they exist) could help to overcome this and may be less conspicuous. They may require a separate power supply from the lamp column. Options that rely on a cable channel may be less visually intrusive but could be difficult to install in surface treatments such as setts and would be an increased maintenance liability even when compared to a gully cable channel in a standard footway.
Village/Semi-rural	• Low density housing and a lack of footways in these areas means that a wall mounted charger offers a good solution in locations where people are often able to park outside their house. However, this implies allocated parking and may encourage people to park against the flow of traffic.

Location Type	Suitability for different charger types
	• The best option because there is no requirement for additional street furniture mounted in the highway or wall mounted which may be less intrusive on the streetscene. • Use of bollards as local hubs could help to address charging blackspots that are more likely to occur in less densely populated locations.
Communal parking	• Due to multiple vehicles needing to park and charge in these public sites, charging bollards are likely to provide for the greatest number of vehicles. Bollards could also include a mix of fast and trickle charging.

Source: Jacobs and Zero Carbon Futures