West of England Combined Authority

ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

Green Recovery Fund: Full Business Case (FBC)

Final v4 // June 2023

Sign-Off:

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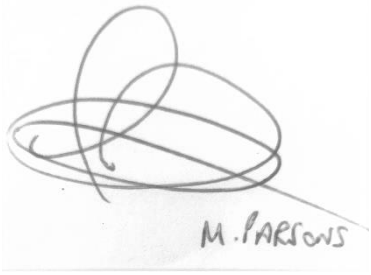
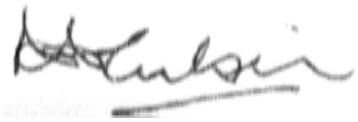
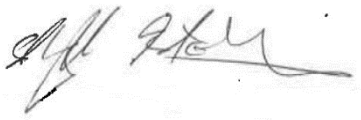
Malcolm Parsons	Head of Capital Delivery West of England Combined Authority		22/05/2023
David Gibson	Director of Infrastructure West of England Combined Authority		23/05/2023
Stephen Fitzgerald	Interim Director of Investment & Corporate Services & Section 73 Officer West of England Combined Authority		24/05/2023

Issue/revision	v1.0	v2.0	v3.19	v4.0
Date	18 November 2022	22 March 2023	22 May 2023	30 June 2023
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1 INTRODUCTION

1.1 Overview

This document contains the Full Business Case (FBC) for the Electric Vehicle (EV) Charging Infrastructure programme (the EVCP scheme). This FBC makes the case for the roll out of new EV charge points (EVCPs) across the West of England, and the expansion of Revive, the region's publicly owned EV charging network.

1.2 Background

After declaring a climate emergency in 2019, the West of England Combined Authority produced a 'Climate and Ecological Strategy and Action Plan'. This plan sets out priorities and key actions to achieve the Combined Authority's ambition to be net zero by 2030 and includes the strategic objective: 'transport CO2 emissions are Net Zero by 2030'. One of the measures to achieve this is increasing the uptake of low carbon vehicles, to ensure that journeys which cannot be made by sustainable and active modes will be in made using an electric vehicle. To support this uptake there is a need for a network of EV infrastructure in the region. Whilst the private sector will provide most of this network, there is a role for the public sector to intervene when gaps in the network occur which cause equality of access issues.

Over the last 18-24 months, the West of England Combined Authority (the CA) has been developing an EV strategy for the region, working with its constituent authorities to support accelerated delivery of EV charging infrastructure. This has included forecasting EV uptake and EVCP requirements, assessing delivery models and funding opportunities, and supporting a collaborative approach.

The draft EV strategy for the region includes a vision for the acceleration of EV uptake and delivery of supporting infrastructure; "*The West of England will transition to a zero-carbon transportation system, where journeys which cannot be shifted to active and sustainable modes are completed using electric vehicles. A network of publicly accessible EV chargers will be implemented to service these vehicles and support uptake.*" The Combined Authority's objectives of the EV strategy were to understand:

- The role that the Combined Authority and Local Authorities (LAs) should play in enabling and/or delivering the EV charging infrastructure required to increase EV uptake in the West of England.
- The potential to demonstrate a robust business case for investment in EV charging infrastructure.
- Issues and opportunities arising from national policy documents.
- The opportunities to enable better EV charging provision in residential areas, set common standards and ensure equity of access to charging infrastructure across the region.

- The potential role that EV car clubs can play in contributing to decarbonisation.
- The delivery options available, including potential advantages and disadvantages of expanding the Revive network.
- The availability of grants and funding which would offset the costs of providing chargers.

The recommendations and proposed actions from the EV strategy are shown in Appendix 1 and summarised in **Table 1**. This includes the schemes described in this business case.

Table 1: Draft West of England EV Strategy Objectives

Objective	Action
Take a proactive role in EV charging infrastructure provision	• Provide scaled-up, commercially sustainable public charging provision, strategically aligned to wider local transport and energy decarbonisation plans • Keep a watching brief on central government announcements on new statutory obligations related to EV charging • Focus on charging access for residents without off-street parking and establishing good network coverage
Promote and support Revive as the region's publicly operated EV charging network	• The Combined Authority should support and promote Revive as the region's publicly operated EV charging network and encourage the LAs to use it as their preferred supplier • Improve upon the existing Revive prioritisation framework
Partner with the private sector to leverage additional investment	• The Combined Authority should adopt a concessionary model to deliver charge points in partnership with the private sector, retaining control of the network delivery to ensure full coverage of charging infrastructure across the West of England • The Combined Authority should focus on ensuring gaps are filled in the network
Engage with stakeholders	• Develop the TravelWest website as the regional EV charge points webpage • Host EV conferences • Create a regional EV taskforce • Improve strategic level engagement with industry • Engage with local businesses to better understand the needs of their fleets and incorporate these into delivery plans
Lead on innovation	• Engage with and invest in EV charging research • Create charging hubs, promote car club electrification and monitor funding

Objective	Action
Take a leadership role in co-ordinating EV charging at a regional level	• The Combined Authority should lead the region in infrastructure planning and identify opportunities for partnership working with the LAs • Establish an EV Working Group and revised Revive Network Board • Leveraging its scale as regional authority, the Combined Authority should establish joint initiatives with the LAs • Ensure charge points are inclusively designed and accessible for residents, businesses and visitors, and in link with local authorities' legal obligations • Address grid capacity constraints • Ensure internal processes for the installation of charge points (for example grant permissions) are efficient, fast and easy to navigate for delivery partners • Raise collective capability
Ensure there is sufficient funding for Revive and the LAs to achieve their EV objectives	• Drive efficiencies through a regional joint procurement exercise • Soft market testing with charge point operators • Implement the investment proposal short list and long list of proposed schemes
Support policy changes which will drive EV uptake	• Ensure across the LAs there are consistent planning requirements and standards for charge point provision at new developments • Keep a watching brief on central government announcements on Planning Practice guidance and Permitted Development Rights
Monitor and evaluate	• Monitor key performance indicators • Review OZEV reporting on market progress

In April 2022, the CA also developed an 'EV charging investment proposal' which developed possible interventions which could be implemented in the short to medium term to meet existing charging demand. The EVCP scheme detailed in this document is a culmination of this work, in which the short-listed interventions will be implemented.

1.3 Scheme extent

The CA was set up in 2017 to make decisions and investments that benefit people living and working in Bath and North East Somerset, Bristol and South Gloucestershire. It aims to deliver economic growth for the region and address some of the challenges such as productivity, skills, housing and transport. The EVCP scheme will provide infrastructure across all three of the unitary authority areas (UAs).

1.4 The Revive Network

Within the West of England there is already significant public sector activity around EV infrastructure provision. The Go Ultra Low West programme (progressed by Bristol City Council (BCC), South Gloucestershire Council (SGC), Bath and North East Somerset Council (B&NES) and North Somerset Council) has had £7m of investment from the Office for Zero Emission vehicles (OZEV) to accelerate EV uptake and establish the publicly funded, owned and operated 'Revive' network of EV charge points (EVCPs) across the West of England.

The aim of the network is to provide publicly accessible EVCPs in order to expand the network of chargers in West of England and drive EV uptake. Not restricted to type or location of charger but to date these have focussed on destination fast and rapid chargers in local authority car parks.

The network currently comprises of 101 chargers (202 charging bays), with 29 rapid chargers and 72 fast chargers. To date these have all been installed in public car parks owned by the local authorities. Although work is underway to expand the network into on-street locations as well.

There are currently 7596 registered users (Dec 2022). Utilisation has risen consistently since 2019 and is providing power equivalent to fuelling 200,000 vehicle miles per month (as of Aug 2022).

The network relies on green energy supply from CityLeap, BCC's energy investment partnership.

Financial and commercial status:

To date the network has operated at a loss. This was due initially to low utilisation which limited income. Subsequently the utilisation rose but rising energy costs in 2021/22 affected profit. However, there is forecast to be an income surplus in the 2023/24 financial year. This is primarily due to the advantageous energy tariff secured via CityLeap which is expected to be well below commercial rates. Any surplus will be reinvested into the operation of the network.

However, any unforeseen operating losses from Revive would be underwritten by the UAs (as per the Revive InterAuthority Agreement) and will continue to be so for the foreseeable future.

The costs of installing new chargers are covered by capital funding, with provision made for the project management by the Revive team.

All liabilities in terms of fixed operational costs (warranty, planned maintenance, back-office subscription) are capitalised for the first five years of an EVCPs lifespan. Subsequent costs are covered by revenue from charging tariffs.

Revive network officers carry out ad-hoc 'Middleware' proactive checks and fault escalation actions. These staff costs have previously been covered by grant funding. In future the network income surplus will cover staff costs (£40k per annum).

1.5 Description of the scheme

The scope of the EVCP scheme is to deliver 362 charging bays, served by 256 EV chargers across the West of England, at 204 locations. Three classifications of site will be created: On-street residential, Community Hubs and Destination chargers in public car parks.

The numbers presented in **Table 2** and **Error! Reference source not found.** represent a target which assumes capital costs remain as forecast. If additional costs such as inflation or DNO fees are higher than expected then site locations will potentially need to be revised.

Table 2: Number of Sites

Scheme	BCC	SGC	B&NES	Total
On-street residential	150	8	4	**162**
Community Hubs	4	14	11	**29**
Destination chargers in public car parks	7	3	3	**13**
Total	**162**	**26**	**26**	**204**

Table 3: Number of EVCPs

Scheme	BCC	SGC	B&NES	Total
On-street residential	150	14	4	**168**
Community Hubs	11	27	13	**51**
Destination chargers in public car parks	26	5	6	**37**
Total	**187**	**46**	**23**	**256**

On-street residential

168 EVCPs will be installed at 162 locations. Whilst various options exist about the most effective charger type, single socket lamp column chargers were preferred for most sites (150 of the 168 EVCPs) as they can utilise the energy supply of the lamp columns and do not require a separate DNO connection to the grid. They are limited to one socket per unit which will serve a single charging bay. These 150 lamp-column chargers are located across 15 Wards in Bristol.

Community Hubs

51 EVCPs will be installed at 29 locations. Most of these chargers (45) will be dual socket chargers which serve two bays, as they are best suited to the intended use of overnight charging.

Where community hubs can serve a dual-purpose role with destination during the day additional ultra-rapid chargers will be added.

Destination chargers in public car parks

39 chargers will be installed at 14 locations, serving 70 EV charging bays. Of which 49 of these chargers will be dual socket fast chargers, with a small number of single socket ultra-rapid chargers (6) and rapid chargers (2).

An ideal ratio of one rapid charger to three fast chargers will be used at destination locations, however, this is dependent on local constraints. If there are physical or grid constraints then the ratio has been adjusted to fit.

1.6 The Five Cases

This FBC has been developed according to the HM Treasury Green Book approach (2020). The five-case model is the means of developing proposals in a holistic way that optimises the social / public value produced by the use of public resources. In addition, the five cases provide different ways of viewing the same proposal. Together these show that the scheme is:

- Closely aligned to wider strategies and objectives — the Strategic Case
- Best value for money — the Economic Case
- Affordable — the Financial Case
- Achievable in commercial terms — the Commercial Case
- Achievable in practical terms — the Management Case

2 THE STRATEGIC CASE

2.1 Introduction

The Strategic Case is the foundation of the Business Case. It demonstrates that the scheme has not been developed in isolation, but as part of a broader strategy for the West of England, in response to anticipated national change and local need, with clear objectives.

Given international and national commitments to achieving 'net zero' greenhouse gas emissions by 2050, the CAs commitment to meet this target by 2030 coupled with the Governments planned phase out of new petrol and diesel cars and vans by 2030, the scheme addresses the pressing need to continue supporting the uptake of EVs across the West of England. It will ensure the region as a whole, and crucially communities without off-street parking, are not left behind in the transition.

This strategic case chapter sets out:

- The drivers for change, describing the major factors accelerating shift to EVs
- The policy context for the scheme, in terms of the support at international, national, regional and local levels
- The scale and pace of change required due to the growing demand for EV charging
- The need for public sector investment in the scheme and benefits of doing so
- The challenges of chargepoint delivery for the public sector, and the associated benefits of taking a regional approach
- The impacts of not delivering the scheme

This is followed by:

- Vision and objectives
- Scheme definition

2.2 Drivers for change

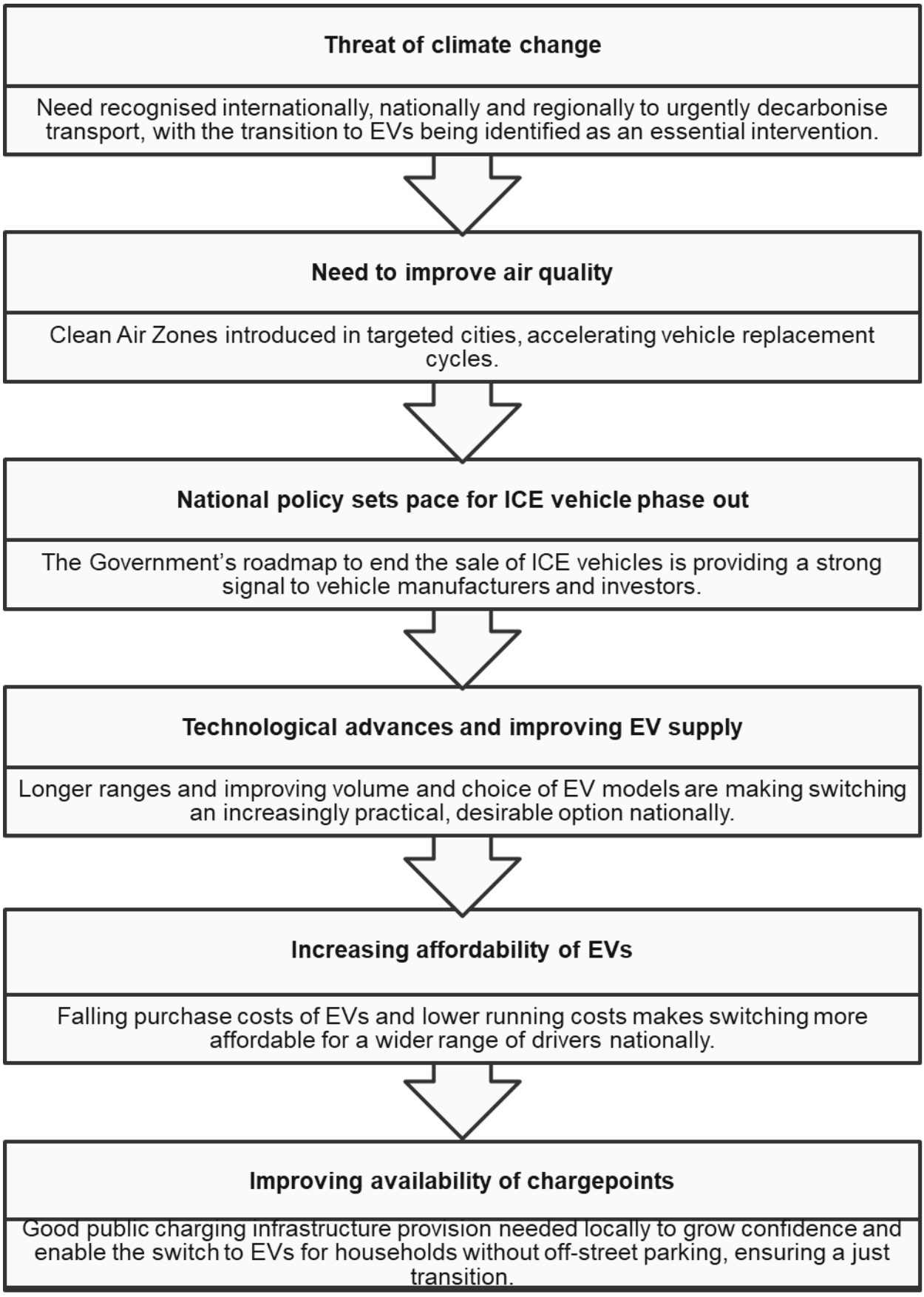
This section describes the key factors which are driving the transition from internal combustion engine (ICE) vehicles to EVs in the UK, and the resulting need for a comprehensive charging network in the West of England. The scheme outlined offers a pathway to meet this need.

The overarching driver for the scheme is the need to ensure a just transition to a net zero society across the West of England. A just transition seeks to ensure the benefits of decarbonisation are shared widely while supporting those who may be disadvantaged, at a range of spatial scales.

The pace of transition to EVs is accelerating nationally, driven by a series of interacting environmental, political, technological, economic, and social drivers. These are making switching to EVs increasingly urgent, technologically feasible, desirable, affordable, and convenient, as summarised in **Figure 1** overleaf.

However, without intervention to improve public charging infrastructure availability locally, EV uptake may falter in the West of England and those without off-street parking could be excluded from the transition. This could ultimately hinder the ability for the Combined Authority to meet net zero ambitions.

Figure 1: Summary of Drivers for Change



2.3 Policy Background

The scheme is closely aligned with government policies and strategies. All levels of national, regional, and local government strongly support investment into public charging infrastructure.

After declaring a climate emergency in 2019, the CA produced a Climate and Ecological Strategy and Action Plan. This plan sets out priorities and key actions to achieve the Combined Authority's ambition to be net zero by 2030 and includes the strategic objective: 'transport CO2 emissions are Net Zero by 2030'. One of the measures to achieve this is increasing the uptake of low carbon vehicles, to ensure that journeys which cannot be made by sustainable and active modes will be in made in electric vehicle. To support this uptake there is a need for a network of EV infrastructure in the region. Whilst the private sector will provide most of this network, there is a role for the public sector to intervene when gaps in the network occur, which will cause equality of access issues.

See Appendix 2 for further details of national, regional and local government policies which support the implementation of the scheme.

2.4 The scale and pace of change required

While the West of England region has an established public EV charging network: Revive, further investment is needed to meet the expected increase in charging demand and prevent inequalities emerging as EV uptake accelerates across the region, driven by the factors outlined previously in **Figure 1**.

Whilst the number of EVs registered in the West of England is currently relatively low as a share of total vehicle numbers, registrations have been growing rapidly, and are forecast to increase significantly over the coming years.

Within the CA area, there are currently 801,867 vehicles, of which 2% are currently electric. Modelling carried out for this study indicates that between 20-40% of vehicles will be EV by 2030.

To support these EVs, it is forecast that approximately 1863 publicly accessible EV chargers will be required. Currently 712 EVCPs are publicly accessible in the West of England (data from ZapMap).

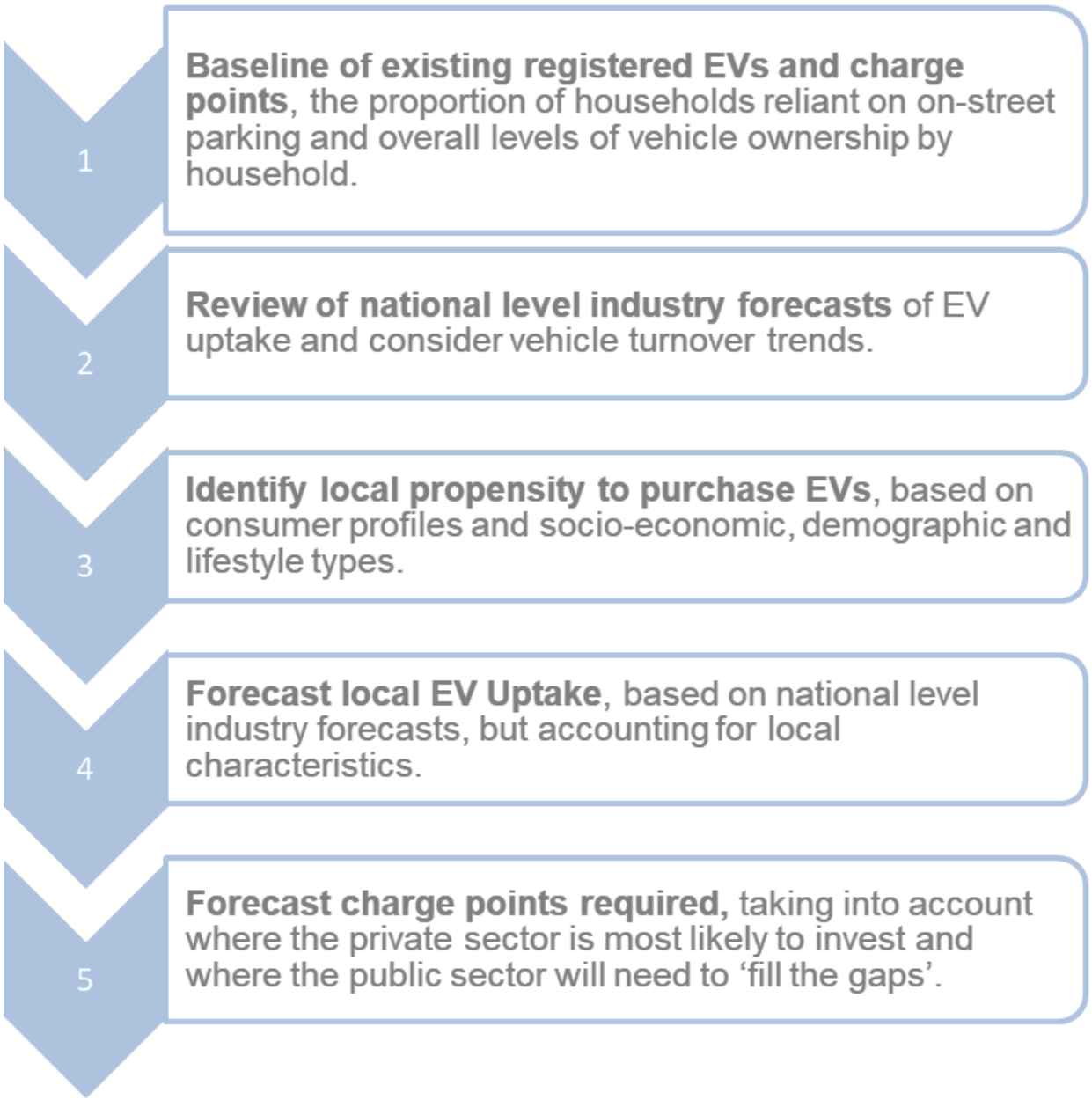
2.4.1 Forecast EV Uptake

To forecast EV uptake and subsequent requirements for charge point provision, WSP's in-house EV:Ready tool was used, this enables sophisticated EV uptake forecasting and scenario testing.

EV:Ready generates granular forecasts, accounting for highly localised spatial variations in the key determinants of EV uptake rates, including: consumer profiles, socio-demographics, the availability of off-street parking, vehicle ownership, vehicle sales and turnover rates, and vehicle ownership trends.

Figure 2 below shows an overview of the process employed by the model and the key datasets input into it.

Figure 2: EV forecasting approach



The number of EVs forecast to be registered in the West of England by 2025 is 39,630 rising to 157,538 in 2030. A breakdown of the forecasts for each UA is shown in **Figure 3** These forecasts seek to account for the trends in total vehicle sales, vehicle age and turnover rates, the localised propensity to purchase an EV of the local population, vehicle ownership levels and reliance on on-street parking, to provide an objective and measured assessment of an EV uptake scenario across the region.

Figure 3: Forecast EV uptake in the West of England

Area	2022 (existing)	2025	2030
South Gloucestershire	2,526	9,185	35,599
Bristol	3,068	18,891	76,363
Bath and North East Somerset	2,114	11,554	45,576
West of England	**7,708**	**39,630**	**157,538**

As demonstrated in **Figure 4**, the share of total vehicles made up by internal combustion engine (ICE) vehicles is forecast to decline and the proportion of EVs will increase rapidly, surpassing ICEs in 2033. The total vehicle fleet is expected to increase slightly up to 2042, before plateauing. By 2050 it is expected 96% of vehicles will be electric, in line with targets in government legislation.

Figure 4: Forecast EV uptake in the West of England up to 2050

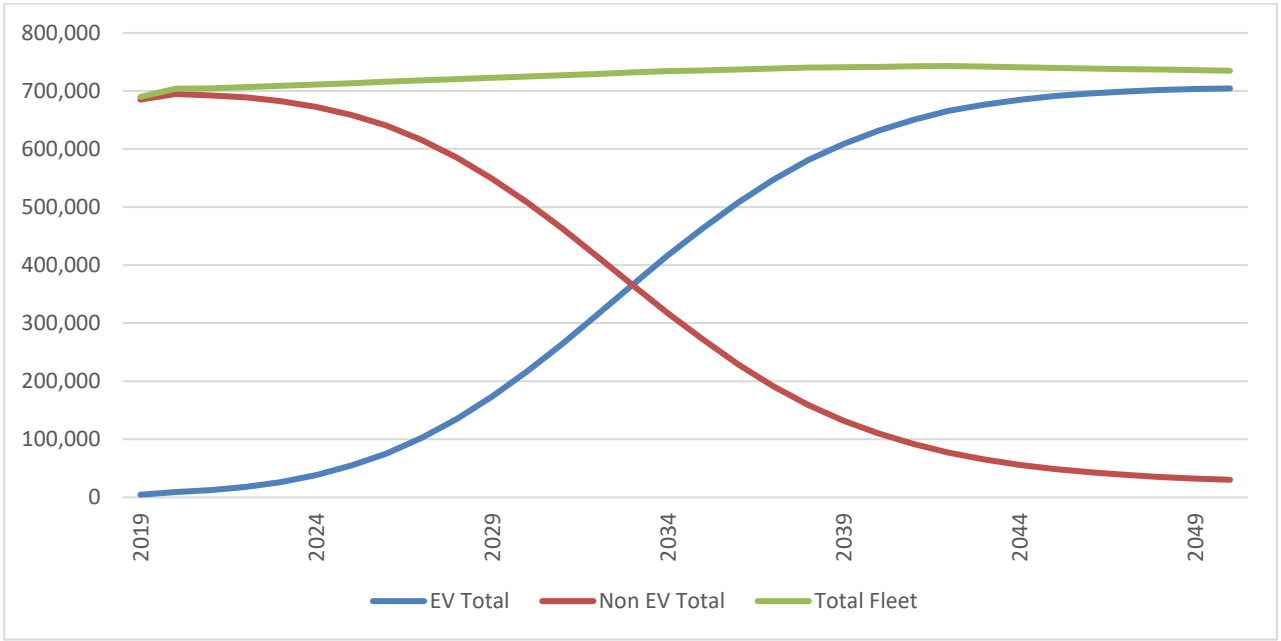
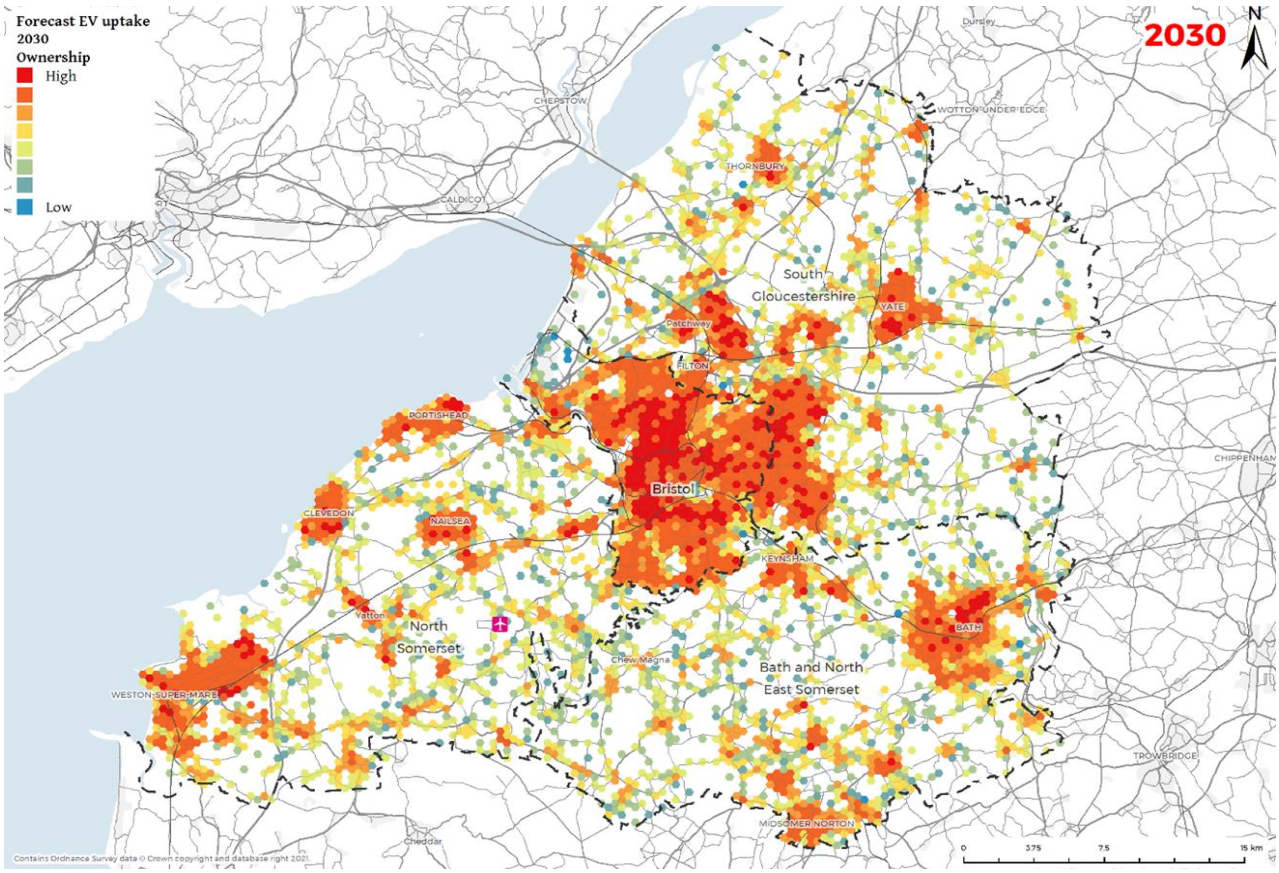


Figure 5 indicates the distribution of EV uptake across the region in 2030, with highest rates focussed in urban centres, particularly Bristol and Bath. White hexagons indicate areas with low population densities where EV uptake will be low or non-existent. Please note this map covers the West of England region including North Somerset, who are not eligible for funding under this scheme.

Figure 5: Forecast distribution of EV uptake across the West of England in 2030



Currently 21% of properties do not have access to off-street parking. At present, EV ownership is heavily skewed toward those on higher incomes, with access to company car leasing schemes, and with access to off-street parking. In the longer term, as EV prices fall, the makeup of EV owners will begin to reflect the wider population more closely, which includes those without access to off-street parking.

2.4.2 Forecast EV charge point requirements

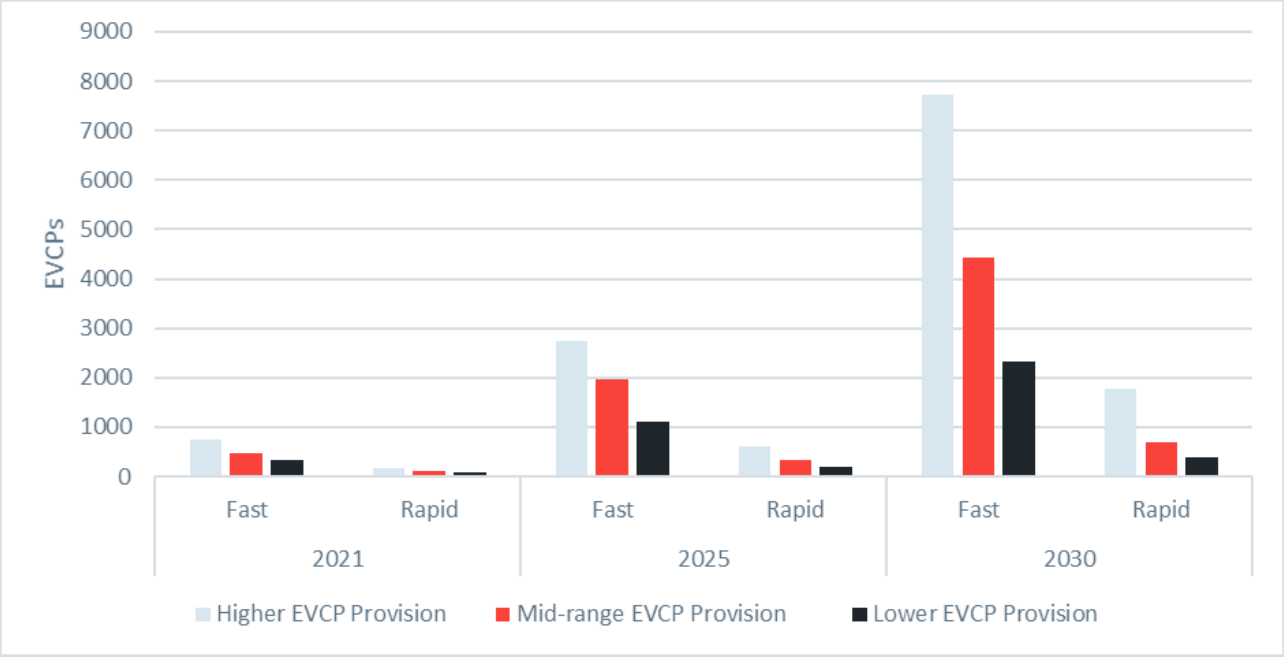
To predict the number of publicly accessible EVCPs required for the volumes of EVs stated in the section above, further modelling was carried out.

The key elements of the calculations were the total kWh required by all EVs and the proportion of this charge which would be distributed by public EVCPs. Then the capability of individual fast and rapid chargers to distribute this charge. As the EV market develops these values will evolve.

Three forecasts were generated representing different ratios of EVs to EVCPs. The low ratio assumes a scenario where charger utilisation is low and there is a focus on slower speed residential and overnight charging. Whereas the high ratio assumes that rapid charging will be preferred in the future. Less units will be required as charge times will be shorter and multiple vehicles per day will be able to use the same EVCP, driving up utilisation.

Figure 6 presents the forecast number of EVCPs required up to 2030, segmented by charger type, under each of the low, mid and high ratio scenarios, for the entire region. By 2030, there would be a requirement for around 4,416 fast chargers and 690 rapid chargers, based on the mid-range scenario, across the region. This would be provided by both the public and private sectors.

Figure 6: Forecast number of EVCPs required up to 2030



2.4.3 Spatial analysis of public EV charging supply and demand

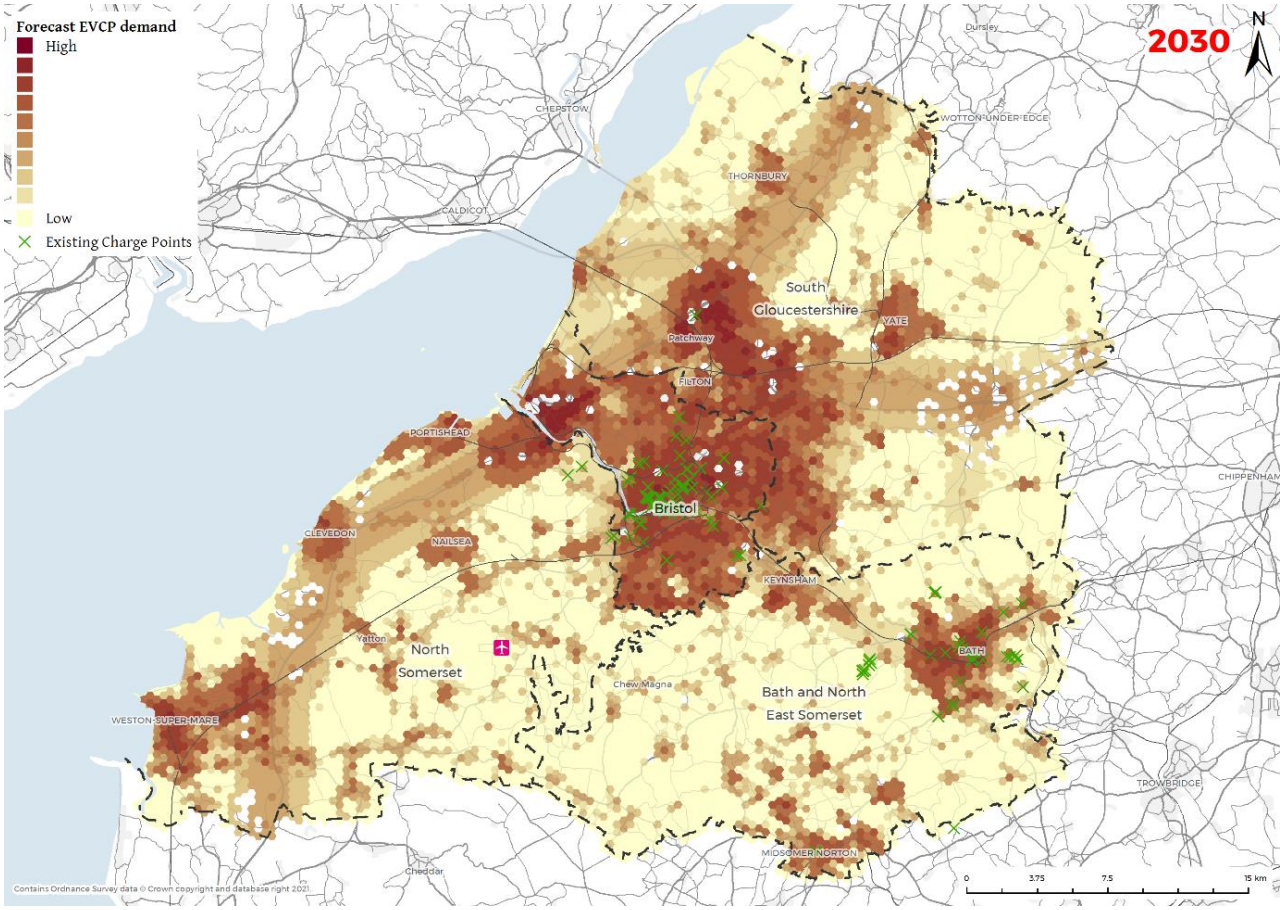
An EV charging supply and demand analysis was carried out. Charge point 'demand' refers to the volume of vehicles which would choose to charge if facilities were available. Areas considered to have high 'supply' potential, are those likely to be attractive to private sector CPO investment. Areas with low supply potential, are likely to require public sector investment in EVCPs.

Figure 7 shows how the level of demand for charge points will be distributed across the region by 2030. The areas of greatest demand are located where EV uptake is forecast to be high and there is limited private off-street parking where drivers could charge their vehicles. The map demonstrates that these areas are generally more urban, and in close proximity to major roads.

This analysis is informed by:

- Forecast EV uptake by postcode
- Number of destination land uses by postcode
- Proximity to high traffic volumes
- Reliance on on-street parking

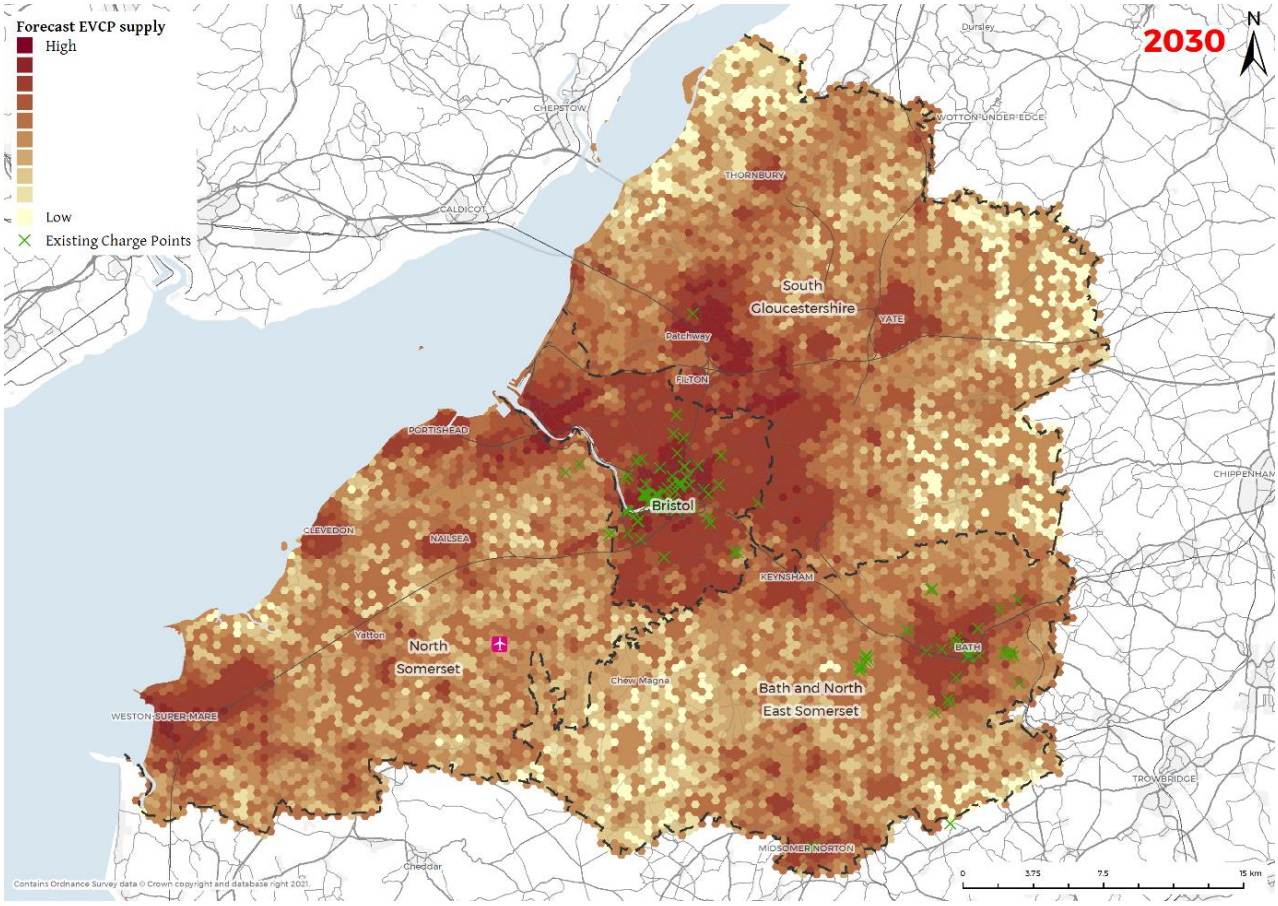
Figure 7: Distribution of EV charging demand



Supply: Further analysis was undertaken to understand where the private sector is likely to provide charge points. Factors considered included grid constraints, proximity to the strategic route network and proximity to destination sites suitable for charge points.

Figure 8 shows how likely the private sector is to invest in charge points across the region, here termed 'charge point supply'. Please note these maps cover the West of England region including North Somerset, who are not eligible for funding under this scheme.

Figure 8: Distribution of areas with high EVCP 'supply' potential



2.5 The need for public sector intervention in EV charging

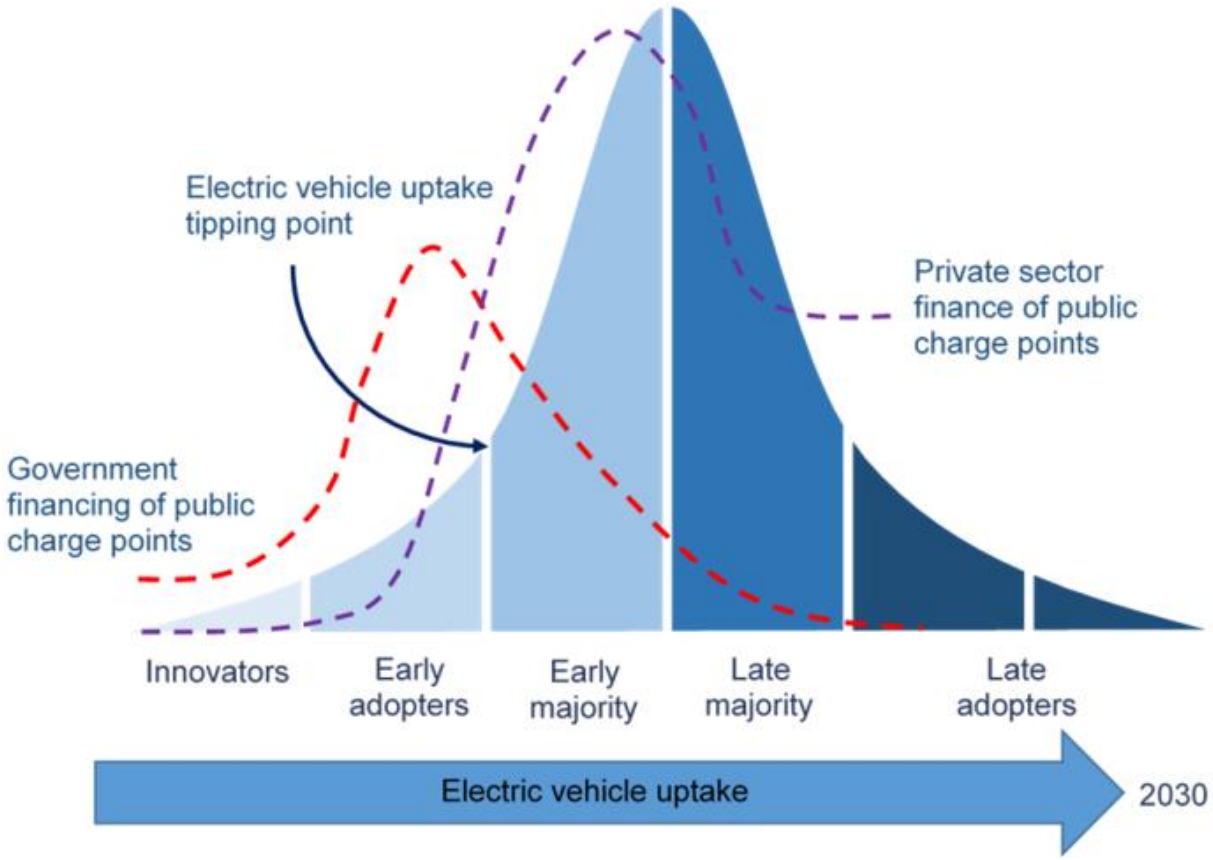
Whilst the private sector has shown a significant appetite to invest in EV charging infrastructure, and this is expected to grow as the number of EVs on the road increases, it is likely there will be areas that are left behind without public sector intervention. An analogy can be drawn with high-speed broadband roll-out, which has been slower to reach more remote, lower density areas, and has required public funding to promote more equitable access. This shows how public sector funding can accelerate the tipping point from early adopters to early majority in the uptake of EVs through the government financing of public charge points.

Where left to commercial operators alone, investment is inevitably heavily focused on the most profitable locations; where high utilisation can be guaranteed and where the highest return on investment can be achieved. This is predominantly in urban centres and more affluent communities where residents are more likely to adopt EVs. Similarly, rapid chargers at destinations with high footfall and regular turnover have the most profitable business models, whereas residential on-street charging has a weaker commercial proposition. As a result, gaps in provision are created where the potential to generate revenue is low, or where expensive infrastructure enhancements are required to improve grid capacity.

There is a clear role for the public sector to intervene to plug these gaps in the evolving EV charging ecosystem in the short to medium term until the market matures, to avoid a lack of charging infrastructure stifling the transition to EVs and ensure a fair and accessible network develops. The CA therefore has a key role to encourage the uptake of EVs by providing or incentivising the market to provide EVCPs in areas that would otherwise be underserved.

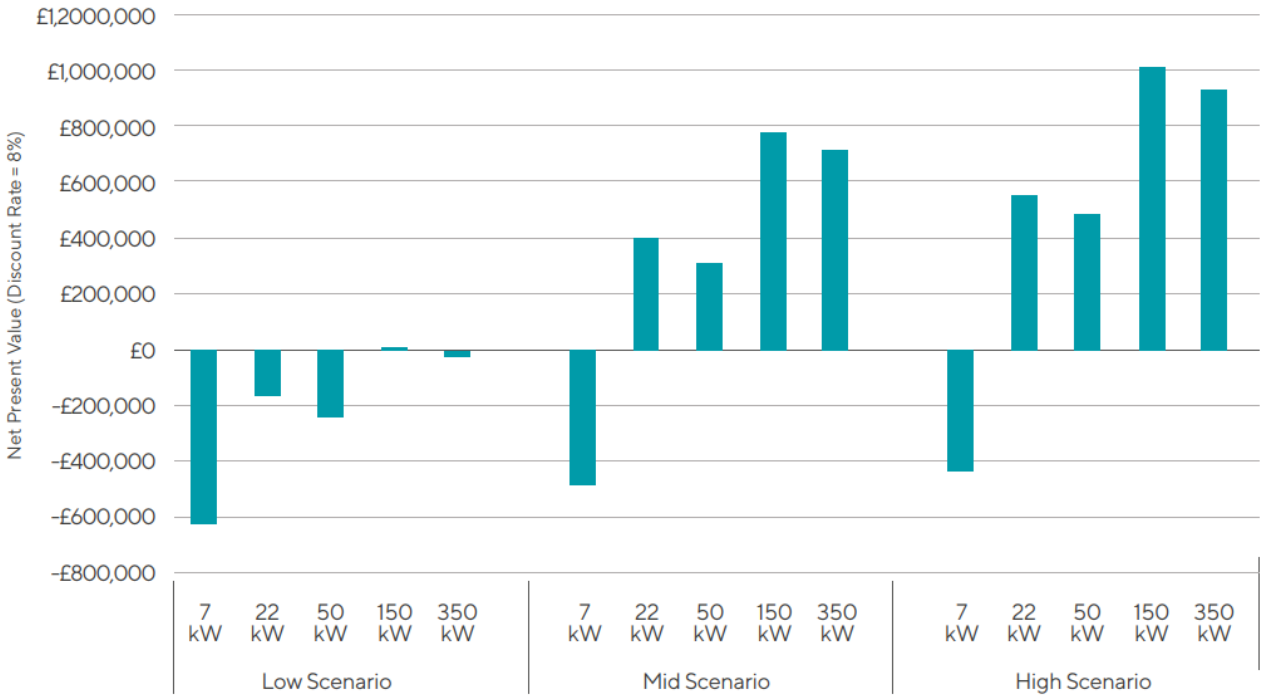
As the EV market evolves and the number of EVs in the UK increases, the role of the public sector in EV charging will change. The Government's role is beginning to shift from the provision of grants and innovation funding to encouraging a more sustainable commercial model. Ultimately, the Government intends for much of the financing for the UK's public chargepoint network to come from private capital, as visualised in **Figure 9**. However, the Government also recognises the importance of continuing funding in some areas to 'de-risk' projects and improve business models, and the crucial facilitation and enabling role of local government.

Figure 9: Transition from Government financing to private sector financing of charge points. *Source: Transport Scotland*



Based on economic modelling, the EV Energy Taskforce, a government-sponsored, industry-wide collaboration, highlights that slow residential and destination charging (under 22 kW) is particularly challenging for investors, despite its importance to aid the transition to EVs by a convenient, affordable, highly visible charging option for those without off-street parking (see **Figure 10**).

Figure 10: Net Present Value of £600k investment in different use cases under three utilisation rate scenarios. *Source: EV Energy Taskforce, Encouraging investment in public EV charging, 2021*



The economic case is weaker for this model due to the limited power that can be drawn per day on these charge points, slower vehicle turnover, limited opportunities for revenue stacking, users' sensitivity to higher tariffs, lifespan of the hardware and need for upgrades, and resistance to long contract terms (over 15 years) by local authorities.

As residential charging is required to form the backbone of the public network, targeted support therefore continues to be required, especially while utilisation rates continue to improve in line with EV uptake. Reflecting this, in the national EV charging infrastructure strategy, OZEV states it will focus its intervention on charging on the strategic road network and local on-street charging.

Without intervention, the EV Energy Taskforce concludes the market is likely to develop more-profitable regional rapid hubs and gravitate towards developing the most profitable sites and leave areas with higher risk or lower margins. More profitable

locations are likely to be predominantly in urban centres and more affluent communities where residents are more likely to adopt EVs sooner.

Gaps in provision are likely to emerge where the potential to generate revenue is low, such as rural areas, or where expensive infrastructure enhancements are required to improve grid capacity. Gaps may also emerge along rural or secondary routes with moderate levels of demand, but with fewer destinations (e.g., retail stores, food outlets) to serve as a platform for chargepoint rollout. There is a role for the public sector to intervene to plug these gaps in the short to medium term to ensure equity of access to charging, which this scheme is designed to fulfil.

In the West of England there are currently (Oct 2022) 349 publicly accessible EVCPs of various speeds. 29% have been installed by the public sector, via the Revive Network (see Table 4), and 71% were installed by the private sector. There are 101 chargers and 202 charging bays on the Revive Network at present, comprised of 29 rapid chargers and 72 fast chargers.

Table 4: Revive Charge Points (CPs) and charging bays

Type	7kW	22kW	50kW	150kW	TOTAL
Live in Jan 23	40 CPs / 80 bays	32 CPs / 64 bays	29 CPs / 58 bays	0	101 CPs / 202 bays
Live + coming online in 23-24 (non-GRF)	51 CPs / 102 bays	41 CPs / 82 bays	36 CPs / 72 bays	0	128 CPs / 256 bays

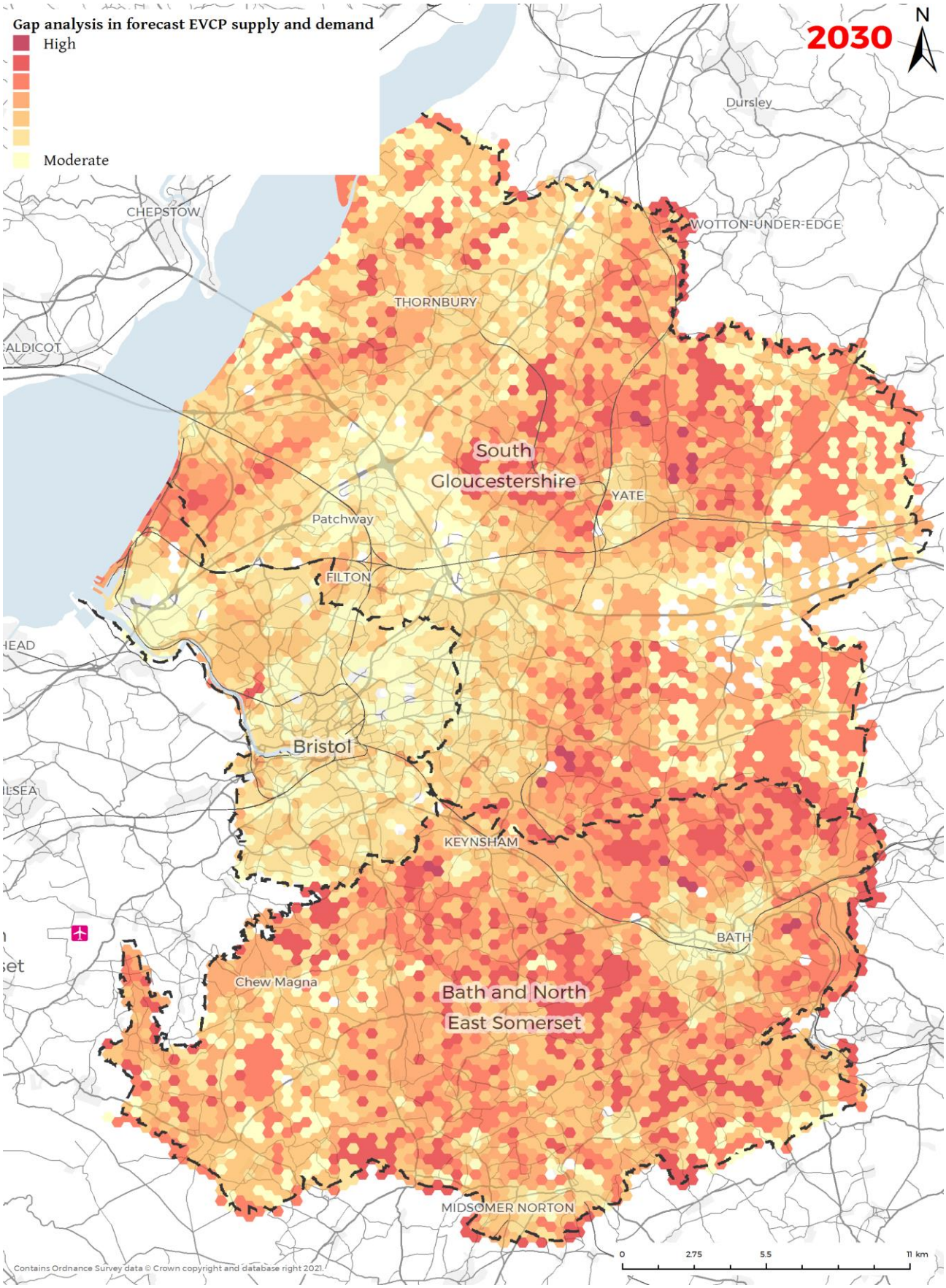
However, forecasts of EVCP demand (based on EV uptake and on-street parking) and charge point supply (through private sector deployments) provide a high-level indication of the distribution of where gaps in charge point provision are more likely to arise.

Figure 11 overleaf provides a high-level indication of where gaps in charge point provision are more likely to arise.

This is the difference between the charge point demand (based on EV uptake and on-street parking), and charge point supply (through private sector deployments). The red areas show where gaps in charge point provision are most likely to occur.

The Combined Authority will need to consider how to serve these areas where demand may not be fulfilled by the private market.

Figure 11: Gaps in forecast EVCP supply and demand



2.5.1 Role of Public Funding in EVCP roll-out

Based on the feedback provided by CPOs (charge point operators) to previous soft market testing with industry, an estimated range for the proportion of chargers which will be funded and delivered by the private sector has been derived. Fast and rapid chargers present different commercial propositions and as such the private sector has different appetites for each type. Over time, as demand increases, costs fall, and commercial viability improves, the ratio of publicly funded to privately funded chargers will shift. By 2030, it is anticipated that approximately 50% of fast chargers and 10% of rapid chargers may still require some degree of public funding, with the remainder fully funded by the private sector. However, initially the investment by the public sector will be far greater.

2.5.2 Number of publicly funded chargers required overall

Using the medium ratio forecast it is anticipated that there will be a requirement for around 1,863 publicly funded charge points by 2030, across the region (a large uplift in comparison to the existing 349 publicly accessible charge points in the West of England). This consists of 1,764 fast chargers and 99 rapid chargers

Table 5 provides a breakdown of the chargers required within each UA by 2030. The highest requirements are in Bristol (903 under a medium ratio scenario, by 2030) and the lowest in South Gloucestershire (421 chargers).

However, it is important to note that there is a wide range between the three scenarios modelled, each representing a different ratio of EVCPs to EVs.

Table 5: Forecast charge points required by each UA in 2030

	Scenario	Fast	Rapid	Total
South Gloucestershire	High	696	51	**748**
South Gloucestershire	Med	399	22	**421**
South Gloucestershire	Low	202	12	**214**
Bristol	High	1494	110	**1604**
Bristol	Med	855	48	**903**
Bristol	Low	434	26	**459**
Bath & North East Somerset	High	891	66	**957**
Bath & North East Somerset	Med	510	29	**539**
Bath & North East Somerset	Low	259	15	**274**
West of England	**High**	**3081**	**227**	**3308**
West of England	**Med**	**1764**	**99**	**1863**
West of England	**Low**	**895**	**53**	**948**

2.5.3 Wider benefits of public charge point deployment

By ensuring equitable access to charging infrastructure for residents across the region, a range of further environmental, social, and economic benefits will be generated:

- Better air quality due to zero exhaust emissions (NOx and particulate matter)
- Lower carbon emissions, which will continue to fall with greater generation of renewable energy. This will help to meet the CA's sustainability strategy goals and demonstrate leadership.
- Cost savings generated by lower running costs of EVs (e.g. fuel, maintenance), for council fleet, businesses and individuals, and favourable salary sacrifice rates for employees.
    - Various online tools provide basic estimates, and can be updated with the most recent fuel and electricity prices
- Local economic benefits from increasing the increasing patronage of local businesses through destination charging and attracting EV drivers as visitors to West of England.
- Increasing demand locally for skilled labour to install and maintain charge points (and for EV-trained vehicle technicians).
    - For example, Nottingham City Council has opened Nottingham EV Services, based in one of its depots, to service EVs for the council fleet, local businesses and residents. The existing team have been trained to work on EVs, and an apprentice role has been created.
- Investment by chargepoint operators (CPO) and will stimulate the UK's technology sector and support innovation.
- Depending on the contract terms and utilisation of the charge points, charge points may provide a revenue opportunity in the future.
- EVs can be integrated into public transport, car club and taxi fleets and mobility hubs, increasing shared and sustainable travel options.
- Widespread smart charging (shifting charging to off-peak times or when renewable generation is high) and in future, Vehicle-to-Grid (discharging electricity back to the grid) will help to mitigate increased peak demand and improve the resilience of the UK grid as the intermittent renewable energy generation increases.
- Can utilise Unitary Authority assets (e.g. car parks) and on-street charging solutions to ensure equitable access to charging, unlocking EV demand.
- Central government grant funding to partly cover capital costs is available, and private sector match-funding is increasing.

The Local Government Association highlights how EVs can benefit local economies, including through:

- Regeneration: Increasing patronage of local businesses through destination charging, improving access to employment through EV car clubs, and improving public health through better air quality
- Business growth: Generating cost savings for businesses operating vehicles and the involvement of local suppliers in chargepoint installation and maintenance.
- Skills and employment: Increasing demand for skilled labour to install and maintain charge points.
- Tourism and trade: Attracting EV drivers, both individuals and commercial drivers, to visit and trade.
- Inward investment: Encouraging organisations to invest in the local area by providing charge points and supporting innovation.

2.6 Case for expanding the Revive network

Details of the Revive network are provided in Section 1.4.

There are several benefits to pursuing an 'own and operate' delivery model for the scheme, rather than the alternative models which engage the private sector to partially or fully fund infrastructure. The advantages and disadvantages of each approach are summarised in **Table 6**.

The key benefits of continuing to fully-fund the Revive Network as the public sector include:

Speed of implementation: Uptake of electric vehicles is increasing rapidly and there is already significant demand for public EV charging in some areas. Expanding the Revive network with capital funding is the quickest path to delivering the charge points currently needed. There are existing supply agreements in place which will allow immediate procurement to take place and then installation by UA contractors. By contrast, engaging a private sector charge point operator (CPO) will require a lengthy procurement process and concession agreement negotiations.

Strategic control: Private CPOs focus on installing EVCPs which will generate the greatest return on investment. Local authorities are focussed on different objectives such as decarbonisation and ensuring equality of provision. Due to these contrasting aims, a delivery model which included private sector funding would necessitate a compromise on the types of sites and technologies selected.

By fully funding change points themselves using the GRF grant, Revive and the UAs retain complete control over the planning, implementation, and management of their EVCPs. In this way they can ensure that the infrastructure they install maximises the intended benefits.

Affordability: As a publicly owned network, Revive is not required to make a profit. This allows tariffs to be kept at a minimum level required to break even. These lower tariffs benefit drivers within the West of England. Those without access to off-street parking and reliant on public charge points are more likely to live in disadvantaged areas, so social equity benefits are maximised.

Supplying EVCPs ahead of demand: Private CPOs can only install EVCPs where there is enough existing demand to ensure high utilisation and revenue. Whereas Revive is able to install ahead of demand, to reassure drivers that there is sufficient infrastructure in place to support them. This encourages the behavioural shift to EVs which will help to achieve the CA's decarbonisation goals.

Existing customer base: There is an existing customer base for the Revive network and a proven track record that shows it meets the needs of its users.

Timescale: The intention for the scheme is to implement chargers at pace to meet existing demand and to provide certainty to residents that if they switch to an EV that there will be the infrastructure available which they need. Engaging the private sector and developing a concessionary agreement would slow down implementation and diminish the benefit of the scheme.

2.6.1 Future considerations

Whilst choosing this approach in the short term to meet immediate goals is beneficial, there remains the option to choose other delivery models for future EVCP rollouts. A mix of models can be applied to meet different objectives. Private sector investment will become more important as EV uptake accelerates and the number of EVCPs required increases. It would also be possible to shift operation of the existing infrastructure to a private operator as part of a profit sharing or concessionary agreement, which is currently being considered in the wider West of England EV Strategy (currently in review).

Table 6: Advantages and disadvantages of various delivery models from the perspective of local authorities

Delivery Model	Control & Income	Risk	Advantages	Disadvantages
Own & Operate All charge point costs are paid for by the public sector, with capital and maintenance costs recouped from user tariffs. charge points are owned by the public sector, with back-office and operation of charge points typically contracted to a private sector CPO for a fixed annual fee.	Highest	Highest	• Highest potential income for the local authority • Full control over locations of installations, tariffs, hardware and software choices, ensuring high quality, equitable provision for residents • Straightforward, quicker procurement process • Easiest to incorporate wider environmental and social value goals • Shorter contracts possible (5-10 years)	• Requires significant central grant funding, often match-funded by the local authority (typically 40%) • Highest risk, in terms of ongoing liabilities, maintenance costs, upgrades, and stranded assets • Revenues dependent on utilisation rates, may not cover costs, especially for <22 kW residential charge points • Use of public funds comes with accountability to taxpayer and political risk • CPO has least incentive to repair faults
External Operator Public sector funds the capital investment, but the charge point supplier provides a back-office system at no direct cost, in return for a revenue share.	High	High	• Local authority retains most of the revenue generated • Reduced liability for operating costs • Retains high degree of control over charge point operations • Shorter contracts possible (5-10 years)	• Requires significant central grant funding to cover all capital costs • Relatively high risk in terms of ongoing liabilities and exposure to varying utilisation rates • Reduced control over the network interoperability of the charge points • CPO has least incentive to repair faults

Delivery Model	Control & Income	Risk	Advantages	Disadvantages
Concession This involves the transfer of operational costs and risks to a charge point operator, the concessionaire. The capital costs of the installations may be fully or part-funded by the CPO, and the CPO will cover the costs of operating and maintaining the charge points for an agreed period. A profit share agreement will be put in place. The local authority retains ownership of the electricity connection point	Medium	Medium	• CPO provides a share of the upfront capital costs, often as match-funding for a central government grant, rather than the local authority, as well as covering the ongoing costs. • Some income shared by the CPO with the authority, often as a profit or revenue share • CPO incentivised and responsible for maintenance and upgrade of the network, leading to better end-user experience • Reduced risk for public sector in terms of ongoing costs • Depending on agreement, public sector may maintain ownership of the underground electrical connection point. This means there is no lasting obligation to the supplier at the end of concession term.	• Reduced income share compared to full ownership • Requires a greater understanding of what the market can offer, and tender process may be more complex than public ownership • Risk that CPOs will not be able to accept the agreement terms, leading to fewer tender responses • Needs to be a relatively large number of sites (>25) so that CPO can balance risk across sites, and long-term contracts (e.g. 10-20 years) • Potential for disputes over responsibility for site failures and expensive termination clauses

Delivery Model	Control & Income	Risk	Advantages	Disadvantages
Lease (Fully funded) All capital and ongoing costs are borne by the CPO, with a long-term lease/licence over which the CPO can recover their costs.	**Lowest**	**Lowest**	• Lowest risk for the local authority • Rental agreements for parking bays can provide guaranteed income • CPO heavily incentivised to provide good end user experience, maintain and upgrade the charge points.	• Lowest potential income • Least control over locations and ability to incorporate wider goals • Likely to involve very long agreement periods and exclusivity agreements • Most likely to suit rapid and ultra-rapid charging in prime locations. Many areas currently unlikely to be commercially viable without public investment, especially slow and fast (<22 kW) charge points in residential areas. • Unlikely to retain ownership of the grid connection point, reducing control over the quality of the service and could hinder switching to a different CPO.

2.7 Impact of not delivering the scheme

Without further targeted investment and proactive engagement from the public sector through the scheme, it is anticipated gaps will remain in the public charging network. This will particularly affect areas reliant on on-street parking, areas with less concentrated demand, more deprived areas and areas where the electricity grid is constrained, increasing installation costs. Some neighbourhoods are likely to be acutely affected, raising concerns about inequity. Gaps in the network are likely to supress EV uptake by undermining confidence of prospective adopters.

Additional risks of not delivering the scheme include:

- Failure to meet public commitments to reduce carbon emissions to net zero by 2030, at a time when public sector leadership is greatly needed
- Slower improvements in air quality and therefore public health outcomes
- Missed opportunities to secure government grant funding while it is available
- Reduced attractiveness of the West of England to investors in private charging infrastructure and fleets compared to other UK regions
- Increased risk of trailing cables across pavements, posing trip hazards, if alternative safe and convenient charging infrastructure is lacking
- Increased resource burden on each unitary authority and inconsistency across the region if each authority takes an independent approach
- Reputational risk as UK Government monitoring of local chargepoint delivery is increasing and the policy direction strengthening.

2.8 Summary of the case for change

Table 7: The case for change

Case for change	Summary
Decarbonising the transport sector	The UK has committed to net zero by 2050, and the West of England and UAs by 2030. The transition to EVs to is critical to decarbonise trips that cannot be switch to active and sustainable modes.
Air quality	Air pollution is the top environmental risk to human health in the UK, with acute issues in Bath and Bristol leading to the introduction of Clean Air Zones. Through the transition to EVs, NO_2 emissions will be reduced.
National legislation	The Government plans to end the sale of new ICE cars and vans by 2030, with phase out dates also being set for other vehicle categories.
Vehicle supply and technology	Advances in EV and chargepoint technology are making switching to EVs an increasingly viable and attractive option for a widening group of private drivers and businesses, and the transition is gathering pace.
Economic factors	EV purchase prices are falling, and are likely to be similar to ICE vehicles by 2030, or sooner. Already, the 'Total Cost of Ownership' of an EV can be lower, incentivising the switch, especially for businesses.
Public opinion and charging infrastructure	Concerns about charging and a lack of charging infrastructure, both real and perceived, continued to hinder EV uptake. A lack of public charging particularly affects those without off-street parking and is necessary to bolster driver confidence more broadly.
Policy context	There is strong support for the EV transition and investment in charging infrastructure at international, national, regional, and local levels. This includes legislation and strategies related to climate change, air quality, levelling up, local transport planning, and future proofing new development.
The scale and pace of change required due to the growing demand for EV charging	EV registrations have been growing rapidly in the West of England and will continue to accelerate. Most charging will happen at home; however, currently 21% of properties do not have access to off-street parking. It is forecast that between 3,000 and 11,000 publicly accessible EV chargers will be required.

Case for change	Summary
The need for public sector investment in the scheme	The economic case is weaker for residential and destination charge points compared to faster types of chargepoint, necessitating continued government support. Left to commercial operators, investment is likely to focus on the most profitable locations, such as those with the highest utilisation and lowest installation costs. There is a clear role for the public sector to intervene to plug these gaps to avoid a lack of charging infrastructure slowing the transition to EVs.
The challenges of chargepoint delivery for the public sector, and the associated benefits of taking a regional approach	Deployment of EVCPS is challenging for the public sector and especially for individual local authorities which can lack the funding, officer resources and knowledge required. The Combined Authority can mitigate the issues faced by taking a regional approach and encouraging collaboration between the UAs. The benefits include greater efficiency, knowledge sharing, standardisation and the strategic planning for the region. Financially there are economies of scale by procuring larger volumes of EVCPs and the ability to cross subsidise profitable and unprofitable areas. By tendering collectively, the offer is more attractive for private sector investment.
The impacts of not delivering the scheme	Not delivering the scheme will result in a slower rate of EV uptake and could result in failure to meet decarbonisation and air quality goals. Gaps in the network of public EVCPs would not be filled and result in inequity of access to charging. Furthermore, there would be reduced attractiveness of the West of England to investors, increased trailing cables and reputational risks as national government oversight of the EV chargepoint sector intensifies.

2.9 Scheme objectives

Figure 12: EVCP Deployment Logic Map

Vision
The West of England will transition to a zero carbon transportation system, where journeys which cannot be shifted to active and sustainable modes are completed using electric vehicles. A network of publicly accessible EV chargers will be implemented to services these vehicles and support uptake.

Objectives	Outcomes	Impacts	Monitoring
To enable the deployment of EV charging infrastructure which will accelerate EV uptake and support the Combined Authority's net zero ambitions	Coordinated, efficient, consistent approach to chargepoint deployment	EV uptake unlocked by giving all drivers the opportunity and confidence to switch to EV, including those without off-street parking	EV uptake in the region
To unlock the adoption of EVs by households without access to off-street parking	Continued support and expansion of the Revive network	Charging infrastructure delivered at scale and pace to meet forecasted charging demand	Financial performance of the Revive network
To ensure comprehensive, equitable access to charge points, plugging any gaps left by the market	Collaboration between the CA and Uas which will ensure a co-ordinated and efficient deployment of infrastructure	Charging solutions tailored to meet local requirements	No. of registered members of the Revive network
To ensure the Revive network remains financially viable in the long-term and can continue to provide benefit to the community	Wider benefits of investing in charge points unlocked, including improved air quality, reduced vehicle emissions, and supporting the 'green recovery' from the COVID-19 pandemic	Equitable charging network established, complementing private sector investment	Air Quality levels
		Consistently excellent user experience across the region	Gap Analysis
		Benefits of available grant funding maximised for the region	
		Vehicle emissions are reduced, supporting the Combined Authority's net zero aims	

2.9.1 Vision

The overall vision for the scheme is as follows: The West of England will transition to a net zero transport system, where journeys which cannot be shifted to active and sustainable modes are completed using electric vehicles. A network of publicly accessible EV chargers will be implemented to service these vehicles and support uptake.

2.9.2 Objectives

To enable the deployment of EV charging infrastructure which will accelerate EV uptake and support the Combined Authority's net zero ambitions

A significant increase in publicly accessible charge points is required over the coming decades to ensure a lack of charging provision does not become a barrier to EV uptake and wider regional decarbonisation ambitions.

There is a strong case for public chargepoint provision to be deployed ahead of demand (in terms of EV uptake) to raise public confidence in chargepoint availability. This gives individuals the confidence to switch to an EV, even those who are unlikely to depend on public charging in practice due to having off-street parking at home. Research undertaken by the consultancy Transport Research Laboratory and the Behavioural Insights Teams within DfT highlighted that drivers' perception of access to charge points is likely to lag behind the actual infrastructure available.

To unlock the adoption of EVs by households without access to off-street parking

Without convenient, affordable access to public charging infrastructure, households without off-street parking will find it harder to be part of the national transition to EVs, creating inequity and slowing the rate of EV uptake and regional decarbonisation.

Within the West of England, 30% of households are estimated to be reliant on on-street parking (for example, those living in flats or terraced housing), and in dense urban areas where air quality issues are more acute, this proportion will be higher.

Providing at or near to home charging for the affected households will require particular attention and support by the public sector as the commercial opportunity for the private sector to invest in slow charge points is weaker than rapid charging. This is due to the higher costs of installations and low potential utilisation due to the slower turnover.

To ensure comprehensive, equitable access to charge points, plugging any gaps left by the market

The private sector CPOs will focus on providing charge points in locations where they can gain the highest return on investment. They are most likely to prioritise core urban areas, commercial centres, and more affluent communities where there is the highest

propensity to own an EV. In these areas utilisation rates are currently highest. The private sector will also avoid locations where expensive upgrades are required to improve grid capacity, even if demand for EVCPs is high. As a result, gaps in the network are created where there is no access to publicly accessible charging. These often occur in less affluent areas which are already impacted by other types of social inequality.

The Combined Authority will plug the gaps in the public charge point network left by the private sector to ensure there is equitable access to charging for all and that communities are able to access the infrastructure they need to switch to an electric vehicle.

To ensure the Revive network remains financially viable in the long-term and can continue to provide benefit to the community

Supported by OZEV's Go Ultra Low City Scheme funding, the West of England pioneered a fully public funded and operated EV charging network, known as the Revive Network. This approach has enabled the development of a successful network with a growing customer base and importantly, the knowledge and processes for efficient expansion. Revive remains the primary route by which the UAs deploy charge points and allows gaps in the network left by the private sector to be plugged.

To ensure that the Revive Network is able to operate long term and continues to provide benefit to the community it must remain financially viable. To achieve this, appropriate tariffs will need to be set and site selection must consider a mix of high and low utilisation sites in order to balance profitability against the other objectives.

2.9.3 Outcomes

To collaborate as a region to ensure efficient deployment, consistency for drivers and leverage private sector investment

Continuing to collaborate as a region, and centralising activity where appropriate, will ensure a coordinated approach to chargepoint provision. Benefits include:

- Greater resource efficiency for UAs. For example, joint procurement and project management through the Revive network will reduce the time burden on officers and duplication of effort. This is particularly beneficial in a fast-moving, novel sector where specialist, technical understanding is advantageous.
- High-quality, consistent user experience. Having a consistent brand, chargepoint technical specification and service standards will encourage drivers to use the network and grow confidence.
- Greater ability to leverage private sector investment. Offering a larger, diverse portfolio of potential charging locations is likely to attract greater private sector interest, by reducing risk for investors and increasing economies of scale on installation costs.

To unlock the wider benefits of investing in charge points, including improved air quality, reduced vehicle emissions, and supporting the 'green recovery' from the COVID-19 pandemic

As EVs have zero tailpipe emissions, enabling and accelerating the use of EVs will reduce air pollution, improving public health.

Investing in charging infrastructure can also provide economic stimulus to help the West of England recover from the COVID-19 pandemic, by levelling up and supporting a 'green recovery'. This includes supporting job creation across the supply chain. Nationally, the Government has invested £73.5 million in research and development in the automotive sector as part of the green economic recovery.

2.10 Options selection and preferred schemes

A comprehensive and robust process was adopted for generating and shortlisting options for the scheme, leading to the selection of the preferred option.

Scheme options generation

The CA and the UAs have carried out a process to identify EV charging schemes which can be implemented in the short to medium term and will contribute towards the objectives of the 'West of England EV Strategy' (draft). Four broad categories of interventions were considered: Policy and guidance, residential charging, destination charging and innovative transport schemes. This process is described in detail in the April 2022 'Investment Proposals' report (See Appendix 3) and summarised briefly below. Table 5 overleaf shows the long list of 18 schemes which were developed.

Following discussion with the CA and UA officers, three schemes were shortlisted for implementation and are the current focus for the CA and UA officers. These are:

- Trials of innovative low cost on-street residential charging (e.g., lamp column charging)
- Trial residential charging hubs
- Install destination chargers in public car parks.

Delivery of these schemes will be a major contribution to the primary recommendations in the strategy – taking a proactive role in the EV charging infrastructure provision, promoting, and supporting Revive as the region's publicly operated EV charging network, and taking a leadership role in co-ordinating EV charging at a regional level.

The forecasting carried out indicates that by 2030 there will be a requirement for 1,863 publicly funded charge points to be installed across the West of England region (see section 2.4). The installation of this charging infrastructure presents a key opportunity for the Combined Authority and the UAs to make progress towards this target, and to

ensure that they are not inhibiting the uptake of EVs through a lack of charging provision.

Other schemes that were not shortlisted through this process and require funding will not be taken forward in the short-term but will be revisited through ongoing monitoring and evaluation of the EV Strategy and could be delivered should future funding opportunities arise. The schemes that do not require capital funding will be investigated in future by the CA and UAs through the EV Working Group.

Table 8: Long list of possible EV charging schemes

Type of scheme	Investment option	Shortlist
Policy & guidance	Create a regional EV Working Group	
Policy & guidance	Greening the council vehicle fleets (combine)	
Policy & guidance	Green procurement	
Policy & guidance	Change planning policy to require EV chargers are installed in new developments	
Policy & guidance	Electrify private hire vehicles	
Residential	Trials of innovative low cost on-street residential charging (e.g. lamp column charging)	**Yes**
Residential	Take a proactive approach to trailing cables	
Residential	Trial residential charging hubs	**Yes**
Residential	Public engagement	
Residential	Rural charging provision (gap analysis)	
Destination	Install destination chargers in public car parks	**Yes**
Destination	Rapid Charging Hubs (incorporate into revive / concession)	
Destination	Rapid chargers for electric taxis and delivery vehicles (same as above taxi point)	
Destination	Deploy Mobility Hubs with EV charging	
Destination	Engage with tourist destinations to help them provide EV chargers for their customers.	
Innovative	Support the introduction of EV car clubs	
Innovative	Clear Air Zones (CAZ) and Zero Emissions Zones (ZEZ)	
Innovative	Emissions based parking tariffs (combine into supporting policy measures, use other reports)	

2.10.1 Preferred scheme descriptions

Residential charging hubs

Residential community charging hubs provide chargers for residents who do not have access to off-street parking where they can charge their vehicles. This concept presents an alternative and complementary approach to providing on-street charging. The Combined Authority will invest in trials of this innovative approach, which can become a blueprint for wider rollout across the region.

Residential hubs typically consist of multiple standard/fast AC chargers (7-22kW) set in an off-street car park in residential or suburban environments, often using a car park which is otherwise underutilised (e.g. overnight).

This approach is being trialled or in the process of being trialled elsewhere, including Dundee, Lanarkshire, and Milton Keynes. As an example, Dundee's residential charging hub 'Princes Street' provides solutions for residents living in flats and locations who are unable to obtain a dedicated charge point.

Destination chargers in public car parks

A successful EV charging network needs to accommodate the different ways in which vehicles are charged. There are four broad categories of EV charging: home, workplace, destination, and intermediate charging. Destination charging occurs mid-journey when drivers are visiting a location such as a supermarket, railway station, shopping centre, cinema or hotel and take the opportunity to charge the vehicle and 'top-up' the batteries. Destination chargers are in public car parks (either on or off-street) and utilise either a fast or rapid charger. This method continues the approach of the current Revive network, which has already installed fast chargers in council owned car parks.

The UAs own a large portfolio of council-owned car parks, which are potentially ideal locations for fast and rapid destination chargers. They are generally located to serve a destination such as a town centre, train station or leisure centre. These prime locations are more likely to attract the higher utilisation rates required for charge points to be commercially viable.

On-street residential charging

Provision of convenient and low cost on-street charging in residential areas, for people without off-street charging, forms an important component of an effective EV charging network and is essential for encouraging the uptake of electric vehicles.

Residential on-street chargers are typically slow to fast AC chargers, positioned at the kerbside and serving a dedicated EV only bay. Located at or close to where vehicles would be already parked, this allows for long dwell times and the ability to charge overnight when demand on the grid is less. This is more convenient for the user and is more affordable than rapid charging. With the added benefit that less degradation to the battery occurs compared to rapid charging.

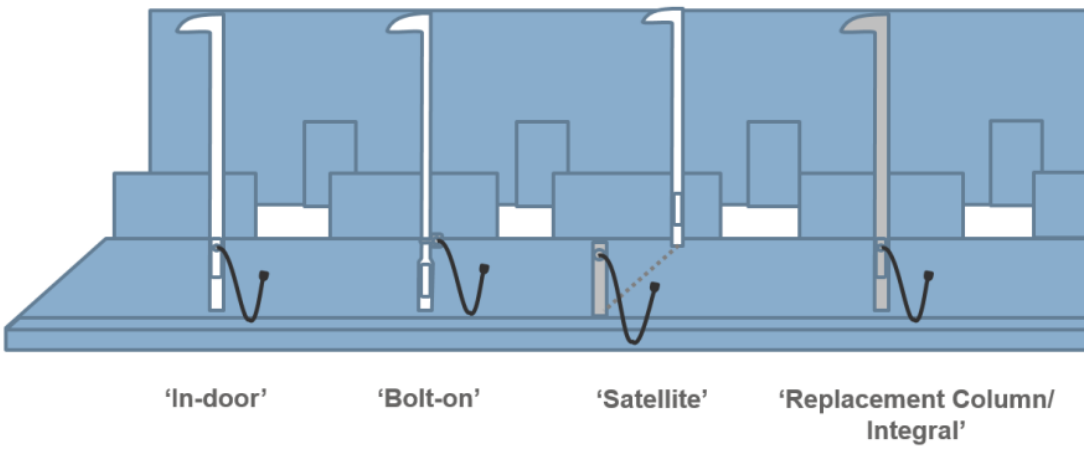
A range of charger technologies are available to meet on-street residential charging. Revive network officers have carried out extensive research and soft market testing to understand the available options. It was decided that lamp column charging best met the needs of the network.

Lamp column chargers are a charging solution that integrate into existing street furniture, providing several key benefits:

- Limited impact on streets: Lamp column chargers integrate into existing street furniture and do not impact pavement width.
- Low complexity and cost of installation: Lamp column chargers have a low cost per unit, and do not need DNO connections, making them low cost to install (or remove).
- Scalability: They can be easily rolled out across all areas where compatible lampposts are available i.e. there is sufficient electrical capacity and earthing.

When lamp columns are located at the back of the footway, there would be issues with trailing cables. To avoid this a 'satellite' bollard can be used, as per **Figure 13**.

Figure 13: Lamp column charging formats



Lamp column chargers are being widely used by local authorities across the UK but to date never in the West of England. As an example, London has several thousand lamppost chargers, including 'Electric Avenue' - the first residential avenue fully converted to provide lamppost charging points. Go Ultra Low Oxford have trialled nearly thirty lamppost chargers and thirteen bollard chargers.

Regarding maintenance of lamp column chargers, the Highways Electrical Asset Team (HEAT) would manage both day-to-day reactive maintenance of lamp columns and the EV Chargers attached to them and will be set up so that faults are not easily transferred from one electrical system to the other by the HEAT. HEAT will manage communication to respective parties, including suppliers.

Regarding procurement of the lamp column chargers, soft market testing and a procurement process has begun and identified a preferred supplier. A contract is expected to be awarded in Spring 2023.

2.10.2 Site selection and scoping process

A budget of £4.9m was agreed to be sought from the Green Recovery Fund, for the scheme. This is to be split between the UAs, proportional to their population. BCC 49%, SGC 29% and B&NES 22%. Some additional budget from DfT ORCS grants (BCC and SGC) and SGC internal capital funding was agreed (£816,722). Sites were then selected which best met the scheme objectives, whilst not exceeding the budget.

A different set of criteria was applied to the lamp column sites, compared to the other sites.

Destination and community sites

A long list of suitable sites was developed, which included key destination sites (e.g. park & ride, railway stations, hospitals and high streets), hotspots of requests from residents and high priority sites identified by the UAs. A GIS model was then developed to rank the suitability of each site, for both destination and community chargers. A range of datasets were included in the model (**Table 9** overleaf) and given an appropriate weighting.

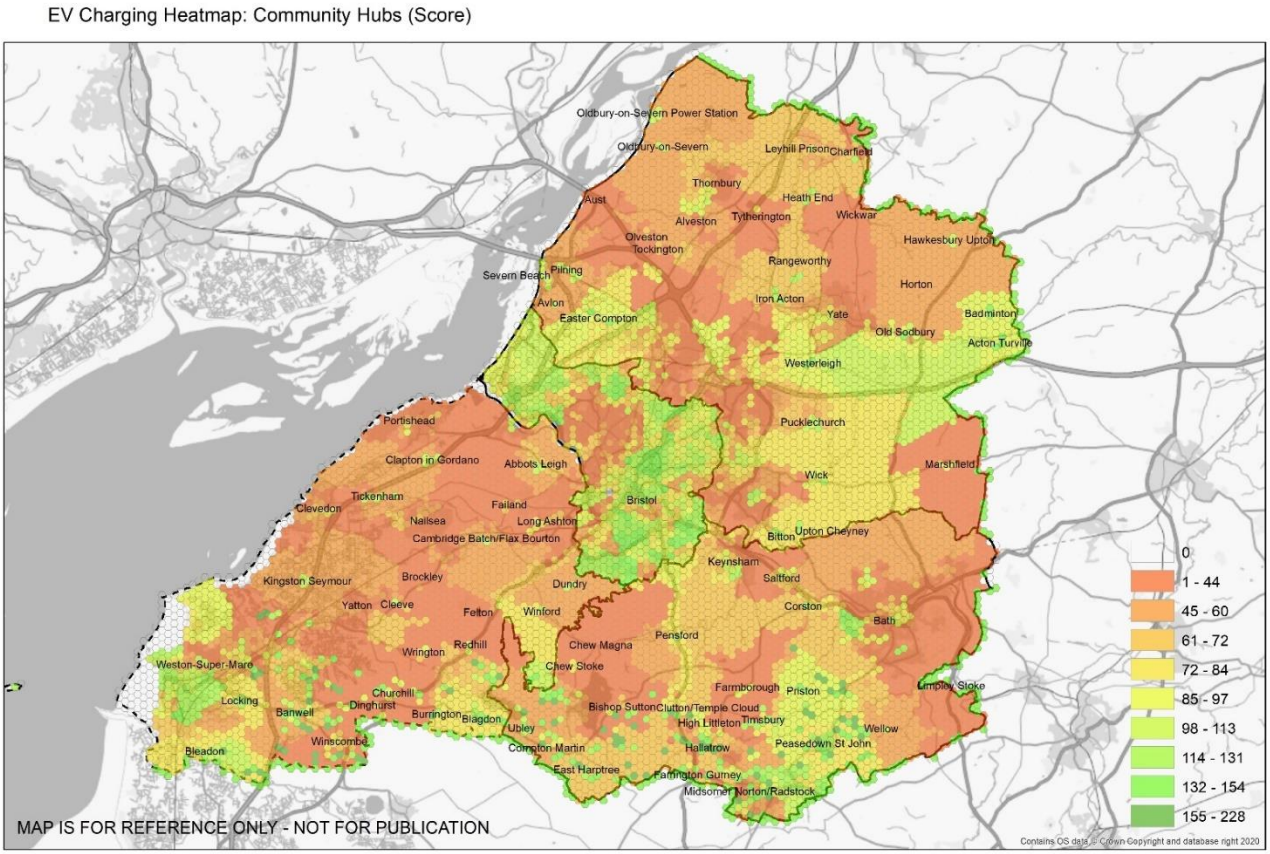
The weightings were developed through a series of workshops with council officers where the relative importance of each indicator was established for identifying both destination and community hub sites. Consideration was given to how each type of scheme contributes to the scheme objectives.

Whereas for destination charging the 'commercial viability' and 'coverage' metrics are the most significant. **Figure 14** shows the models' community charging suitability scores across the CA area. The final output was a long-list of sites for each UA.

Table 9: Weighting of datasets used in site selection model

Indicator	Source data or analysis	Destination Chargers	Community Hubs
Demographic/Social Equity	A number of demographic indicators were used including Index Multiple Deprivation, car ownership by household, current EV uptake and National Travel Survey trip volumes.	10%	37%
Coverage	Number of existing EVCPs within a 5 min drive.	33%	26%
Ward Coverage	Whether or not the ward within which the site sits currently has any existing EVCPs.	4%	3%
Commercial Viability	EV Forecast modelling (see section 2.4). Areas identified as being likely to be attractive to private sector CPOs and will not require public investment.	47%	0%
Public Investment	EV Forecast modelling (see section 2.4). Areas identified as being unlikely to be attractive to private sector CPOs and will require public investment.	0%	29%
Air Quality	Air quality as recorded by air quality monitoring stations.	7%	5%
TOTAL		**100%**	**100%**

Figure 14: Example output from GIS site selection analysis



A manual sift of the highest ranked sites was then carried out by officers at each UA to select the final sites to be taken forward. Officers reviewed the sites against the following criteria:

- **Utilisation**: How well is the parking space currently used, will introducing an EV charging bay result in parking stress.
- **Political Support**: Will there be support for implementing charging at this location internally from officers and members as well as externally from residents and businesses.
- **Parking Spaces**: Is alternative parking available nearby.
- **Local Electrical Infrastructure**: Are there known electricity grid constraints in the area.
- **Awareness**: Is it in prominent public location which will promote the increasing availability of EV chargers. Perceived lack of chargers is a barrier to EV uptake amongst the general public.
- **General commentary**: Does the officer believe the site is suitable overall.

Each UA has an extensive list of potential sites for EVCPs, and if problems are identified which mean a chosen site becomes unsuitable, then replacement sites can be selected from these lists. In addition, requests for chargers that cannot be accommodated by the scheme will be collated using 'site suggestions' and will be considered in future installations when funding is available.

Residential charging locations

In order to identify broad areas (LSOAs) which would benefit most from lamp column charging a GIS analysis was carried out. Two key datasets were used to calculate demand for this infrastructure. Firstly, a measure of access to off-street parking was used, which is a proxy for demand for on-street residential charging. Secondly, a database of requests for EVCPs made by the public. Further desktop assessments were then conducted to choose suitable locations on specific streets within these areas. See Appendix 5, for further details.

Requests from residents are collated via the Travelwest website and included in on-going site selection work. When future rounds of installs are funded, areas of high demand not accommodated by this scheme will receive chargers.

Costings

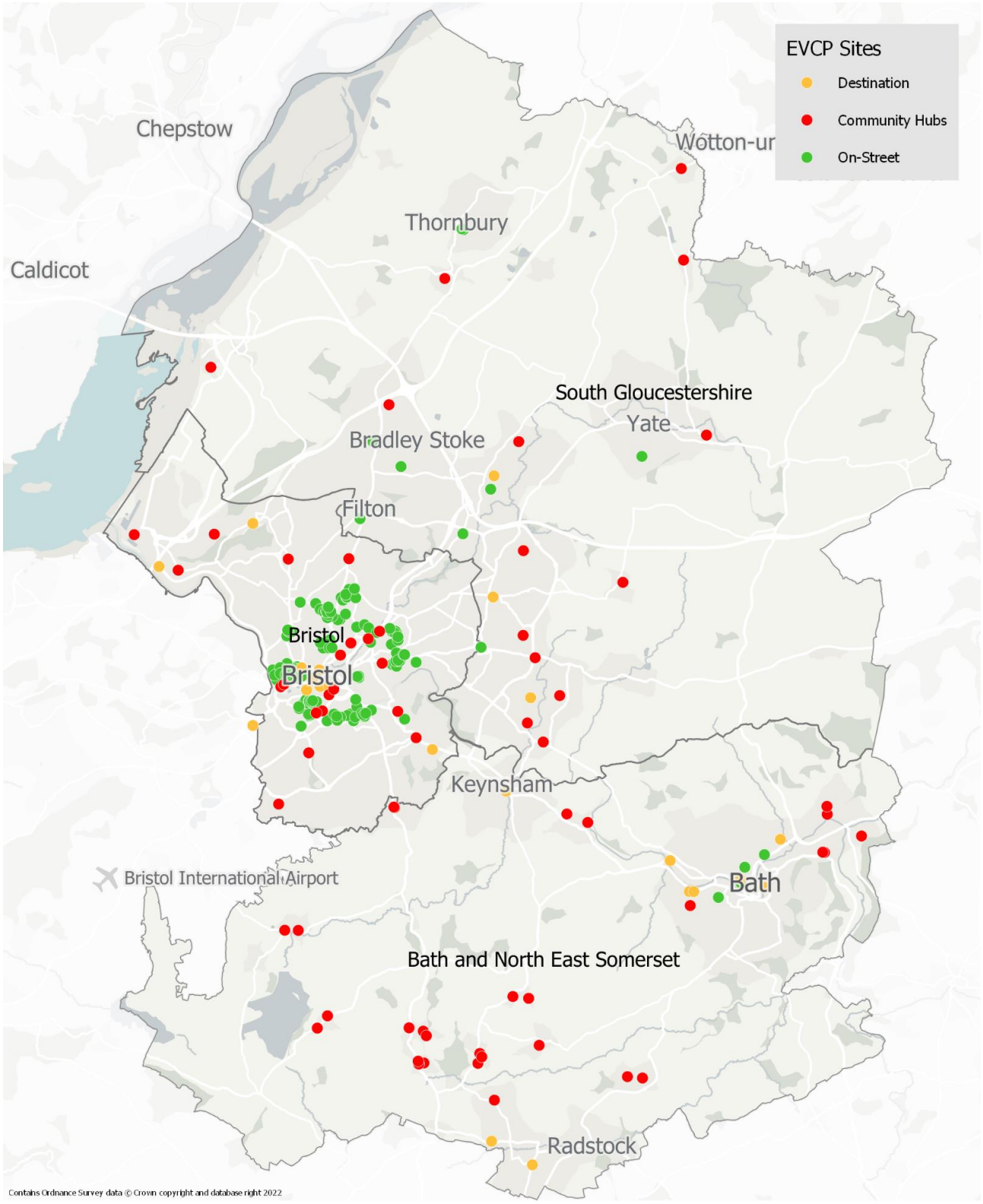
Detailed costings were developed using the cost schedules from the existing EVCP supply agreement, engagement with the DNO (Distribution Network Operator), National Grid, and engagement with internal council teams which will be involved. There is high confidence in these values as the Revive Network has been installing chargers for several years. However, there remains uncertainties over inflation.

Number of chargers to be delivered

As a result of the site selection and scoping process it was established that 256 EVCPs could be delivered, at 204 sites. These were split across the three UA regions and three EVCP typologies (On-street residential, Community Hubs and Destination chargers in public car parks).

Figure 15 overleaf shows the location of the chosen sites, including the locations of the highest scoring 18 back-up Community Hub and Destination sites and 38 back-up on-street lamp column sites in Bristol.

Figure 15: Locations of EVCP sites including highest scoring backup sites



3 THE ECONOMIC CASE

3.1 Introduction

The Economic Case identifies and appraises the scheme's impacts to determine its overall Value for Money (VfM). The Economic Case also takes account of the costs of developing and operating the scheme, and its benefits and disbenefits. These include impacts that can be monetised as well as quantitative and qualitative impacts that cannot be monetised. In addition, the Economic Case considers the extent to which the scheme's benefits outweigh its costs.

3.2 Options Development

Shortlisted Options

The HM Treasury Green Book requires a business case to identify shortlisted options appraised in the Economic Case. As part of the previous Green Recovery Fund Investment Proposal project, eighteen (18) possible EV charging schemes were developed. The three schemes which were shortlisted for implementation are the following:

- **Scheme 1**: Trials of innovative low cost on-street residential charging (e.g. lamp column charging)
- **Scheme 2**: Trial residential charging hubs
- **Scheme 3:** Installation of destination chargers in public car parks.

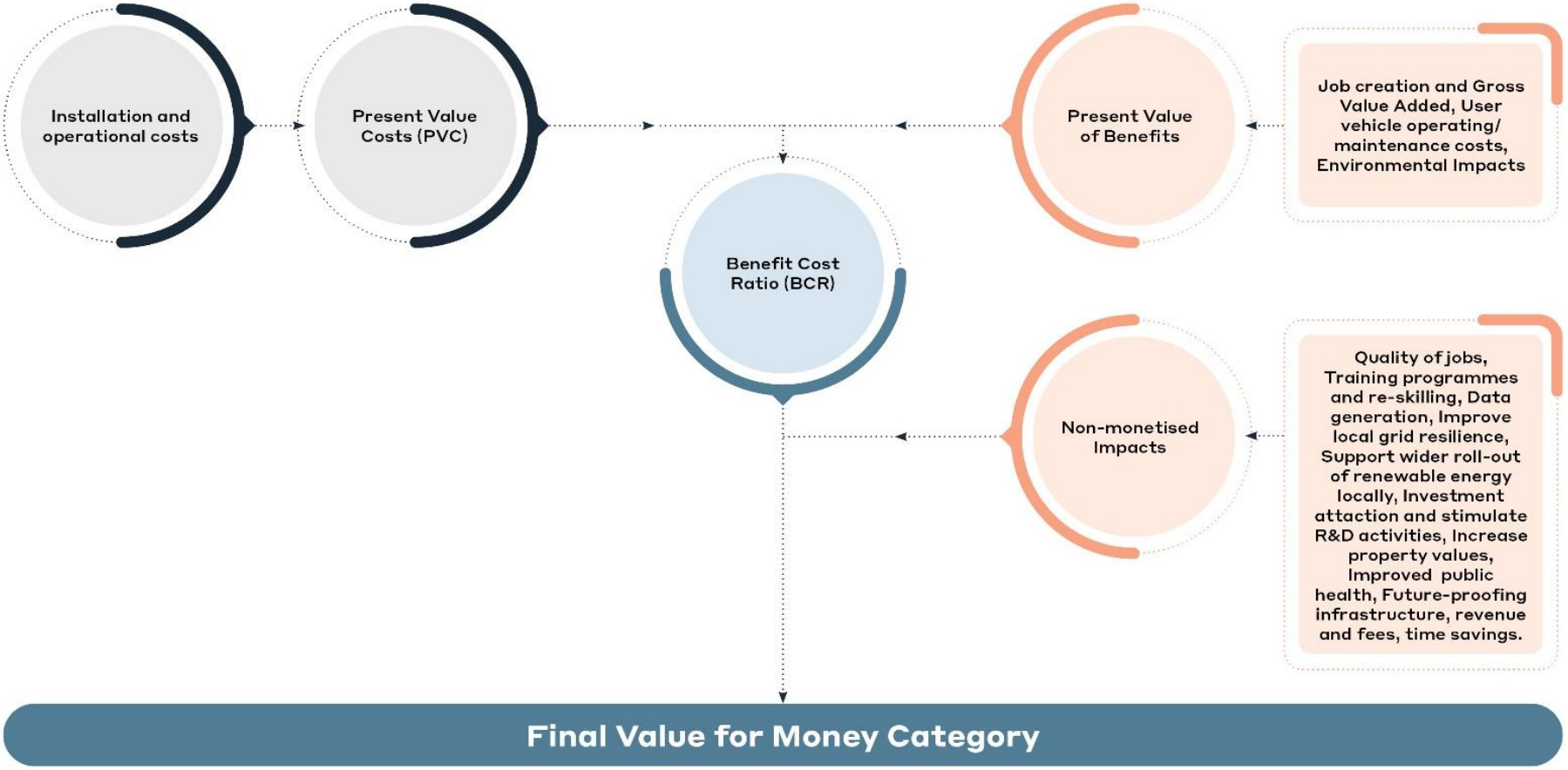
The focus of this FBC is to demonstrate the case for investment in EV charging infrastructure across the region. This Economic Case appraises the following options:

- **Option 1: Do Nothing** (Business As Usual, BAU) – the scheme does not move forward and the trends identified in the Strategic Case continue. The Strategic Case also describes the "Impact of not delivering the scheme" scenario.
- **Option 2: Do Something** (Preferred Option) – A total of 256 EV charging points will be installed across the three UAs.

3.3 Overview of Approach

The economic assessment of the EV charging infrastructure schemes has been undertaken in accordance with the HM Treasury Green Book and MHCLG (now the Department for Levelling Up, Housing and Communities) guidance.

Figure 16: Overview of the appraisal framework & process



General Appraisal Assumptions:

- All impacts have been calculated over a 15-year appraisal period from 2023 to 2037.
- A total of 256 EVCP units will be delivered across the three UAs, based on the assumed breakdown discussed in Table 3 (Section 1.5) of the Strategic Case.
- The total uplift in EVs attributed to the scheme is assumed to be 5% (20,857 EVs in 15 years).
- All EVCPs are assumed to be installed and operational by 2027.
- All financial amounts are discounted to 2010 values; and
- The results are shown in 2010 prices and in present value terms.

3.4 Estimation of Costs

The processes in DfT WebTAG guidance, (Units A1-1 Cost-Benefit Analysis and A1-2 Scheme Costs) have been followed, in order to calculate a Present Value of Cost (PVC) for each option appraised.

Base Cost Estimate

Costs are categorised as capital costs and site maintenance costs. The capital cost estimate includes the EVCP unit costs, installation, bay markings, signing, protective barrier, testing, handover and DNO connection. The operational cost estimate includes data and back-office support, warranties, maintenance, standing charge card processing, electricity, capacity charge, climate change levy and VAT. The public sector will contribute to the delivery of all EVCPs and leverage private sector investment. The base cost estimate of the preferred option is presented in **Figure 17** below:

Figure 17: Base cost estimate of the preferred option

	Preferred option
Capital cost	£5,591,914

Risk Assessment

Transport Analysis Guidance (TAG) requires public sector organisations to undertake a risk assessment of the shortlisted options. In line withA1-2 Scheme Costs, an Optimism Bias (OB) adjustment has been applied to all costs. The purpose of Optimism Bias is to ensure that the cost-benefit analysis is robust. OB is only applied to costs in the economic assessment and is not included in the Financial Case. The recommended OB uplifts for Local Authority and Public Transport Schemes are set out in **Table 10** below:

Table 10: Recommended optimism bias uplifts

Category	**Stage 1** Strategic Outline Business Case (SOBC)	**Stage 2** Outline Business Case (OBC)	**Stage 3** Full Business Case (FBC)
Roads	46%	23%	20%

It is believed that the 'base' scheme cost is well developed and robust as the estimates are based on existing costs used by the UAs. A significant portion of the risks have already been identified and accounted for in the overall budget. Therefore, the OB adjustment applied to the cost items in the appraisal is 20%.

Rebasing

TAG Unit A1-1 Cost Benefit Analysis explains that, when applying monetary values to cost impacts over a long appraisal period, it is important to take into account the effect of inflation. Failure to do so would distort the results by placing too much weight on future impacts, where values would be higher simply because of inflation. The GDP price deflator index contained in the TAG data book has been used to convert prices from the 2023 price base year to 2010: 100 (at 2010) / 133.29 (at 2023).

Discounting

A discount factor is applied to adjust costs across the 15-year period as per the Green Book. A discount rate of 3.5% per year is applied for the time period 2023 to 2037. This reflects the lower weighting placed on costs (and benefits) incurred at a future date compared to those incurred in the present.

Market prices

The final stage in preparing the cost for appraisal is to convert the aggregate scheme cost from the 'factor cost' to the 'market price' unit of account using the TAG indirect tax correction factor of 1.190, which reflects the average rate of indirect taxation in the economy.

Operational costs

A number of operational costs have been accounted for in the appraisal. The total net impact of operational costs of the scheme equates to £8,583,661 in 2023 prices for the preferred option across the appraisal period.

Revenue

Cash flow modelling was undertaken for the proposed charger deployments (Rapid/Ultra-rapid chargers (50-150kW+) and Standard/Fast Chargers (7-22kW). The assessments consider key revenue items for the chargers, accounting for the number of units installed, the installation programme (i.e. when chargers are installed and begin generating revenue), utilisation, costs and revenue assumptions. The financial viability is greatly affected by variability in utilisation and price setting. A sensitivity analysis (low, medium, high) has therefore been incorporated to account for the current uncertainty for assessing the business case for EVCPs.

The principal revenue source are the units of electricity sold (kWh), which is captured in the projections for the kW drawn per charger and the prices at which these are sold (pence per kW) versus the electricity costs incurred.

On average, it is estimated that 256 EVCPs in the preferred option would result in revenue of £6,701,038 in 2010 prices and is accounted for as a negative cost to the public account.

Table 11: Summary of Present Value of Costs (PVC) in 2010 prices

Item	Core Scenario
Base Costs	£5,591,914
Base Costs adjusted to outturn (inflation)	£6,260,929
Plus Optimism Bias	£7,513,115
Re-based to 2010 and discounted	£3,438,887
Converted to market prices (x1.19)	£4,092,275
Capital cost	**£4,092,275**
Operational cost	**£3,256,784**
Revenue Impact	**-£6,701,038**
TOTAL	**£648,021**

3.5 Present Value of Benefits

3.5.1 Carbon Reduction Benefits

The scheme is expected to accelerate EV uptake across the three UAs. This will lead to a reduction in direct and indirect carbon emissions, depending on the grid mix. The Net Present Value (NPV) of the carbon emissions reduction has been calculated using the TAG Greenhouse Gases Workbook over the 15-year appraisal period. The assumptions used to calculate the emissions with and without the scheme are given below.

- Total uplift in EVs attributed to the scheme is 5%, resulting in 20,857 EV users in 15 years.[1] The appraisal includes only the carbon reduced within private vehicle owners.
- Average driving distance per year 4,208 km.[2]
- Average regional carbon intensity for the South West of England is 187 gCO2/kWh[3], calculated using 2021 figures. The carbon intensity was forecasted to change throughout the appraisal period based on historic trends.
- Energy consumption for EVs is 0.22 kWh/km[4].
- Carbon emission for average ICE vehicle is 2.40 kg CO2e/litre[5].
- Fuel consumption for average ICE vehicles is 0.47 litre/km[6].

The environmental impacts of accelerating EV uptake will result in a reduction in carbon emissions. The preferred option will result in NPV of carbon dioxide equivalent emissions of approximately £68.3 million over the appraisal period.

By this methodology the scheme is projected to have reduced CO_2 emissions by 35,648 tonnes in 2030. This will aid the West of England in meeting its Net Zero target, which forecasts a need to reduce carbon emissions by 3.29m tonnes by 2030.

[1] WSP calculation based on a comparison of EV uptake rates in UAs with high levels of public EVCPs per registered vehicle with comparable UAs with otherwise similar characteristics.
[2] National Travel Survey – Table NTS9904 (2021) Department for Transport Statistics.
[3] Regional Carbon Intensity Forecast (2021) National Grid ESO
[4] TAG data book (2021) Department for Transport
[5] TAG data book (2021) Department for Transport
[6] TAG data book (2021) Department for Transport

3.5.2 Air Quality Benefits

EVs have no internal combustion engine, and therefore they do not produce NOx emissions. This generates a significant environmental benefit, resulting in improved air quality. Air quality benefits are harder to allocate spatially, and therefore acceleration in EV uptake in the region would contribute to improved air quality across England. The economic benefit of the carbon emissions reduction has been calculated by monetising the carbon saving during the 15-year appraisal period. The assumptions used within the economic modelling are given below.

- Total uplift in EVs attributed to the scheme is 5%, resulting in 20,857 EV users in 15 years.[7] The appraisal includes only the carbon reduced within private vehicle owners.
- Average driving distance per year 4,208 km.[8]
- Average NOx emission by ICE vehicle is 0.07g/km[9], while the NOx emission by EVs is 0g/km.
- Damage cost of NOx is £8,169.64/tonne.[10]

Accelerating EV uptake will also result in improved air quality, through the reduction of NOx emissions. The monetised benefit is the damage cost of NOx of the vehicles, which will reduce as more people purchase EVs. The scheme will result in an environmental benefit related to NOx emissions of £241,415 in 2010 prices and value over the appraisal period.

[7] WSP calculation based on a comparison of EV uptake rates in UAs with high levels of public EVCPs per registered vehicle with comparable UAs with otherwise similar characteristics.
[8] National Travel Survey – Table NTS9904 (2021) Department for Transport Statistics.
[9] Euro Emissions Standards (2017).
[10] TAG data book (2021) Department for Transport

3.6 Non-monetised Benefits

Several positive impacts associated with the scheme cannot be monetised. However, these benefits should be considered as part of the overall Economic Case and are qualitatively described below. These benefits should be considered as part of the overall Value for Money framework and can influence the final BCR.

- Job Creation and Gross Value Added
- Time Savings

Job Creation and Gross Value Added

The scheme is expected to create and secure jobs across the EV infrastructure supply chain in the three UAs and beyond. This will subsequently generate significant economic benefits for the area. The analysis also examines the impact of capital and operational investment (base cost estimate) on Gross Value Added (GVA) – see **Table 12.**

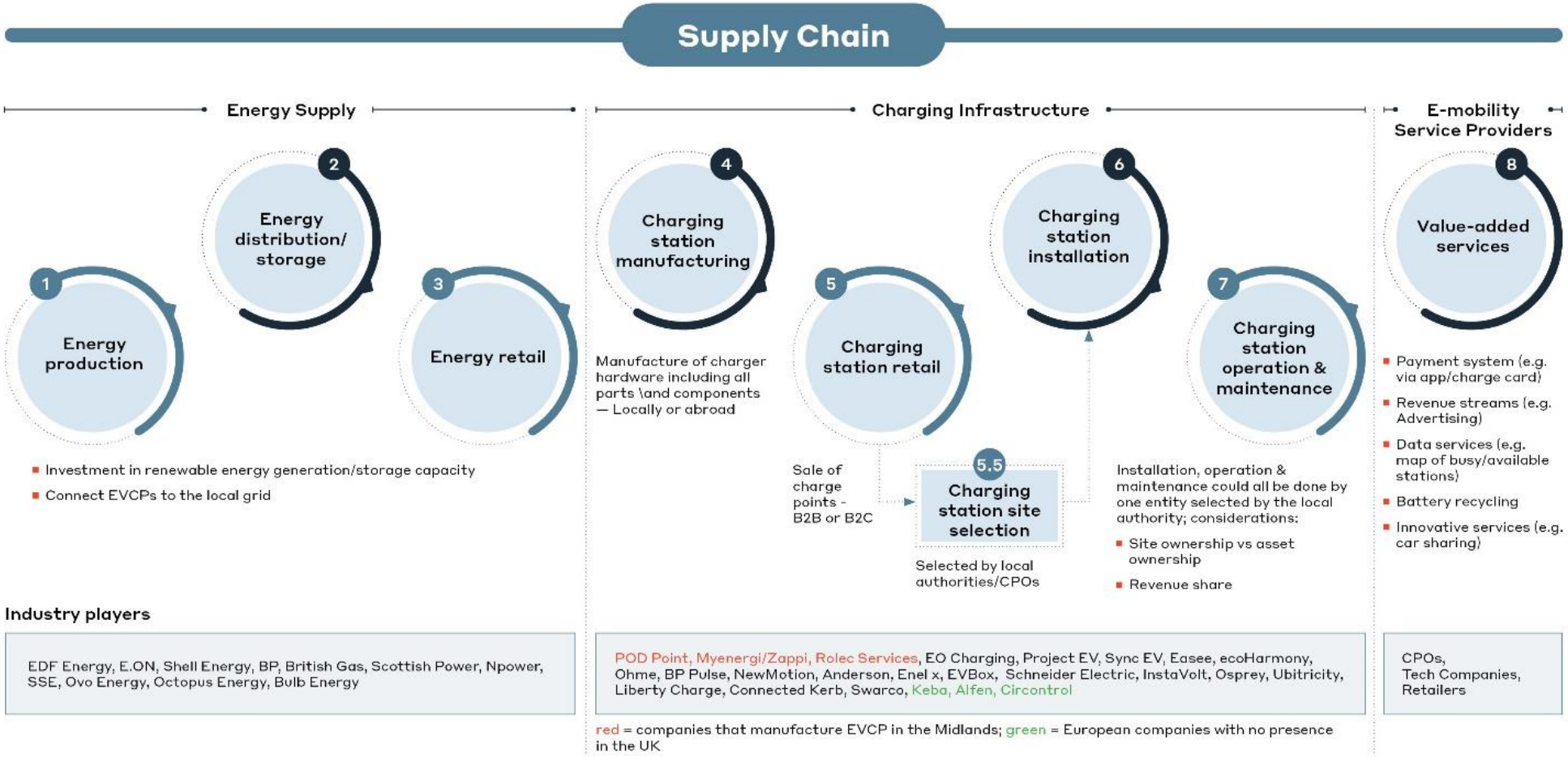
Table 12: Steps to calculate jobs and GVA

Steps	Data sources
Step 1: Map out the EVCP supply chain	Secondary data, WSP market knowledge, peer-reviewed reports, management consulting and investor advisor reports.
Step 2: Map out Standards Industry Classifications of economic activities (SIC) codes for each EV supply chain activity	UK SIC 2007. (2022). Office for National Statistics (ONS). 2022 Companies House data.
Step 3: Create sector profiles for each supply chain activity by using the SIC codes	Regional gross value added (balanced) by industry: all ITL regions (2022). ONS. Business Register and Employment Survey (2022). ONS.
Step 4: Split the capital and operational investment by supply chain activity	WSP professional knowledge and project experience.
Step 5: Calculate output and GVA	Input-Output Analytical Tables (2018). ONS.
Step 6: Calculate direct and indirect jobs	FTE multipliers and effects, the reference year 2018 (2022). ONS.
Step 7: Calculate regional benefits by accounting for leakage	WSP analysis based on Step 3 findings. Additionality Guide Fourth Edition (2014) Homes & Communities Agency (HCA).

Step 1: Map out the EVCP supply chain

The supply chain was mapped based on secondary research and WSP professional knowledge about the industry. The final supply chain used to calculate the economic benefits consists of eight key stages and this is summarised in **Figure 18.**

Figure 18: EVCP Supply Chain Map



Step 2: Map out Standards Industry Classifications of economic activities (SIC) codes for each supply chain activity
Once the supply chain was mapped, all SIC codes relevant for each supply chain stage were identified. This was undertaken by mapping the SIC code description to the supply chain activity. Some of the SIC codes were identified according to relevant company SIC codes stated in the Companies House webpage and some were identified by discussing them with EV experts within WSP.

Step 3: Create sector profiles for each supply chain activity by using the SIC codes
A high-level economic profile was created for all the identified SIC codes. The sector profile included employment in the West of England Combined Authority, sector GVA in the region, market trends and the location quotient compared to Great Britain. This analysis revealed which parts of the supply chain are competitive and which EV related activities are well represented in the region.

Step 4: Breakdown of capital investment and operational investment by supply chain activity
The capital investment and operational investment required was calculated as a total value for scheme delivery, covering all three UAs. The investment required was split across the supply chain activities based on WSP professional knowledge about the industry, industry and CPO engagement and previous project experience (**Table 13**).

Table 13: Investment split across supply chain activities

Steps	Supply chain activity	Split
CAPEX	Stage 1: Energy Production	25%
CAPEX	Stage 2: Energy distribution/ storage	25%
CAPEX	Stage 3: Charging station manufacturing	20%
CAPEX	Stage 4: Charging station retail	20%
CAPEX	Stage 5: Charging station installation	30%
OPEX	Stage 6: Energy retail	60%
OPEX	Stage 7: Charging station operation and maintenance	30%
OPEX	Stage 8: Value-added services	10%

Step 5: Calculate output and GVA
The scheme's output effect was calculated by multiplying the investment split for each supply chain activity with the relevant Output (P1) multiplier. Output (P1) refers to all products created during the accounting period from the initial injection into the economy. Output (P1) multipliers can be used to generate an estimate of direct and indirect impacts on output in the economy.

The GVA generated from the total scheme investment was calculated. The investment split was multiplied by using GVA multipliers relevant for each supply chain activity. The output of this represents a total GVA generated from the scheme.

Step 6: Calculate direct and indirect employment
The output effect, calculated in Step 5, was multiplied with the employment multipliers for each supply chain activity. Type 1 multiplier was used as it also calculates supplier linkages. This calculation provides the total direct and indirect full-time equivalent (FTE) employment for each supply activity generated by the scheme.

Step 7: Calculate benefits in the region by applying leakage
We acknowledge that not all jobs and additional economic activity will be created in the West of England region. Some of the benefits would leak out to other regions in the UK. To calculate the jobs and GVA created in the West of England region, the HCA's Additionality Guide was used to calculate the level of 'leakage' (i.e. the proportion of new jobs expected outside of the Midlands). An appropriate leakage rate was assigned to each supply chain activity based on the sector profile in the region (created in Step 3).

Table 14: Leakage rates across EVCPs supply chain

Supply chain activity	Level of leakage	Leakage rate
Energy Production	Medium	25%
Energy distribution and storage	Medium	25%
Energy retail	Medium	25%
Charging station manufacturing	High	50%
Charging station retail	High	50%
Charging station installation	High	50%
Charging station operation and maintenance	Medium	25%
Value-added services	Medium	25%

The final findings on GVA and jobs based on the seven steps above are presented below.

The scheme will create direct and indirect jobs across the supply chain. The three scheme is expected to create a total of 217 Full Time Equivalents (FTEs) jobs in the West of England region (after leakage). Approximately 84 FTE jobs are created during the development phase, and additional 134 FTE jobs during the operational phase (15 years). Employment creation across the eight EVCP supply chain stages is presented in **Table 15.**

Table 15: Job creation across the EVCP supply chain

Scheme	Number of jobs created
Energy Production	22
Energy Distribution & Storage	22
Energy Retail	73
Charging Station manufacturing	6
Charging Station retail	8
Charging Station installation	25
Charging Station operation & maintenance	45
Value-added services	16
Total	**217**

The estimates of GVA are based on output multipliers for each supply chain activity. The total GVA benefits related to the schemes across the appraisal period are approximately £10.5 million in 2010 prices.

Time Savings

The scheme is expected to result in time saving benefits for EV owners. A wider network of public chargers will enhance driver convenience and will save time, due to the ease of access to EV charging infrastructure. It is also important to acknowledge that many drivers with access to a charge point at home many never need to use the public charge point network, and therefore not all charging requirements can be credited to the scheme.

Time saving benefits have not been included in the PVB and BCR calculations due to high level of uncertainty around the methodology. Although time saving benefits are acknowledged in transport modelling, the method for calculating time saving benefits in the scheme context are less acknowledged.

3.7 Value for Money Assessment

The cost benefit analysis for the scheme shows that the monetised benefits (PVB) are greater than the monetised costs (PVC). The benefit-cost ratio (BCR) of 105.80 indicates a Very High Value for Money (VfM), as presented in **Table 16**.

Table 16: BCR, VfM based on the quantitative impacts and the Net Present Value (NPV) for each sensitivity test

Item	Core scenario (£ million)
Total CAPEX	£4,092,275
Total OPEX	£3,256,784
Revenue	-£6,701,038
PVC	**£648,021**
Environmental Impacts	£68,557,522
PVB	**£68,557,522**
NPV	**£67,909,502**
BCR	**105.80**
VfM Category	**Very high**

3.8 Sensitivity Analysis

Alongside the core scenario, sensitivity tests were considered to take into account uncertainty regarding the assumptions used in the core scenario surrounding costs, utilisation and EV uplift.

3.8.1 Sensitivity to Costs

The cost estimation developed for the scheme was extensive and detailed. Nevertheless, the actual project costs can vary from the original cost estimate. The scheme's sensitivity to the cost estimate was tested by changing the level of OB to 30% for the high-cost scenario and 10% for the low-cost scenario. The results are set out in **Table 17**.

Table 17: Sensitivity testing on Optimism Bias (OB)

Item	High Cost (£ million)	Low Cost (£ million)
Total CAPEX	£4,433,298	£3,751,252
Total OPEX	£3,256,784	£3,256,784
Revenue	-£6,701,038	-£6,701,038
PVC	**£989,043**	**£306,998**
Environmental Impacts	£68,557,522	£68,557,522
PVB	**£68,557,522**	**£68,557,522**
NPV	**£67,568,479**	**£68,250,525**
BCR	**69.32**	**223.32**

The sensitivity tests on costs indicates Very High VfM across both scenarios. These sensitivity tests provide a high degree of certainty that that the scheme will generate significant benefits which will outweigh the costs of the scheme.

3.8.2 Sensitivity to Utilisation

To account for sensitivity in revenues, high and low EV charge point utilisation scenarios were tested. The sensitivity tests on utilisation indicates a Very High VfM for the low utilisation scenario and an even higher 'Very High' VfM for the high utilisation scenario.

As per Box 1.2 of the Value For Money Supplementary Guidance on Categories, a negative PVC (where difference between revenue exceeds project costs) and a positive PVB and NP(P)V are present then a negative BCR is in fact Very High FM.

Table 18: The results of sensitivity testing on EV charge point utilisation

Item	High Utilisation	Low Utilisation
Total CAPEX	£4,092,275	£4,092,275
Total OPEX	£5,891,942	£2,649,551
Revenue	-£14,921,469	-£4,806,765
PVC	**-£4,937,252**	**£1,935,062**
Environmental Impacts	£68,557,522	£68,557,522
PVB	**£68,557,522**	**£68,557,522**
NPV	**£73,494,775**	**£66,622,461**
BCR-	**-13.89**	**35.43**

3.8.3 Sensitivity to EV uplift

The core scenario assumes 5% of the total forecasted EV increase in the local authorities are attributed to this scheme. This sensitivity also influences the Environmental Impacts benefit. The sensitivity tests on EV uplift (by modifying the core scenario of 5% by ±1.25%) indicate a Very High VfM across both scenarios.

Table 19: The results of sensitivity testing on EV uplift

Item	High Uplift	Low Uplift
Total CAPEX	£4,092,275	£4,092,275
Total OPEX	£3,256,784	£3,256,784
Revenue	-£6,701,038	-£6,701,038
PVC	**£648,021**	**£648,021**
Environmental Impacts	£92,130,637	£55,525,790
PVB	**£92,130,637**	**£55,525,790**
NPV	**£91,482,616**	**£54,877,770**
BCR	**142.17**	**85.69**

3.8.4 Combined sensitivity scenario

This scenario combines the most negative conditions of the previous three scenarios (high costs, low utilisation of CPs and low uplift in number of EVs). A Very High VfM is still achieved under these conditions.

Table 20: The results of sensitivity testing on the most negative conditions of the three previous scenarios combined.

Item	High Cost, Low Utilisation, Low Uplift
Total CAPEX	£4,433,298
Total OPEX	£2,649,551
Revenue	-£4,806,765
PVC	**£2,276,084**
Environmental Impacts	£55,525,790
PVB	**£55,525,790**
NPV	**£53,249,706**
BCR	**24.39**

3.9 Value for Money Summary

Table 21 presents the Benefit Cost Ratio and therefore the Value for Money based on the quantitative impacts and the Net present Value (NPV) for each sensitivity test.

Table 21: Value for Money summary table

Scenario	NPV	BCR	VfM
Core	£67,909,502	106	Very high
High costs	£67,568,479	69	Very high
Low costs	£68,250,525	223	Very high
High utilisation of CPs	£73,494,775	-14[11]	Very high
Low utilisation of CPs	£66,622,461	35	Very high
High uplift in EVs	£91,482,616	142	Very high
Low uplift in EVs	£54,877,770	86	Very high
High costs, low utilisation & low uplift	£53,249,706	24	Very high

The VfM is categorised as 'Very High' in all scenarios. These sensitivity tests demonstrate that the scheme will generate significant benefits which will outweigh the costs of the scheme.

[11] Where a negative PVC and a positive PVB and NP(P)V are present then a negative BCR is categorised as Very High FM, Box 1.2 of the Value For Money Supplementary Guidance on Categories.

4 THE FINANCIAL CASE

4.1 Introduction

This section sets out the Financial Case for the proposed scheme and covers scheme costs and funding availability, to demonstrate the scheme's overall affordability. The Financial Case also covers the assumptions and approach to calculating the costs. The Value for Money appraisal is dealt with separately in the Economic Case.

4.2 Scheme Cost Estimate

The scheme costs were provided by the CA and the UAs who undertook an extensive costing exercise and produced a Cost Plan. See Appendix 6.

4.2.1 Capital Expenditure (CAPEX)

Capital costs were calculated for each proposed site. Each UA provided costing for the sites within their areas, as they will be responsible for the delivery using their inhouse design and maintenance resources.

The Revive network and UAs are already engaged in the installation of EVCPs and therefore have detailed information available on known costs for services and labour. In addition, there are fixed supply agreements in place for equipment. Detailed assessments were carried out including requesting DNO connection quotes when possible. Where this was not possible historical prices were used.

Overleaf is an example cost plan, detailing the individual elements considered, including PM, Design, Legal, Civils, Grid Connection and Equipment.

VAT: Only unrecoverable VAT was included in cost estimates

Figure 19: Capital cost calculations for South Gloucestershire Council sites

Scheme	Site no.	Area	Rapid CPs	22kW CP	PM	Design	Legal	Civils	DNO	Electrical	Chargers
On-street	1	Yate	0	2	£2,850	£5,000	£0	£15,705	£5,775	£11,014	£11,253
On-street	2	Patchway	0	2	£2,850	£5,000	£0	£21,550	£4,285	£13,147	£11,253
On-street	3	Kingswood	0	2	£2,850	£5,000	£0	£21,582	£2,950	£10,837	£11,253
On-street	4	Thornbury	0	4	£2,850	£5,000	£0	£23,286	£24,835	£27,436	£22,507
On-street	5	Bradley Stoke	0	1	£2,850	£5,000	£850	£19,943	£2,975	£12,508	£5,374
On-street	6	Frenchay	0	1	£2,850	£5,000	£850	£19,943	£2,930	£12,508	£5,374
On-street	7	Winterbourne	0	1	£2,850	£5,000	£850	£19,943	£2,175	£12,508	£5,374
On-street	8	Filton	0	1	£2,850	£5,000	£850	£19,943	£2,958	£12,508	£5,374
Community	1	Wickwar	0	2	£2,850	£5,000	£1,500	£23,286	£19,406	£12,508	£11,253
Community	2	Charfield	0	2	£2,850	£5,000	£1,500	£23,286	£2,906	£12,508	£11,253
Community	3	Alveston	0	1	£2,850	£5,000	£850	£19,943	£3,806	£12,508	£5,374
Community	4	Severn Beach	0	2	£2,850	£5,000	£1,500	£23,286	£3,367	£12,508	£11,253
Community	5	Almondsbury	0	1	£2,850	£5,000	£850	£23,286	£3,850	£12,508	£5,627
Community	6	Frampton Cotterell	0	2	£2,850	£5,000	£1,500	£23,286	£21,071	£12,508	£11,253
Community	7	Chipping Sodbury	0	1	£2,850	£5,000	£850	£19,943	£5,342	£12,508	£5,374
Community	8	Emersons Green	0	1	£2,850	£5,000	£850	£19,943	£1,694	£12,508	£5,374
Community	9	Pucklechurch	0	3	£2,850	£5,000	£1,500	£23,286	£6,070	£12,508	£16,880
Community	10	Kingswood	0	1	£2,850	£5,000	£850	£19,943	£5,000	£12,508	£5,374
Community	11	Warmley	0	3	£2,850	£5,000	£1,500	£23,286	£23,454	£12,508	£16,880
Community	12	North Common	0	2	£2,850	£5,000	£1,500	£23,286	£16,070	£12,508	£11,253
Community	13	Willsbridge	0	2	£2,850	£5,000	£850	£23,286	£3,740	£12,508	£11,253
Community	14	Bitton	0	4	£2,850	£5,000	£850	£23,286	£6,458	£12,508	£22,507
Destination	1	Staple Hill	1	0	£2,850	£5,000	£0	£23,286	£4,666	£12,508	£28,265
Destination	2	Winterbourne	1	1	£2,850	£5,000	£0	£23,286	£2,999	£12,508	£33,891
Destination	3	Cadbury Heath	0	2	£2,850	£5,000	£850	£19,943	£3,186	£12,508	£11,253

4.2.2 Operational Expenditure (OPEX)

The development cost delivers 256 EVCP units. The cost estimation also includes operational costs for a period of 15 years. The operational cost estimate includes data and back-office support, warranties, maintenance, standing charge card processing, electricity, capacity charge, climate change levy and VAT. The costs are based on values provided by the Revive Operational team and based on the existing networks known costs.

Electricity:

The Revive network is supplied energy by Bristol City Leap Joint Venture Company at a preferential rate. Whilst the costs are variable the forecast tariff in 2023/24 is expected to average £0.20/kWh.

Tariffs

As of March 2023 the Revive network tariffs were as set out below. These are reviewed periodically and will be adjusted in line with changes in electricity costs if required.

- Fast chargers (7-22kW): £0.45 per kWh
- Rapid chargers (50kW and higher): £0.59 per kWh

Transaction costs

The back-office software and systems are managed by GeniePoint Ltd. For each individual charging session a £1 fee is charged to Revive.

Utilisation

Utilisation of the charge points is the key driver of revenue. Three future utilisation scenarios (low/mid/high) were developed by analysing past performance of the network and expected future trends in numbers of EVs. The scenarios are shown below:

Figure 20: EVCP utilisation assumptions

	Avg. sessions per day per charger	Avg. kWh per session
Core - Fast	0.6	17
Core - Rapid	3	27
Low - Fast	0.3	10
Low - Rapid	1	15
High - Fast	2	22
High - Rapid	5	30

Officer time and project management

Officer time required to project manage and deliver the schemes was calculated and included within the financial forecasts. Each UA provided a project management cost per site as part of their costings. Any additional time required would be covered as part of the existing EV officers full time employment (FTE).

In addition, provision was made for a project manager at the CA to oversee the delivery of the scheme, equivalent to a Grade 10 for 0.3 FTE (1.5 days per week) for three years.

Inflation

A forecast inflation value was calculated for each year for the period 2023 to 2037. Inflation is expected to affect elements of the costs differently. Separate inflation values were applied for CAPEX, OPEX and electricity costs. A number of costs are fixed through the supply agreements and will not inflate. This was accounted for by calculating weighted averages for the fixed and variable cost elements.

Figure 21: Annual inflation assumptions per financial year

Inflation per year	CAPEX	OPEX	Electricity	Tariff
Inflation 23/24	7.2%	3%	0%	4%
Inflation 24/25	4.6%	2%	0%	4%
Inflation 25/26	4.6%	2%	0%	4%
Inflation 26/27	2.3%	2%	2%	4%
Inflation 27/28	2.3%	2%	2%	4%
Inflation 28/29	2.3%	2%	2%	4%
Inflation 29/30	2.3%	2%	2%	4%
Inflation 30/31	2.3%	2%	2%	4%
Inflation 31/32	2.3%	2%	2%	4%
Inflation 32/33	2.3%	2%	2%	4%
Inflation 33/34	2.3%	2%	2%	4%
Inflation 34/35	2.3%	2%	2%	4%
Inflation 35/36	2.3%	2%	2%	4%
Inflation 36/37	2.3%	2%	2%	4%
Inflation 37/38	2.3%	2%	2%	4%

Risk and contingency

A contingency of 12% of the total budget (£585,184.25) is allocated for the project. This provision was calculated through the QRA process which accounted for a range of risks. This included inflation, as described above. See Appendix 4 for details.

Optimism Bias is only used in the Economic Case.

4.3 Spend profile

Subject to funding, the scheme will commence in 2023/24 and the first EVCPs will become operational within six months. An indicative spend profile is set out below in **Table 22**, and the base out turn cost estimate is presented in Table 23.

Table 22: Indicative spend profile (out turn costs)

Activity (£1m's)	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38
OPEX	0.331	0.415	0.533	0.548	0.565	0.582	0.599	0.618	0.637	0.657	0.678	0.699	0.722	0.746	0.771
CAPEX	2.161	1.576	1.855	-	-	-	-	-	-	-	-	-	-	-	-
Revenue	0.488	0.667	0.934	1.020	1.114	1.217	1.329	1.451	1.585	1.730	1.890	2.064	2.253	2.461	2.687
Surplus	0.156	0.251	0.401	0.471	0.549	0.635	0.729	0.833	0.947	1.073	1.212	1.364	1.531	1.715	1.916

Table 23: Base cost estimate (out turn costs)

Activity	Total Cost
Development	£5,591,914
Operation (15y)	£9,106,844
Total	**£14,698,758**

4.4 Overall Affordability and Funding

4.4.1 Funding

The scheme requests a funding contribution of £4.9 million from the West of England Green Recovery fund. In addition to this, a combination of secured public grants will also contribute £691,914 to the total costs. The funding is outlined in Table 24.

The additional funding was secured from three sources. Both SGC and BCC have separately applied to the Office of Zero Emission Vehicles (OZEV) for On-street Residential Charging Scheme (ORCS) funding and won £283,553 and £182,000 respectively.

The grant is specifically for public residential EV charging provision and each council has made detailed applications which detail the location and type of chargers to be installed. 75% of the cost of equipment and installation is covered with a requirement for 25% match funding. The grant must be drawn down by the end of 2024.

In addition, South Gloucestershire has secured £226,361 of internal climate emergency capital funding for EV charging. There is no time limit on this funding.

Table 24: Proposed funding profile

Activity	Total Cost	Status
West of England Green Recovery Fund	£4,900,000	Subject to approval of FBC
OZEV ORCS	£465,553	Secured
Other (UA Capital Funding)	£226,361	Secured
Total	**£5,591,914**	

It should be noted that on addition to the OZEV ORCS funding detailed here, it has been indicated by OZEV that their follow-up scheme (Local EV Infrastructure fund – LEVI) contains and indicative £6m of funding for the West of England from 2024-25 onwards (subject to Expressions of Interest). This could potentially expand or supplement the match funding to the Green Recovery Fund business case.

Table 25: Green Recovery Fund £4.9m Financial Summary

BCC	SGC	B&NES	Proposed UA grant from GRF
£2,161,079	£1,143,114	£932,813	**£4,237,006**

WECA PM Costs (G10 at 0.3 FTE):	£ 76,194
Contingency of 12% (including inflation):	£ 586,800
Total	**£4,900,000**

Table 26: Summary of grant funding for the scheme

Fund	CA	B&NES	BCC	SGC	Total
UA GRF On-street		£195,167	£521,447	£148,607	**£865,221**
UA GRF Community Hubs		£572,542	£749,086	£787,904	**£2,109,532**
UA GRF Destinations		£165,104	£890,546	£206,603	**£1,262,253**
GRF Contingency	£310,450				**£310,450**
GRF Inflation Allowance	£276,350				**£276,350**
GRF Programme Management	£76,194				**£76,194**
GRF Total	**£662,994**	**£932,813**	**£2,161,079**	**£1,143,114**	**£4,900,000**
ORCS		£0	£283,553	£182,000	**£465,553**
SGC Climate Emergency		£0	£0	£226,361	**£226,361**
GRAND TOTAL	**£662,994**	**£932,813**	**£2,444,632**	**£1,551,475**	**£5,591,914**

Table 27: Cost summary, broken down per site

UA	Location	Scheme	Lamppost columns	Ultra-rapids (120kW)	Rapids (50kW)	Fasts (7-22kW)	Total	CAPEX
B&NES	Moorland Rd, Oldfield Park, Bath	On-street				1	1	£48,792
B&NES	Snow hill, Bath	On-street				1	1	£48,792
B&NES	Julian Rd, Circus Area, Bath	On-street				1	1	£48,792
B&NES	New King St. Area, Bath	On-street				1	1	£48,792
B&NES	#1: Greenlands Car Park #2: PC Beacon Hall	Community Hub				1	1	£48,792
B&NES	Paulton High Street Car park	Community Hub				1	1	£48,792
B&NES	#1: Wedmore Car Park #2: Shallows Car Park	Community Hub				1	1	£48,792
B&NES	Timsbury High Street Car Park	Community Hub				1	1	£48,792
B&NES	#1: Batheaston New Village Hall #2: Church of the Good Shepperd	Community Hub				1	1	£48,792
B&NES	#1: High Littleton Primary School #2: The Star Inn	Community Hub				1	1	£48,792
B&NES	Mountain Wood (near Bathford Primary School)	Community Hub				1	1	£48,792
B&NES	#1: Clutton Social Club #2: Clutton Primary School	Community Hub				1	1	£48,792
B&NES	#1: Bathampton Pharmacy #2: Bathampton Methodist Chrch	Community Hub				1	1	£48,792
B&NES	#1: Farmborough Memorial Hall #2: Farmborough Church Primary	Community Hub				2	2	£66,709
B&NES	#1: Bishop Sutton Community Hall #2: Chew Valley Library	Community Hub				2	2	£66,709
B&NES	#1: Twerton Village Hall #2 Bath City Football Club	Destination				2	2	£55,035

UA	Location	Scheme	Lamppost columns	Ultra-rapids (120kW)	Rapids (50kW)	Fasts (7-22kW)	Total	CAPEX
B&NES	#1: Newbridge P&R	Destination				2	2	£55,035
B&NES	Larkhall Car Park	Destination				2	2	£55,035
SGC	Abbotswood	On-street				2	2	£51,083
SGC	Derwent Close	On-street				2	2	£57,504
SGC	Boulton Road	On-street				2	2	£53,928
SGC	Rock Street	On-street				4	4	£104,854
SGC	Hawkesley Drive	On-street				1	1	£49,005
SGC	Marlborough Drive	On-street				1	1	£48,961
SGC	Perry Close	On-street				1	1	£48,213
SGC	Bevan Court	On-street				1	1	£48,988
SGC	Wickwar Village Hall	Community Hub				2	2	£75,045
SGC	Charfield Memorial Hall	Community Hub				2	2	£58,710
SGC	Greenhill Road	Community Hub				1	1	£49,828
SGC	Severn Beach Village Hall	Community Hub				2	2	£59,167
SGC	Woodlands Park	Community Hub				1	1	£53,431
SGC	Frampton Cotterell Car Park	Community Hub				2	2	£76,693
SGC	Horse Street	Community Hub				1	1	£51,348
SGC	Beaufort Road	Community Hub				1	1	£47,737
SGC	Pucklechurch Community Centre	Community Hub				3	3	£67,413
SGC	Fisher Road / Tennis court road	Community Hub				1	1	£51,010
SGC	Warmley Community centre	Community Hub				3	3	£84,623
SGC	North Common Village Hall	Community Hub				2	2	£71,743
SGC	Long Beach Rd/Willsbridge Mill	Community Hub				2	2	£58,893
SGC	Bitton Railway Station	Community Hub				4	4	£72,724
SGC	Byron Place	Destination			1		1	£75,809
SGC	Flaxpits Lane	Destination			1	1	2	£79,729
SGC	Newton Road	Destination				2	2	£55,035

UA	Location	Scheme	Lamppost columns	Ultra-rapids (120kW)	Rapids (50kW)	Fasts (7-22kW)	Total	CAPEX
BCC	Multiple locations: 15 Wards	On-street	150				150	£805,000
BCC	Oldfield Place, Hotwells	Community Hub		1		3	4	£182,220
BCC	Junction 3 Library	Community Hub		2			2	£187,208
BCC	Westbury Hill, Westbury-on-Trym	Community Hub		2		2	4	£304,650
BCC	Little Paradise, Bedminster	Community Hub		1			1	£75,008
BCC	Trenchard Street CP	Destination				6	6	£253,830
BCC	Long Ashton P&R	Destination				3	3	£64,520
BCC	Portway P&R	Destination				3	3	£64,520
BCC	West End car park	Destination				3	3	£64,520
BCC	Brislington P&R	Destination				2	2	£46,848
BCC	The Grove car park	Destination		2		4	6	£361,190
BCC	SS Great Britain	Destination				3	3	£35,118
CA	**West of England**	**All**	**150**	**8**	**2**	**96**	**256**	**£4,928,921**

WECA PM Costs (G10 at 0.3 FTE)	£76,194
Contingency of 12%	£586,800
Total	**£5,591,914**

4.4.2 Funding Profile

A funding profile showing the forecast drawdown from each funding source, in each financial year is shown in **Table 28** below.

Table 28: Forecast drawdown from each funding source in each financial year

	2023/24	2024/25	2025/26	Total
West of England Green Recovery Fund	£1,562,195	£1,535,821	£1,801,984	**£4,900,000**
BCC OZEV ORCS	£283,553	-	-	**£283,553**
SGC OZEV ORCS	£182,000	-	-	**£182,000**
SGC Capital Funding	£133,252	£40,093	£53,016	**£226,361**
Total	**£2,161,000**	**£1,575,914**	**£1,855,000**	**£5,591,914**

4.5 Risk of Operating Losses

Whilst it is expected that the scheme will generate a surplus each year from its inception, there remains a risk of annual operating losses being incurred by Revive.

The key risks are that either that the expected level of utilisation is not achieved or that electricity costs are higher than expected. The results of sensitivity tests (Table and Table) show the impact of different utilisation and electricity prices. In all scenarios there would be a positive cashflow each financial year.

Any losses incurred would be underwritten by the UAs as agreed in the existing Revive Inter-Authority Agreement (IAA). However, there is the option to raise the tariff charged to users. The common industry practice is to adjust tariffs relative to the electricity cost to maintain a constant profit margin.

4.5.1 Financial impact on the Revive network

The scheme will be an expansion of the existing Revive network. Between Revive's inception and 2021 the network incurred annual loses due to insignificant utilisation levels resulting in not enough revenue to cover costs. In 2021/22, utilisation had risen noticeably as a result of rising EV uptake in the region, and the network was on track to achieve a surplus. However, significant increases in electricity costs eroded this profit.

Despite this, in the last six months of 2022-23 and beyond the existing network is forecast to achieve a surplus. Electricity costs have been controlled through an agreement with CityLeap which will provide below market rate renewable energy. Recorded utilisation at the network continues to rise and is tracking national trends.

Across the network there is an expectation that more profitable sites will subsidise the less profitable sites. Rapid chargers in destination locations, such as retail centres, generate the greatest revenue, and fast chargers in residential locations generate less revenue.

Table 29: Income surplus sensitivity test: Low, Mid & High utilisation scenarios (£000s per financial year)

	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38
Low	42	117	246	294	348	408	474	547	627	715	812	919	1,037	1,167	1,309
Core	156	251	401	471	549	635	729	833	947	1,073	1,212	1,364	1,531	1,715	1,916
High	655	834	1,076	1,240	1,420	1,618	1,836	2,075	2,338	2,627	2,944	3,292	3,674	4,093	4,552

Table 30: Income surplus sensitivity test: electricity cost scenarios (core utilisation, £000s per financial year)

	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32	32/33	33/34	34/35	35/36	36/37	37/38
Low	156	251	401	471	549	635	729	833	947	1,073	1,212	1,364	1,531	1,715	1,916
Med	108	191	324	392	467	549	641	742	853	975	1,110	1,258	1,421	1,601	1,798
High	59	130	247	312	384	464	553	650	758	877	1,008	1,153	1,312	1,487	1,680

5 THE COMMERCIAL CASE

5.1 Introduction

This chapter outlines the Commercial Case for the scheme and the procurement strategy, which includes supply agreements. The sections below cover:

- Service Requirements and Outputs
- Delivery Strategy
- Procurement Strategy

5.2 Service Requirements and Outputs

The scope of the scheme includes investment in three different types of EV charging infrastructure (fast, rapid and lamp column chargers). The Revive Network, owned by the UAs and operated by CityLeap through Bristol City Council (BCC) on behalf of the West of England's Authorities, will act as the Charge Point Operator (CPO). Revive will be contracted to procure and deliver the required charging infrastructure on an output-based model. In construction terms, the outputs can be summarised as follows:

- Land preparation works
    - Site surveys
    - Civil works
    - Electrical enablement works
- EVCP hardware
- EVCP connection to energy grid (DNO cost)
- EVCP installation

The level of design and planning varies between sites, as shown below in **Error! Reference source not found. 31**. Within Revive's model each UA is responsible for their own site identification, design and enablement works, however the EVCP hardware and installation is provided through Revive's procurement framework.

Table 31: Level of site design and preparation completed to date

SGC	Detailed costings and design completed, including DNO connection quotes.
BCC	Detailed site surveys completed. Design work will commence once funding secured.
B&NES	Sites identified through desktop surveys and officer knowledge. Design work will commence once funding secured.

5.3 Delivery Strategy

There are typically three types of delivery strategies employed for the provision of publicly accessible EV chargers. These strategies are:

1. Fully private sector funded
2. A concessionary arrangement
3. Public ownership

There are advantages and disadvantages associated with each of the delivery models, as outlined in **Table 6, Section 2.6**. The best approach depends on the type of sites and chargers to be deployed, as well as the hosts' attitude to risk, level of funding and resources.

5.3.1 Public Ownership

The most common model to date in the UK has been the publicly funded model, where local authorities (LA) define the requirements and fund the capital investment, or at least part of those investment costs using funding grants.

All charge point costs are paid for by the public sector, with capital and maintenance costs recouped from usage charges. Charge points are owned by the public sector, with back-office and operation of charge points typically contracted to a private sector partner (PSP) for a fixed fee.

The fully public model entails the greatest role of the LA, as they are funding installation, enabling works and operating costs, but in doing so also retain all the revenues generated by the scheme. The LA retains ownership of the charge point and electrical connection. Typically, the LA would contract a charge point operator (CPO) to operate and maintain the charge points. The cost of the CPO may either be covered through taking a share of the revenue generated, or on a fixed rate basis regardless of utilisation.

The public model is expected to remain the dominant model in areas where the commercial case does not appeal to private sector investment, either because the utilisation is likely to be modest or the delivery costs are high. In particular, on-street charging and rapid or ultra-fast charge points in rural areas, or areas with high connection costs, are expected to continue to require some form of public sector support to make the investment case.

In the longer term, EV charge points are likely to be delivered on an increasingly commercial basis in many settings, as the number of EVs on the road increases and business case improves. The public sector role is expected to evolve towards a greater focus on the remaining hard to reach areas.

5.3.2 Fully Private Sector Funded

A wide range of private sector companies with differing interests and backgrounds have entered the burgeoning EV infrastructure market. These range from oil and gas companies, start-ups and innovators, often with a technology or renewables background, automotive OEMs and electrical hardware manufacturers.

In the Fully Private Sector Funded model, all costs are borne by the CPO, with a long-term lease/licence over which the CPO can recover their costs. This option is similar to a 'do nothing' approach since no public funding is being provided for charge points. However, a local authority (LA) can decide which parts of council land (e.g. car parks) to lease/license, for how much, and can add any requirements for CPOs to comply with. The disadvantage is the lack of control that the CA and UAs would retain over the operation and location of sites.

5.3.3 Concessionary model

The Concessionary Model is one where the public sector either partially or wholly funds the installation of charge points, which are then operated and maintained by a private sector partner (PSP) for an agreed period under a profit share arrangement. In the partially funded option, the PSP also invests in the capital costs.

In broad terms, the greater the share of the risk taken on by the LA through a public model, the greater their potential revenue share and control. Conversely, when the concessionaire has a larger stake in the investment, they will typically require more assurance over levers such as pricing or longer contracts, in order to be able to recoup their investment.

A key advantage of the Concessionary Model option is that the public sector can 'package' more profitable and less profitable sites together, encouraging private investment in areas which would otherwise be underserved for EVCPs.

5.3.4 Selected Delivery Strategy

The delivery strategy selected for this project is the Public Ownership model, which will require the CA and UAs to fully fund all of the EV charging infrastructure costs. Charge points will be owned by the public sector, with back-office and maintenance contracted to a third party.

The capital investment will be covered through a grant of £4.9 million from the West of England Green Recovery Fund. Additional funding will be provided through the Department for Transport (DfT) ORCS (On-Street Residential Chargepoint Scheme) and by the South Gloucestershire Climate Emergency Fund.

The ongoing operating costs, including maintenance, back-office, officer time, will be recouped from tariffs charged to users, with any surplus invested back into the network.

5.3.5 Justification for Selected Delivery Strategy

The scheme objectives include the aim to create 'equitable access to charge points', 'plug the gaps left by the market' and 'unlock the adoption of EVs by households without access to off-street charging'. To achieve these aims it is important to be able to choose the exact locations of the EVCPs to be installed, and this has been done through the detailed site selection process which identified areas best aligned to these objectives.

Both a concession or private sector funded model would require a partnership to be established with a private CPO operator. To ensure they obtain a suitable return on investment these operators aim to prioritise the highest utilisation locations, which are least likely to be intersect with the locations which meet the social equity aims of the project.

It is acknowledged that the CA and UAs aspire to obtain private sector investment in future rounds of charge point roll outs but extensive preparatory work will be required to ensure that any schemes tendered for are both attractive to private CPOs whilst also meeting all relevant objectives of the West of England EV Strategy (draft). An additional benefit is that this scheme can be delivered at pace to meet existing demand for chargers in the region and accelerate the uptake of EVs in the short term.

Experience from the existing Revive network and other networks across the UK shows that there will be variation in the utilisation and subsequent revenue at each site. The viability of the scheme depends on the network as a whole being profitable, even if some sites are loss making. The financial modelling (carried out in Section 4) forecasts that the expansion of the network would generate a profit surplus throughout the fifteen years of the scheme lifetime. It is therefore viable to pursue a Public Ownership model if Green Recovery Fund grant funding can be obtained for the upfront capital costs.

The impact on the existing Revive network is outlined in Section 4.5. There are sufficient resources amongst officers to manage the expansion and the forecast revenue has potential to increase the overall income of the network which can be reinvested in additional chargers in the future.

5.4 Procurement Strategy

Under UK Treasury Green Book guidance, the strategy by which the required services, supplies or works can best be procured must be set out. This also needs to be in accordance with established rules and regulations and the commercial strategy of the overarching organisation responsible for delivery of the scheme.

5.4.1 Selected Procurement Strategy

The preferred model selected for this scheme, is to use the existing procurement processes already set up by BCC (now through CityLeap) for the Revive Network where possible. This will capitalise on existing work completed to set up a procurement route, minimise officer time and shorten the project timeline. Lamp column charging equipment is not available through the existing suppliers and alternative suppliers will be procured.

The procurement models has three elements, each of which is required to of the goods and services required to complete the scheme; three different procurement exercises will be completed. These are:

- Revive Procurement Model for Fast and Rapid Charge Points
- New supply agreement for On-street Residential Charging Technology
- Costs not accounted for within the above supply agreements, provided by the UAs internal teams

5.4.2 Revive Procurement Model for Fast and Rapid Charge Points

As part of Go Ultra Low West (GULW, the £7 million project to accelerate the purchase of EVs across Bristol, South Gloucestershire, and B&NES), BCC, as the lead UA partner for GULW, established a single supply agreement for the procurement of EV charge points. EV charge points are purchased by BCC on behalf of BCC and the other Unitary Authorities. The charge points are then owned a by the Unitary Authorities and operated by Revive on their behalf.

Using the ESPO 636_17 framework, a competition tender was launched for the supply of fast and rapid chargers, along with maintenance and back-office systems. BCC has a price schedule from the successful bidder Yunex Traffic Ltd. (formerly Siemens Mobility). This includes sub-contractor Equans (part of Engie EV Solutions, formerly Chargepoint Services) who provide the CPMS back-office services. The goods and services included in the agreement are shown in the box below.

The contract is for “5 + 5” years (from May 2019 to May 2024 for the initial contract period).

The contract also includes discounts for volume purchases (for items 11-50 and 50+ on certain items). This offers increased Value for Money (VfM). The contract has spare capacity within the published limits and should there be a need to extend this, BCC’s

Procurement team have provided a pathway to publish an increase in the publicised contract value (up to 50%, and beyond if necessary).

- 7kW dual-socket fast charge points (post/wall mounted, floor mounted)
- 22kW dual-socket fast charge points (post/wall mounted, floor mounted)
- 7-22kW single-socket fast charge points (post/wall mounted, floor mounted) an option which has not been used, but was there just in case
- 50kW triple tethered cable rapid charger (floor mounted)
- Delivery, installation and commissioning to a 'final-fix' solution prepared by each unitary authority
- A number of optional extra add-ons such as mounting posts, signal boosters and contactless payment terminals
- Charge point management system (CPMS) back office facilities to operate the charge points, including a white label option for an "own branded" network;
- Planned operational costs (covering annual warranty, planned maintenance inspection, and annual CPMS back-office subscription costs)
- Additional setup costs and communications costs

5.4.3 Variations / New or Upgraded Technology

Revive has already proceeded with variation offers made by Yunex. These cover further add-ons to existing products (e.g. contactless payment terminal upgrades).

A pathway with BCC's Procurement team has been agreed to procure an upgrade covering 60-120 items and up to 350kW ultra-rapid charge points. These will utilise the existing supply agreement and this will be advantageous as it will avoid the need to carry out a further procurement exercise.

This represents the current procurement model and the one that Revive will continue to use for Green Recovery Funding (GRF). Should there be any variation to this, this will be as a result of a novation of current contract or establishing a duplicate supply agreement for the CityLeap JVCo.

5.4.4 On-street Residential Charging Technology

Revive is unable to procure the required lamp column chargers for on-street residential charging through the existing supply agreement with Yunex Traffic Ltd. For this reason, there is a requirement to set up a separate agreement for this type of charger. Revive officers are preparing a separate supply agreement for the on-street residential EV charge points. Soft market testing has been carried out and a preferred supplier identified.

The goods and services included in the agreement are listed below:

- 3-7kW single-socket fast charge point (external post mounted)
- 3-7kW single-socket fast charge point (internal lighting column mounted)
- 11-22kW single-socket fast charge point (external post mounted)

- Delivery, installation, commissioning
- Charge point management system (CPMS) back-office to operate the charge points, including white-label option for own branded network
- Planned operational costs (covering annual warranty, planned maintenance inspections and annual CPMS back office subscriptions)
- Additional setup costs and communications costs

The prices used for the lamp column chargers are based on cost estimates received from market engagement during the On Street Residential Charging Scheme bids and were used for the successful BCC bid. There is a healthy risk allowance for BCC on-street lamp column chargers detailed in the Quantitative Risk Assessment (see Appendix 4).

As per the schedule it is estimated that four-months is required by CityLeap officers to complete this procurement (however there is some float included in the BCC on-street schedule).

The intention is to award a short-term contract for the provision of the 150 lamp column chargers in this scheme. In 2024 the current supply agreement with the provision of fast and rapid chargers is due for re-tender in 2024 there will be an opportunity to re-tender for a new contract that includes lamp-post chargers. This will then meet the needs of future projects.

5.4.5 Goods and services not accounted for within the above supply agreements

Where possible Revive, the CA and the UAs will provide services using their existing in-house resources. This approach has been established under the existing Revive network. It is proven to work effectively and reduces costs. The following goods and services will be provided in this manner.

The UAs will carry out the charge point delivery on behalf of Revive. This process has been formalised in the existing Revive inter-council agreement. The Revive network board, of which all UAs are a part, will plan and oversee the implementation process and then delegate out tasks to the UAs for chargers in their respective areas. They will provide the following services:

- Site design and enabling works are undertaken by the host Unitary Authority
- Project management for site delivery is undertaken by the host Unitary Authority

Revive officers, previously part of BCC and now moved to City Leap will provide the following services:

- Reactive maintenance, to be arranged on an ad-hoc basis by Revive, with income from the network used to offsets these costs
- ‘Middleware’ contract management and service level monitoring to be carried out by Revive. GULW project costs have covered this to date, but going forward this will be funded by income from the network

6 THE MANAGEMENT CASE

The Management Case sets out the processes and controls in place to manage the implementation of the scheme, and to track and realise future benefits. It demonstrates the way in which the scheme will be delivered in accordance with best practice, outlines timescales, and establishes the governance structure and assurance framework that will oversee the project. The sections below cover:

- Organisational Structure and Roles
    - Stakeholder Mapping
- Governance Model
- Programme Plan
- Monitoring and Evaluation Approach
- Risk Management Strategy
- Land Acquisition, Planning and Other Consents
- Engagement and Consultation
- Equality Impact Assessment
- Communication Plan

6.1 Organisational Structures & Roles

6.1.1 Organisational structure

The West of England Combined Authority (the CA) supports the Local Enterprise Partnership (LEP) and the unitary authorities (UAs) of Bath and North East Somerset (B&NES), Bristol (BCC) and South Gloucestershire (SGC). The Combined Authority makes decisions and investments that will provide a wide range of economic benefits across the region. The CA is committed to decarbonising the region by 2030 and a key priority to meet this target is supporting the uptake of zero emission vehicles through the provision of charge point infrastructure. The organisation structure applicable to the EV charging scheme is as follows:

Figure 22: Organisation structure for the £4.9m GRF EV charging scheme

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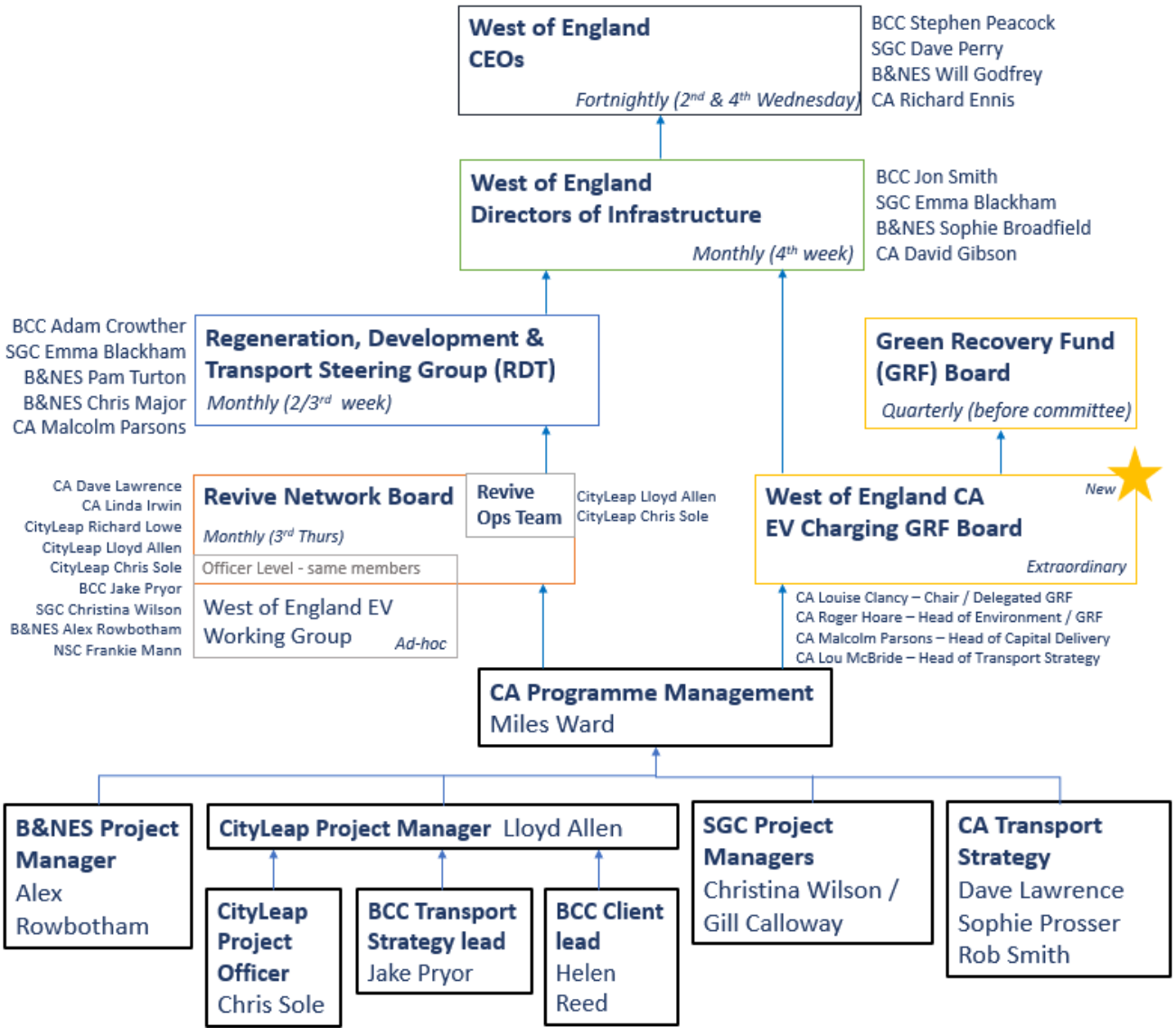


6.1.2 Project Experience

The UA officers in the project team have a wealth of experience delivering EV charging points across the region from the £7.1m Go Ultra Low West (GULW) programme, which included the installation of 120 EV charging points across the region from 2017 to 2021, and the launch of the Revive network (taking over from the previous Source West network). As part of the GULW programme, larger charging hubs were installed in key locations, such as the Bristol & Bath Science Park in South Gloucestershire, which is an exemplar and template for an innovative community hub, and the Eastville Car Park charging hub in Bristol, an exemplar and template for destination charging hubs. The CA team brings a wealth of experience from working on EV charging in both the private and public sector in the West of England, and also experience of Go Ultra Low schemes in other areas of the UK.

6.1.3 Roles and responsibilities / internal stakeholders

The scheme will be delivered jointly by CA and the participating UAs. The roles and responsibilities within the organisational structure are presented in **Table 32** below.

Table 32: Project Roles & Responsibilities

Scheme participants	Role	Responsibilities
CEOs (Chief Executive Officers)	Escalation	Accountable for reporting upwards to Mayors/Council Leaders/Government as required Responsible for approving UA funding changes (within scope of organisational sponsorship)
Directors	Escalation	Accountable for reporting upwards to CEOs as required Responsible for approving site changes between intervention types & UA funding changes (within scope of organizational sponsorship)
RDT (Regeneration, Development & Transport Steering Group)	Steering Board	Responsible for approving site changes between intervention types & UA funding changes (within scope of organizational sponsorship) Responsible for overseeing decisions and providing approval on decisions made
CA EV Charging GRF Board	CA Strategy & Funding Oversight	First point for formal discussion of request for additional funding or time Accountable for reporting upwards to RDT/Directors as required
Revive Network Board	Regional EV Strategy	Responsible for approving sites / authorizing changes to site locations (within scope of organizational sponsorship) Focus on decision making for the specifics of operation, delivery, communication and marketing for Revive
Revive Operational Team (led by BCC)	Day-to-day operations	Manages maintenance, commissioning, and communications whilst delivery of specific works for EVCPs is undertaken by Highways teams at the UA level

Scheme participants	Role	Responsibilities
UA Officers	Project Managers	Accountable for commissioning work as approved by the Revive Network Board and or developing/delivering policy as instructed/delegated Dealing with escalations for Risks, Issues and Dependencies Approval of appropriate gateways within delegated authority Accountable for ensuring that any work commissioned is in line with regional priorities as agreed in policy & strategy, government policies/strategies etc. Responsible for ensuring the group has sight of pipeline and any potential planning constraints/risks/dependencies generated by other projects Accountable for completing actions as required by the group
CA Project Manager	Programme Management	Accountable for Programme Delivery (within scope of organizational sponsorship), presenting spotlights and requests for key decisions as requested Accountable for providing status updates to the Revive Network Board, CA EV Charging GRF Board and RDT as per agreed quality, format and timings Approval of appropriate gateways within delegated authority

6.1.4 External stakeholders

EV charging infrastructure concerns and affects multiple stakeholders with varied interests. Identifying these stakeholders will be critical as the scheme moves forward. This will ensure that their expectations and concerns can be understood and addressed. Key stakeholders based on experience of similar projects are presented below. This stakeholder list will be refined as the programme moves forward with the relevance of each stakeholder and additional stakeholders being identified as necessary.

Table 33: External stakeholders

Stakeholder	Description
Distribution network operators (DNOs)	Own and operate the electricity infrastructure across the UK. There are six DNOs across the UK which operate regionally. DNOs are usually involved with EVCP provision when grid capacity upgrades are required. The DNO covering the three UAs is National Grid.
Energy providers	The electricity supplier, who determines the tariff for the electricity cost, whether renewable energy is offered, and will be responsible for any new energy meters where required.
Charge point operators (CPOs)	Responsible for operating the EVCPs, taking payment and maintaining the infrastructure. Examples of CPOs include Revive and GeniePoint.
Charge point manufacturers and suppliers	Responsible for producing the EVCP hardware and supplying them to the CPOs, or directly to a client for implementation. Several CPOs manufacture and operate their own units, such as GeniePoint, BP Pulse, Podpoint and EO. However, many purchase in the hardware from 3rd party suppliers, such as Osprey and InstaVolt.
Change point installers	The contractors who install the units themselves, and may be electrical contractors/ civil engineers who install a wider range of equipment, or a specialist contractor for EV charge points specifically. Some CPOs/ suppliers have their own team of in-house installers, others contract out with a network of approved installers, where installers are required to have completed specific training and certification to install their EVCPs.

Stakeholder	Description
E-mobility service providers	An e-Mobility Service Provider (eMSP) provides the customer facing aspects of the charging network. eMSPs help drivers find charging stations, start charging events and pay with various methods. In the UK in many cases the CPO also performs this function. However, some eMSPs permit roaming across multiple networks. In these cases the company, e.g. an energy utility, typically offers the service to an existing customer base. In which case the eMSP's EV charging management platform needs to integrate to leading eRoaming platforms such as e-clearing.net, GIREVE, and Hubject.
Charge point software providers	Supply the software that runs on the chargers, and/or the platform on which the chargers are managed as part of a wider network. As with a number of the other roles, there are blurred boundaries between these various roles, with several charge point manufacturers providing their own propriety software, whilst others come with limited software functionality, and are more typically set up on a wider platform.
Government	The Office for Zero Emission Vehicles (OZEV) spans the Department for Transport (DfT) and the Department for Business, Energy & Industrial Strategy, with the responsibility for driving national EV infrastructure strategy, policy and legislation.
End customers	Users of the EV charging facilities, including individual EV owners and institutions customer such as fleet operators.

6.2 Governance Model

6.2.1 Reporting

The funding of the EV charging project is primarily being provided by the Combined Authorities' (CA) Green Recovery Fund. Some additional funding has been secured via an Office of Zero Emission Vehicles (OZEV) On-street Residential Charging Scheme (ORCS) grant and as well as capital funding from SG. The CA is the sponsoring organization with responsibility for ensuring that the funds allocated are managed effectively to ensure that the benefits are realised.

The UAs have been chosen to deliver the works in their areas, as per the existing Revive Network arrangement. The CA will issue Grant Offer Letters on FBC approval to each UA. As this will be a live construction programme, site visits will be conducted by all levels of the organisation structure throughout the life of the project, and ad hoc visits by the CA Project Manager (PM) are to be expected. Although CDM 2015 compliance is expected with the UAs undertaking the role of Client, the CA will need copies of major statutory documents such as appointment letters, Pre-Construction Information Packs (PCIPs) and Construction Phase Plans (CPPs) where appropriate.

The day-to-day management of the project within CA will be led by a PM, in collaboration with the programme specific EV Charging GRF Board. Both the EV Charging GRF Board and Revive Network Board report to the Regeneration, Development & Transport (RDT) Steering Group. The SRO for this project is Malcolm Parsons who is a member of the EV Charging GRF Board and chairs RDT.

The EV Working Group provides a platform for knowledge sharing, strategic planning and management of the project. Working group meetings have an important role to play in ensuring that progress is maintained for all activities, and that there is an effective link between project delivery and relevant expertise functions across different parts of the organisation.

The RDT Steering Group will:

- Be accountable for oversight of the work programme;
- Translate strategy into delivery;
- Oversee assignments of work & project setup;
- Regularly report to Directors on progress; and
- Oversee decisions and give final sign off on decisions made.

The CA EV Charging GRF Board will provide a link between the Capital Delivery and Transport Strategy areas of the CA organization, and link to the Environment Directorate and overall GRF budget holder (this is the Director of Environment, Roger Hoare). The board will also be a first escalation point for the funding profile, benefits realisation changes and any change in the overall funding position.

The UA PMs will be asked to submit a dashboard every month summarizing costs, schedule, and risk information. This will be supported by a monthly progress meeting between CA & the UA PMs where the dashboards, live risk register and change logs will be reviewed, updated, and agreed by all parties.

Claims will be processed on a quarterly basis, submitted by the UAs to the CA PM and reviewed offline. If issues arise that require escalation, these will initially be raised at the monthly progress meeting or if more urgent via email or phone to the CA PM. If the issue cannot be resolved at this meeting, the issue will be taken to either the EV Charging GRF Board or the Revive Network Board in the first instance (dependant on issue type as per the Change Approval Gateways). If required, this will then be further escalated to RDT.

6.2.2 Change Approval Gateways

Due to the straight-to-FBC approach for the EV Charging £5m GRF project, and the programme having over 200 sites, with some having detailed design yet to be developed, Change Control and the approach to Change will need to be robust but proportionate. As such, Change Approval Gateways are laid out below.

Change Approval Gateways (within approved FBC programme value):

General Site Approval:

Revive Network Board	established way of working

Site Change between interventions within same UA:

Revive Network Board	5% and under of GRF programme value
RDT	between 5-10% of GRF programme value
Directors	over 10% of GRF programme value

Change in Funding between UAs:

RDT	under 2% of GRF programme value
Directors	between 2-5% of GRF programme value
CEOs	over 5% of GRF programme value

Programme Level Contingency Draw Down:

CA Programme Manager	0.5% and under of GRF programme value
CA EV GRF Board	0.5-1% of GRF programme value
Directors	1-2% of GRF programme value
CEOs	over 2% of GRF programme value

Any applications for further budget or a change in benefits (i.e. change in the number of sites / chargers), or re-profiling costs between years, will be first taken to the CA EV GRF Board by the CA PM and then taken through the correct decision pathway as per the CA Defined Tolerances.

6.3 Programme Plan

A programme plan has been developed by the CA setting out the key milestones and their dates in **Table 34** below. This is summarised below (Level 0) however a more detailed project plan can be viewed in Appendix 8: Level 3 Schedule.

Table 34: Key Milestones

Key Milestones	Baseline dates
Year 1: 150 lamp column charger points installed	March 2024
Year 1: 31 charge points installed	March 2024
Year 2: 32 charge points installed	March 2025
Year 3: 43 charge points installed	March 2026
All sites delivered	**March 2026**

6.4 Monitoring and Evaluation (M&E) Approach

Monitoring and evaluation are essential elements of any major project. They help determine the extent to which it meets its objectives and delivers the expected benefits, helping to improve future decision-making. The HM Treasury Green Book (2022) states that monitoring and evaluation should be part of the development and planning of a project. In general, monitoring seeks to check progress against planned targets and involves data collection to improve current and future decision making for successful delivery. Evaluation is the assessment of the initiative's effectiveness and efficiency during and after implementation. It seeks to assess the scheme's design, implementation and whether the anticipated outcomes have been realised.

The Green Book stipulates that monitoring and evaluation of evidence and reports should be actively owned by the Senior Responsible Officer and the team responsible for an intervention’s delivery. A detailed monitoring and evaluation method will be developed by the CA prior to implementation of the EV charging infrastructure. The plan is to have monitoring and evaluation as part of the ongoing management of the scheme. It is expected that both the programme delivery team and Revive Network will monitor and evaluate EVCP performance. The key metrics will be updated and reviewed on a quarterly basis, starting three months after the first delivery of charge points.

The CA has identified some key activities and indicators that will be monitored. The list below is not exhaustive, however, and will be developed further with the Revive Network and UAs.

The current suite of data available is as follows:

- Number of sessions
- Total kWh used
- Number of charge point user registrations with the Revive Network
- Number of units installed
- Revenue – network total and per EVCP;
- Costs – construction and operation

These categories of datapoints are currently restrictive, only offering basic data points. This is due to the back-office system Revive are currently operating. However, the contract and framework for this system (as well as the EVCP supply contract) is planned to be re-tendered in 2024, at which point further data stipulations are planned to be incorporated into future specifications.

The intent of the M&E plan is to provide data on a quarterly basis for each installed Charge Point on the GRF scheme and associated match funding as per Tables 35-37 for at least a 5-year M&E period from March 2026 to March 2031.

This data will be provided to the CAs Policy & Strategy team for analysis with the intent that information will then be summarised 6-monthly to the Environment team in-line with the Climate and Ecological Strategy and Action Plan (CESAP) reporting cycle. Please note the internal M&E function at the CA is still being developed by the Policy & Strategy team's analysts.

By analysing the data points described above, and in the tables below, and comparing with the previous data available from the Revive network the uplift in EV's due to the scheme can be estimated and benefits quantified and compared to the original business case, including the reduction to Scope 1 emissions in the West of England.

Table 35: Usage reporting aspirations for each charge point

Data Item	Description	Fields / Format	Measurement
Charge Point Availability	Average time the Charge Point is fully operational as a percentage of the total time the Charge Point could be available in the month	xx.xx%	Availability = total number of minutes Charge Point fully operational (including time when Charge Point in use) in the month / total number of minutes Charge Point could be available in the month*100 Calculation should be made on a daily basis and an average taken over the month.
Utilisation Rate	Total time the Charge Point is in use as a percentage of the total time the Charge Point is fully operational in the month.	xx.xx%	CP utilisation rate = total charging time in the month in minutes / total number of minutes Charge Point fully operational (including time when Charge Point in use) in the month*100 Calculation should be made on a daily basis and an average taken over the month.
Total number of charging sessions	Total number of charging sessions for each Charge Point in the month	Number	N/A
Total number of unique customers	Total number of unique customers who have used the Charge Point in the month	Number	N/A

Data Item	Description	Fields / Format	Measurement
Total kWh delivered	The electrical energy transferred during the charging event for each Charge Point in the month	Number kWh	N/A
Total duration of charging sessions	Total number of hours Charge Point is being used for in the month	Number hours	Sum of each charging session per charging point in hours for the month
Breakdown of usage by individual charge	The amount of electricity consumed by each charge and time, date of charge.	Number kWh	N/A
Total percentage Charge Point availability	Average Charge Point Availability across the Revive Network	xx.xx%	Average of Charge Point Availability across all Charge Points in GULCS network

Table 36: Maintenance and fault reporting aspirations

Data Item	Description	Fields / Format	Measurement
Total number of incidents/faults raised	Compared to Service Level Agreement with back-office & maintenance provider	Number	Total number of incidents and faults raised per period
Breakdown by Incident Type	Compared to Service Level Agreement with back-office & maintenance provider	Number	N/A
Overall percentage of incidents resolved within SLA timeframe	Compared to Service Level Agreement with back-office & maintenance provider	xx.xx%	N/A

Table 37: Additional aspirations

Data Item	Description	Fields / Format	Measurement
Overall percentage of correspondence responded to within SLA timeframe	Compared to Service Level Agreement with back-office & maintenance provider	xx.xx%	N/A
Electricity Costs	Total electricity cost in the month per Charge Point	£	N/A
Pay-as-you-go average price per kilowatt hour	Average price charged to Customers for use of Charge Points on a pay-as-you-go basis	£	Average of Average price per kilowatt hour

6.5 Risk Management Strategy

The management of risk and uncertainty is critical to the successful delivery of the scheme. It is a process that helps identify threats to project delivery and enables practical risk management actions to be assigned. The following process covers a typical approach to risk management and has proven to be effective across various projects:

- Risk identification
- Risk quantification – assessing the impacts of risk
- Managing risk

Completion of each of these processes enables the population of a risk register for operations and CPO use.

6.5.1 Risk identification

During the preparation of this business case, two joint workshops were held with attendees from the participating UAs and CA. In the workshops, potential risks were discussed, and these included the probability and impact of the risk becoming material (with corresponding mitigations to manage the risks). The risk register will also be a 'live document' and this will be reviewed regularly so that individual risks can be monitored and updated. The current risk register, presented in **Table 38** below, provides an overview of the risks associated with the overall programme.

Table 38: Risk register summary

Risks	Probability	Severity	Mitigation
Delivery time scale / desire to get boots on the ground ASAP if FBC approved	Medium	Medium	Expectations and timeline have been set clearly & pragmatically.
Lack of engagement from operators	Low	Medium	Existing relationship with Revive Network, the CPO for the schemes. Engagement has already started and will continue.
Financial model is not viable	Medium	High	The financial model will be reviewed regularly and updated based on inputs from the Revive Network.
Supply chain delays	High	High	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with cabling and electrical assets. Plan delivery according to lead times given by suppliers and manage expectations on timelines.

Risks	Probability	Severity	Mitigation
Site selection	Low	Medium	Location selection is backed by extensive research, and the plan is to finalise the site selection with the UAs. If preferred sites cannot be used, back-up sites have already been identified.
Grid connection	Low	High	Programme wide contingency pot / Long-list of sites developed to allow for back-up sites. Engage with National grid.
Performance risk	Medium	High	The EVCPs will be delivered in phases, which will help to deliver EVCP as the demand increases. Furthermore, the EVCP sites will be advertised to ensure local residents are aware of the new EVCPs.
Permission from landowners	Low	Low	CA will engage with landowners to get a wayleave agreement. Revive Network in charge of getting permission for sites and handles the legal agreement. UA has existing private host lease agreement template. If preferred sites cannot be used, back-up sites have already been identified.
Lack of detailed designs	Low	Medium	Although the designs are at a relatively early stage, they are sufficient for evaluation purposes at this stage of the business case cycle and can be revisited and 'firmed up' prior to project delivery.
Delays in acquiring Traffic Regulation Order (TRO)	High	High	Start process to acquire TRO early, as soon as FBC has been approved.
Buried services discovered during construction	Low	Minor	Utilities drawings will be checked, and sites will be surveyed.

6.5.2 Risk quantification

As new risks are identified, they will be quantified by assessing the severity of the impact on the project. These are scored using a three-scale point system covering Low, Medium and High-cost mitigations.

The CA has developed a Quantitative Risk Assessment (QRA) process with inputs from the UAs (see Appendix 4). This was used to inform the Programme Level contingency pot in the Financial Case.

6.5.3 Managing risks

Following the initial assessment of risks, the plan is to follow a systematic approach responding to these risks as well as allocating responsibility to the most appropriate party in line with the governance arrangements. Potential strategies for developing a suitable response plan include:

- Accept or tolerate consequences if the risk occurs – if a) the cost of taking any action exceeds the potential benefit gained, or b) there are no alternative courses of action available
- Treating the risk – Continuing with the activity that caused the risk by employing four different types of control, including preventative, corrective, directive and detective controls
- Transferring the risk – Risks could be transferred to a third party e.g. insurer or contractor
- Terminating the activity that gives rise to the risk

6.6 Land Acquisition, Planning and Other Consents

192 of the 204 required sites are located on West of England UA land. However, twelve sites in B&NES and SGC are located either on Parish Council or private land. This is due to the lack of UA-owned land in areas that are a high priority for public sector EV Charging interventions.

The project will follow the precedent set by the Revive Network in the past to gain way-leave agreements in order to install chargers on this land. Although it may potentially be time-consuming to get these agreements, it is relatively low risk as the majority are owned by Parish Councils who are keen for this type of investment in their local areas. For this reason, all sites on non-UA land will be moved to the third year of delivery to allow for these legal agreements to be put in place.

Traffic Regulation Orders (TROs) will be sought where applicable for on-street charging points and destination charging sites. South Gloucestershire have already started this process using their On-street Residential Chargepoint Scheme (ORCS) funding. TROs are desirable for on-street charging points to avoid charging points being ICE'd (blocked by an Internal Combustion Engine vehicle). Consideration has been given to how this aligns with RTRA 1984 and LA TRO procedures 1996. The approach of this project follows the example of completed schemes in Greater London, where the majority of lamp column chargers were installed with no TRO in place. This is still being discussed and has therefore been included in the quantitative risk assessment if the assessment changes during the life of the programme.

6.7 Engagement and Consultation

Each UA will manage their own engagement and consultation plans as best fits the nature of their sites. However, there has been engagement and consultation taking place across all UAs on the Revive Network through the Travel West website, with the public being able to suggest new sites for EVCPs. This data has been used to inform site selection.

6.8 Equality Impact Assessment (EqIA) Summary

As the EV Charging GRF Programme is based on intervening where the private sector is likely not to invest, most sites are focused on areas that are in the lower percentile bands of the index of multiple deprivation. This is in order to close the gap with respect to EV ownership in these communities. 86% of the chargers are focused on addressing this social equity issue in residential areas, whereas the remaining destination charging sites are more commercially focused. The intent is that these more commercially viable sites will help cross-subsidise the larger number of social equity sites. For the full EqIA see Appendix 9 – however please note this is a living document and will be added to throughout the life of the project.

6.9 Communications Plan

6.9.1 Overall communication aims of this plan

Communication activity will be based on the following principles:

- All communications use clear, accessible language
- Benefits continue to be promoted and communities kept updated
- Concerns of local people are addressed as far as possible
- Directly affected residents and businesses are informed
- Specific communication activities focussed on the right level for particular stakeholders. Different types of stakeholders have different interests and concerns and require a different level of information

The community engagement principles are:

- Early engagement of stakeholders to inform and influence the process
- Regular engagement and feedback
- Building long-term relationships with community groups throughout the different stages of the project
- Keeping local people updated with appropriate levels of information about forthcoming phases of work
- Regular meetings with stakeholder bodies
- Regular informal and formal communication with local decision makers

The purpose of the communications are:

- To build public knowledge and understanding of the overall corridor improvements
- To ensure that the public, businesses and stakeholders are aware and informed that the scheme is progressing and to encourage a positive response
- To explain the benefits of the scheme will bring to users and non-users.
- To inform residents and businesses in the immediate vicinity of the work sites of timescales and traffic management during construction and the mitigation measures in place
- To update all on progress throughout construction
- To manage any opposition to the scheme
- To update when work is complete

6.9.2 Stakeholders and audience

Public:

- Residents living in the immediate vicinity
- Businesses
- Wider public
- Community organisations/institutions
    - Community groups may be affected and will likely have interest in project
- Media; ultra-local, local and regional
- Landowners and developers affected by the proposals

Internal:

- Ward members
- CA & UA political administration
- CA & UA staff

Other:

- Town / Parish Councils
- Local MPs

6.9.3 Key messages

Messaging will continue to be developed as the project evolves, however a number of key messages have been identified. They include:

- The scheme is focused on providing electric vehicle charging in areas where there is little or no residential off-street parking
- The scheme will make it easier for nearby residents to make the switch to electric vehicles by providing charging infrastructure across the region
- The scheme will lead to an improvement in air quality for residents by encouraging the switch from internal combustion engine vehicles to electric vehicles
- The project is primarily being funded by the West of England Combined Authority

6.9.4 Communication matrix and timeline

Communication channels to consider:

- Press releases
- Letters to local residents, businesses and other stakeholders
- Emails to stakeholders
- Dedicated email account for project
- Project webpage on TravelWest website
- CA & UA social media platforms
- Briefings – online and in person
- Public drop-in sessions
- Attend existing public meetings, e.g., Community Engagement Forums
- CA & UA newsletters
- FAQ document
- Posters and postcards
- Adverts in local press

Immediate and long-term communications timeline:

Table 39 below shows the proposed timeline of communications and engagement activity for the project. This is indicative only and is likely to be subject to change as the project evolves.

Table 39: Communication timeline

Timescale	Milestones	Activity to consider
June/July 2023	Consultation Launch	• Brief local members • Press release • Letter drop • Email to stakeholders • Social media posts • Council newsletter • Web update • Launch of online survey • Posters / postcards
Ongoing	Consultation ongoing	• Social media posts • Council newsletter • Presentations to groups and organisations

Timescale	Milestones	Activity to consider
Aug/Sep 2023	drop-in/online events	• Social media posts • Council newsletter
June/July 2023	Funding application / announcement	• Press release • Brief local members • Email to stakeholders • Council newsletters • Update project webpage • Social media posts
October 2023	Construction starts	• Press release • Brief local members • Attend public meetings • Social media posts • Letter drop • Email to stakeholders • Council newsletters • Update project webpage • Road signs
Ongoing	Ongoing construction	• Social media updates • Filming and photo opportunities • Webpage and FAQ updates • Responses to enquiries • Letter drops • Email to stakeholders • Council newsletters • Press releases when appropriate • Site visits • Brief local members • Attend public meetings
March-April 2026	Completion	• Press release • Brief local members • Photo opportunity • Video/drone footage • Social media posts • Stakeholder/business briefings • Letter drop • Council newsletters • Email to stakeholders • Project webpage update

APPENDIX 1: EV STRATEGY: RECOMMENDATIONS

Nine key objectives have been identified which the Combined Authority and the LAs will need to implement. Within each objective a number of distinct actions are defined, which will be implemented over the short, medium and long term. The Combined Authority will either lead on these actions or enable the LAs to deliver them.

1.1 Proactivity in providing public EV charging infrastructure

Provide scaled-up, commercially sustainable public charging provision, strategically aligned to wider local transport and energy decarbonisation plans.

A significant increase in publicly accessible charge points is required over the next ten years to meet the forecasted charging demand and support the Combined Authority's decarbonisation ambitions. When the Local Transport Plan is refreshed, it should be aligned with the Combined Authority's EV Charging Strategy and any local area energy planning underway. Producing, publishing and delivering an ambitious EV strategy is a key role and responsibility identified by OZEV for local and mayoral authorities.

Keep a watching brief on central government announcements on new statutory obligations related to EV charging

The Government is looking to take pre-emptive powers, subject to consultation, to ensure there is a clear statutory obligation to develop local charging infrastructure strategies and oversee their delivery. Given its progress to date, the Combined Authority is well-positioned if any obligation materialises, but the potential should be communicated early internally and to members due to the resource and policy implications.

Focus on charging access for residents without off-street parking and establishing good network coverage

Working closely with LAs, the Combined Authority should seek further grant funding available through On-Street Residential Charging Schemes and Local EV Infrastructure Schemes, while leveraging increased private sector investment.

In collaboration with the private sector, Combined Authority should finalise the number of charge points to be deployed over the next 5 years and beyond, informed by the forecasts provided.

The EV Infrastructure Strategy directs authorities to set how charging needs will be met at scale and over time (for example, over five years) and, where possible, ahead of need.

1.2 Promote and support the Revive Network

The Combined Authority should support and promote Revive as the region's publicly operated EV charging network and encourage the LAs to use it as their preferred supplier

Revive has already developed a successful network of charge points, a customer base and importantly, the knowledge and processes for efficient expansion. Whilst it is not currently profit making, the early investment in assets will return profits as EV uptake increases.

Improve upon the existing Revive prioritisation framework
Ensure that Revive prioritisation framework will meet the needs of all the LAs and covers the full range of charge point types which will be required in the future, in both rural and urban areas.

1.3 Private sector partnerships to leverage investment

In the EV Infrastructure Strategy, OZEV states that the market is expected to lead the majority of public charge point deployment. OZEV expects local authorities to adopt a commercial approach which reflects local priorities, maximises opportunities to draw in private investment, and provides long term certainty on availability, reliability and ongoing maintenance costs and revenue generation.

The Combined Authority should adopt a concessionary model to deliver charge points in partnership with the private sector, retaining control of the network delivery to ensure full coverage of charging infrastructure across the West of England.

This model will allow the public sector to support the investment case for delivering charge points in all areas of the West of England but also leverage private sector investment to cover capital and ongoing operational costs.

Significant grant funding is required to ensure that a publicly funded model of charge point delivery does not operate at a loss. It also presents the highest risk in terms of liabilities, stranded assets and ongoing costs to cover operation, maintenance and upgrades of charging infrastructure.

However, at the other end of the scale, a private model of delivery – where an independent CPO fully funds and delivers charging infrastructure – comes with its own disadvantages. With this delivery model, authorities have little control over where charge points are delivered. Many areas in the West of England are unlikely to be commercially viable without public investment and so will not be attractive to the private sector to deliver charge points in these locations. A concessionary model offers a middle pathway, balancing these risks.

The Combined Authority should focus on ensuring gaps filled are in the network

By 2030 it is anticipated that approximately 50% of fast chargers and 10% of rapid chargers may still require some degree of public funding, with the remainder fully funded by the private sector. The strategy sets out the areas with requirements for charge points by 2030 but where the private sector is unlikely to deliver EV charging infrastructure. These gaps are mainly located in rural and low-density residential areas or areas with high connection costs.

These areas are less attractive to the private sector due poor utilisation rates and high enabling costs, and therefore the least profitable and uncertain to ensure a strong return on investment. The areas of highest demand are generally focused in affluent urban areas or at high footfall destinations such as railway stations, supermarkets and town centres, where top-up charging will occur, and it is these locations that the private sector model will deliver charge points. OZEV expects local authorities to consider where and to what extent provision is likely to be met by the market, without additional intervention, for example through destination charging or local electric forecourts.

A key advantage of the concessionary model is that charge point sites can be packaged up so that the commercially challenging sites are delivered together with more lucrative sites. By packaging up a number of sites and inviting concessionaires to operate the sites to agreed terms, authorities can seek to offset the less commercially viable sites with others that are more attractive to operators. This avoids a scenario whereby the Combined Authority and the LAs are left with only the hard to deliver sites, which are likely to be loss-making, though the share of revenue will be significantly lower than in fully public owned model.

Alongside private sector investment, the Combined Authority and the LAs should continue to seek OZEV grant funding from ORCS and LEVI scheme to support equitable provision.

The Combined Authority should actively consider developing contract terms that promote competition and fair pricing across a region, and flexibility as technology and consumer needs evolve.

When partnering with the private sector, the Combined Authority should consider how the Revive network will deliver choice and affordability for drivers. The Combined Authority should aim for a consistent user experience, but this should not necessarily mean the appointment of a single operator. This may serve to limit competition and legislation is driving minimum standards to improve consumer experience. In the EV Infrastructure Strategy, OZEV states that, where possible, local authorities should ensure there is more than one charge point operator within a local area.

1.4 Take a regional leadership role in co-ordinating EV charging

The Combined Authority should lead the region in infrastructure planning and identify opportunities for partnership working with the LAs.

The Combined Authority should co-ordinate EV infrastructure planning, work closely with LAs as the highway authorities to plan for local requirements and produce local delivery plans which are revisited every 18 months.

The Combined Authority should ensure there is clear ownership of planning and delivery across the LAs and lay out the overarching objectives for the region. This is a key responsibility identified in the EV infrastructure strategy. In the EV Infrastructure Strategy, the government expects an EV charge point strategy for an area to be produced by the highest tier authority responsible with transport planning (i.e. the combined authority), in active collaboration with the relevant highway authorities and other councils. Lower tier councils within a combined authority area should be actively involved in the development of these strategies, to ensure that the specific charging needs are incorporated. Strategies should be published

OZEV expects the Combined Authority and LAs to ensure there is clear ownership and resourcing of the planning and delivery of charge point roll out. Local EV charging infrastructure strategies should define the local authority (or authorities) responsible for procuring and managing contracts for delivering charge point infrastructure.

Establish an EV Working Group and revised Revive Network Board

It is recommended that the Combined Authority establish a West of England EV Working Group, as proposed by Revive officers.

The forum will allow officers and representatives from all of the Revive, the Combined Authority and the LAs to come together on a regular basis (i.e.bi-monthly or quarterly) to discuss common issues, to promote good practice, and share information, particularly as planning charge points will impact on neighbouring areas. The forum would build on the positive collective engagement with the LAs undertaken as part of this strategy and allow officers to continue these discussions. OZEV expects LAs to talk a cross-sector approach, drawing in expertise from transport, planning, parking, commercial, property and energy teams.

Leveraging its scale as regional authority, the Combined Authority should establish joint initiatives with the LAs

Managed through the EV Working Group, these initiatives can include:

- Delivering a common and consistent user experience of charge point bays, technologies and payment options: A consistent approach, meeting a minimum standard and allowing easy use by users will give confidence to users that they will be able to use charge points across a given area.
- Develop consistent technical standards: A common approach to providing charge points can speed up delivery as suppliers would benefit by having one specification to work towards and reduces the burden on LAs to develop local specifications or guidance.

Ensure charge points are inclusively designed and accessible for residents, businesses and visitors, and in link with local authorities' legal obligations

This is a new responsibility for local authorities identified by OZEV in the EV Infrastructure Strategy. Local authorities should avoid street clutter, not allow trailing cables unless adaptive infrastructure is provided, and maximise pavement space for those with disabilities.

Charge points must be incorporated into existing street furniture or parking bays wherever possible. British Standards Institute (BSI) is developing charging standards to improve disabled people's experience when using public EV charge points.

Address grid capacity constraints

As DNO connections and upgrades to grid capacity can be costly and create a barrier to the installation of charge points, a regional fund for meeting the cost of grid upgrades will ensure a more equal allocation of charge points.

Ensure internal processes for the installation of charge points (for example grant permissions) are efficient, fast and easy to navigate for delivery partners

This is a new key responsibility for local government identified by OZEV in the EV Infrastructure Strategy.

Coordinate with Western Gateway as they develop regional assessments of charging demand

OZEV expect Sub-national Transport Bodies to lead regional assessments of demand to assist local authorities and electricity network operators with planning charge point roll out, by the end of 2022. This includes identifying areas of demand where there is reliance on on-street parking and from fleet depots.

Raise collective capability

A collaborative, co-ordinated approach can help to reduce local skills and knowledge gaps by bringing together a range of expertise that will help raise the collective capability of the Combined Authority and the LAs.

1.5 Ensure there is sufficient funding for Revive

Drive efficiencies through a regional joint procurement exercise
Working together, authorities will have greater strength when engaging the market, through collective buying power and delivering efficiencies and cost savings through economies of scale. OZEV now expects local authorities to collaborate and use scale as a lever to increase the commercial attractiveness of any proposition.

The Combined Authority may wish to run a region-wide procurement exercise to identify at least one supplier to attract economies of scale and discounts, as well as greater consistency across the region. Interoperability would need to be specified to ensure the region is not tied to the suppliers beyond the life of the contract(s).

Soft market testing with charge point operators
Once the prioritised sites and charge point requirements have been identified, a collective soft market testing exercise with CPOs would engage the level of market interest to be gauged and enable a tender to be scoped that reflects any feedback from suppliers.

Implement the investment proposal short list and long list of proposed schemes
The Combined Authority and the LAs have developed a number of EV charging schemes which can be implemented in the short to medium term and will contribute towards the objectives of this strategy.

1.6 Engage with stakeholders

The Combined Authority as the overarching transport authority is well placed to lead on engagement with stakeholders with an interest in EV charging including residents, businesses and industry. A centralised approach will ensure consistency and ensure information is shared freely.

Develop the TravelWest website as the regional EV charge points webpage
Provide a user-friendly website to invite expressions of interest from residents to gain insights into local demand for charge points. With the agreement of the working group, the Combined Authority could consider identifying a single point of contact, for example for residents wanting to learn about EVs or wanting to request or enquire about a charge point.

Host EV conferences
Host business focused events throughout the year, targeting differing areas and industries.

Creating a regional EV taskforce
Bring together partners from the business, energy, infrastructure along with the Combined Authority and the LAs to discuss challenges and barriers to delivery and to act as a sounding board as guidance and standards are developed.

Improved strategic level engagement with industry
This could help achieve economies of scale. A coordinated policy and delivery framework and targeted investment in strategic locations, could also give the market confidence to accelerate the pace of roll-out beyond what a free-market approach would otherwise enable.

Engage with local businesses to better understand the needs of their fleets and incorporate these into delivery plans
The Combined Authority should seek to engage directly with businesses as well as draw on wider work being undertaken across sub-national transport bodies and nationally, as outlined in the EV Infrastructure Strategy. This will allow clusters of demand to be identified and planned for.

1.7 Support policy changes which will drive EV uptake

Ensure across the LAs there are consistent planning requirements and standards for charge point provision at new developments.

Review the new national building regulations for charge point provision in new developments, which require all new homes with associated parking and non-residential properties have charge points. The Combined Authority should acknowledge these as minimum standards and consider adopting enhanced and more ambitious targets across the LAs' local planning policies, building on BCC's previous work on this topic.

Keep a watching brief on central government announcements on Planning Practice guidance and Permitted Development Rights

In the EV Infrastructure Strategy, the Government states is considering what further role Planning Practice Guidance (PPG) can have in ensuring the delivery of EV infrastructure and explore options to streamline and reduce barriers in the planning system, including examining the role of Permitted Development Rights.

1.8 Lead on innovation

Engage with and invest in EV charging research

To establish the West of England as a leader in EV charging, the Combined Authority should carry out research and engage in trials of innovative technologies and approaches to EV charging which have potential to overcome the current barriers to EV uptake. These can then be rolled out across the region and act as an exemplar for other regions to adopt themselves.

Create charging hubs, promote car club electrification and monitor funding

Two short term opportunities are the creation of community charging hubs and the electrification of car clubs. Also outlined in this report is the opportunity to permit trailing cables. The Combined Authority should also monitor funding opportunities offered by Innovate UK.

1.9 Monitor and evaluate

Monitor key performance indicators

A key factor that will determine the scale of benefits across many of the monetised and non-monetised benefits is the rate of uptake of EVs. It is recommended that the Combined Authority implement a monitoring and evaluation plan to measure and monitor progress again specific key performance indicators (KPIs). KPIs could include year on year increase in EV ownership in line with or exceeding the national average or local forecast uptake, and rollout of publicly accessible charge points.

Review OZEV reporting on market progress

The Combined Authority should also be aware that OZEV will be tracking the progress of LAs to assess if, and where, the market is failing to deliver. In addition to reporting on charge points per capita and public charge points per region, metrics will also account for local needs, such as on-street parking reliance, average walking times to on-street charge points and utilisation, alongside monitoring of consumer behaviour, experience and confidence.

APPENDIX 2: POLICY BACKGROUND

2.1 International and UK Policy Context

The transition to EVs is closely aligned with international and national ambitions to decarbonise and level-up the UK economy and improve air quality, as summarised in **Table 40**. The Government's roadmap for the phase out of ICE vehicles is driving the pace of the EV transition.

Table 40: Summary of major global and national policies supporting the EV transition

Policy level	Policy document	Summary	Support for the scheme
Global	COP 21 Paris Agreement (2015)	• Goal of keeping global average temperatures to well below 2°C above pre-industrial levels, and ideally within 1.5°C.	Support for decarbonising transport systems.
Global	COP26 Glasgow (2021) Pact	• Reaffirmed goal of 1.5ºC from COP21. • Over 30 countries, six major vehicle manufacturers and other actors, like cities, set out their determination for all new car and van sales to be zero emission by 2040 globally and 2035 in leading markets.	Global commitment to transition to EVs from governments, vehicle manufacturers and other actors, such as fleets.
National	Taking Charge: The Electric Vehicle Infrastructure Strategy (March 2022)	• Sets out a vision and action plan for the rollout of EV charging infrastructure in the UK up to 2030, including identifying roles and responsibilities for local authorities.	Support for local authority involvement in deploying EVCPs, alongside private sector investment.
National	Decarbonising Transport: A Better, Greener Britain (July 2021)	• Commitments and the actions needed to decarbonise the entire transport system in the UK by 2050. • This includes accelerating modal shift to public and active transport and decarbonising road transport through EVs.	Sets out phase out dates for non-zero emission vehicles, major investment in charging infrastructure and outlines a world-leading regulatory framework.

Policy level	Policy document	Summary	Support for the scheme
National	Net Zero Strategy: Build Back Better (October 2021)	• Sets out UK's decarbonisation pathway to 2050. • Reiterates phase out dates for cars and vans and commits to invest an additional £620 million to support the transition to EVs. • Introduces a zero-emission vehicle mandate, which will set targets for a percentage of manufactures' new car and van sales to be zero emission from 2024.	Strong signal to vehicle manufacturers and investors.
National	Ten Point Plan for a Green Industrial Revolution (Nov 2020)	• Announcement of end the sale of new petrol and diesel cars and vans by 2030.	Significant driver of EV uptake and market change.
National	Clean Air Strategy (January 2019)	• Sets out how the government will tackle all sources of air pollution, including from transport through Clean Air Zones in targeted areas.	Support for EVs as a lever to improve air quality.
National	Changes to Building regulations - Infrastructure for the charging of electric vehicles (In force 2022)	• Sets out requirements for charge points for all new residential and non-residential buildings.	Support for home charge points.
National	Levelling UK the United Kingdom White Paper (February 2022)	• Sets out how the Government will spread opportunity more equally across the UK. • Supports manufacturing of EVs in the UK and reskilling e.g. EV maintenance. • Aim that by 2030, local public transport connectivity across the country will be significantly closer to the standards of London, with improved services, simpler fares and integrated ticketing. Several references to electric buses schemes.	Broad support to decarbonise and improve local transport systems.

2.2 Regional Policy Context

Several regional strategies provide clear support for increasing investment by the CA to accelerate the transition to EVs which will be achieved through the scheme.

Climate and Ecological Strategy and Action Plan
After declaring a climate emergency in 2019, the Combined Authority produced a Climate and Ecological Strategy and Action Plan. This plan sets out priorities and key actions to achieve the Combined Authority's ambition to be net zero by 2030, and includes the strategic objective: 'transport CO2 emissions are Net Zero by 2030'.

One of the measures to achieve this is increasing the uptake of low carbon vehicles, including electric vehicles, by increasing EV infrastructure in the region in the short term. This provides clear support for the scheme. This will be complemented by the electrification of council fleets by the UAs.

Joint Local Transport Plan 4 (JLTP4)
The long-term aspiration for transport in the West of England is encompassed in the vision for JLTP4: 'Connecting people and places for a vibrant, inclusive and carbon neutral West of England'. The plan recognises that the transition to EVs will have an impact on several JLTP4 objectives:

- A direct impact on 'Take action against climate change and address poor air quality' and 'Contribute to better health, wellbeing, safety and security'
- An indirect impact on: 'Support sustainable and inclusive economic growth' and 'Better places' (includes improving access to opportunities for employment, growth and education while creating a safer and more satisfactory environment for transport users)

The strategy highlights that the CA is working to facilitate zero and low emission vehicles, including by building four rapid charging hubs at high-profile locations across the region and delivering more EV-capable car club bays. Additional actions related to EVs include:

- Identify and address any barriers to the uptake of ultra-low emission vehicles (ULEVs), especially in areas declared as Air Quality Management Areas or Clean Air Zones (CAZs)
- Introduce policy measures to encourage EV uptake
- Support the introduction of low emission buses
- Provide advice, support and training to other private and public-sector organisations to encourage ULEVs
- Maximise CO_2 reductions from EVs, by promoting ULEVs to run on renewable energy and to act as batteries for the electricity grid
- Through changes to parking standards, include charge point requirements for new developments

- Promote EV taxis through improvements to infrastructure, grants and incentives.
- Investigate the potential of using waterways to carry freight and use of EVs or cargo bikes in town and city centres

The JLTP4 sets targets of:

- 5,000 EV registrations per year from 2020 in the West of England
- ensuring 100% of new homes (where applicable) have a charge point available

EV uptake and EV infrastructure will be monitored through the Department for Transport (DfT) Vehicle Licencing data (quarterly / annual data) and through the Go Ultra Low West project. **Table 41** summarises these regional policies and how they lend support for the scheme.

Table 41: Summary of regional policies supporting the EV transition

Policy document	Summary	Support for the scheme
West of England Climate and Ecological Strategy and Action Plan (2022)	Aim for transport CO2 emissions to be net zero by 2030, and identifies uptake of EVs and investment in charging infrastructure as actions.	Support for investing in charging infrastructure.
Joint Local Transport Plan 4 (JLTP4) (2020)	Highlight how the transition to EVs directly and indirectly supports several objectives, and identifies various EV-related actions. Sets a at target 5,000 EV registrations per year from 2020 in the West of England.	Places EVs in the wider strategic context of the regional transport network and sets a target for EV uptake.
West of England Local Industrial Strategy (Local Enterprise Partnership)	One of the 4 key priorities is 'Innovation in Infrastructure' to tackle climate change, address air quality and ensure quality of life.	Supports investment in charging infrastructure to support innovation and the regional economy.

2.3 Local Policy Context

The three UAs within the CA each have policies detailing their ambitions to reduce carbon emissions and improve air quality, and related actions. All declared a Climate Emergency and have aligned ambitions to reach net zero emissions by 2030.

Table 42 summarises the strength and nature of policy support across the region for the scheme, with further details provided in **Table 43, 44** and **Table 45**.

Table 42: Summary of policies across the West of England Unitary Authorities

Policy Topic	B&NES	BCC	SGC
Climate Emergency	Yes	Yes	Yes
Net Zero by 2030	Yes	Yes	Yes
Clean Air Zone	Yes (2021)	Yes (2022)	No
EV Strategy	Yes	No	Yes (draft)
EV uptake targets	Yes	Yes	No
Charge point planning standards	Yes (draft)	Yes (draft)	Yes (draft)
Council vehicle fleet electrification	Yes	Yes	Yes

Bristol City Council

In November 2018, Bristol declared a Climate Emergency and has since set a new ambition to be carbon neutral for direct emissions by 2025. In 2018, the UK Government directed BCC to produce a plan to achieve compliance with legal limits of NOx in the shortest time possible. Bristol introduced a Clean Air Zone (Class D) in November 2022, which charges non-compliant vehicles a daily fee, including private cars, to drive within the central zone. The zone is likely to accelerate the rate of vehicle replacement with newer, cleaner vehicles, including EVs.

Table 43: Bristol City Council Policies

Policy document	Summary	Support for the scheme
Mayor's Climate Emergency Action Plan (2019)	Sets out actions that the Council will take, including investment in charge points.	Public commitment to charge point investment, strategic recognition of role of EVs
One City Climate Strategy (2020)	Sets ambition to be achieve carbon neutrality by 2030 and an objective for 25% of Bristol's cars are ULEVs, reaching 100% by 2050, and ensure vehicles are zero emission by 2040.	Sets targets for EV uptake
Clean Air Zone (Operational from November 2022)	Non-compliant vehicles will be charged a daily fee to drive within the central zone from November 2022.	Incentivises a shift to cleaner vehicles, with grants and loans available for some groups to upgrade vehicles or switch to active travel
Bristol Transport Strategy (2019)	The strategy supports sustainable growth while reducing carbon emissions and embracing new technology, and includes commitments to the expansion of the charging network and the council's electric fleet.	Support for investment in charging infrastructure
Draft Local Plan Review: Draft Policies (2019) Due to be adopted in 2024 after further consultation.	Draft Policy T5 requires charge points to be integrated into developments, setting out requirements for residential and non-residential developments of varying size.	Requires charging infrastructure provision at new developments

Bath & North East Somerset Council

Bath & North East Somerset Council also declared a Climate Emergency in 2019, and the subsequent action plans indicate support for EV uptake and the expansion of the charging network to achieve the target of carbon neutrality by 2020.

The council was directed in 2018 by the UK Government to produce a plan to achieve compliance with legal limits of NOx in the shortest time possible, and a Clean Air Zone was introduced in March 2021 in Bath. Unlike Bristol, private cars will not be charged.

The council has adopted an EV charging strategy which commits to the provision of a network of public on-street charging points by 2030, indicating clear support for the scheme.

As of June 2022, the council is leading by example and currently has fifty (50) electric vehicles, including small vans, street cleansing machines and sweepers and plans to replacement further vehicles as the availability increases of larger electric vans, specialist vehicles and HGVs, such as electric refuse and recycling collection lorries.

Table 44: Bath and North East Somerset Council Policies

Policy document	Summary	Support for the scheme
Climate Emergency Action Plan (2020)	Aims to achieve carbon neutrality by 2030 and recognises transport as a priority. Subsequent analysis suggested that targets should be: 1. To reduce vehicle mileage by 25% per person. 2. A shift to 76% Zero & Ultra Low Emission vehicles (ULEV) and 14% hybrid vehicles. 3. Only 10% of vehicles to be powered by petrol and diesel. 4. Increase in mass transit, walking and cycling.	Supports investment in charging infrastructure. While not targets for EV uptakes, indicates pace and scale of change required.
Journey to Net Zero (May 2022)	Outlines projects to achieve carbon neutrality. One of the themes is 'Supporting Future Mobility', described as 'Exploiting the opportunities presented by evolving transport technology, to improve physical connectivity.'	References Go Ultra Low West network as a short-term priority.

Policy document	Summary	Support for the scheme
Clean Air Zone Operational March 2021	Non-compliant taxis, vans, buses, coaches and HGVs are charged a daily fee to drive within the zone.	Incentivises a shift to cleaner vehicles, particularly for businesses and taxi drivers.
Getting Around Bath Transport Strategy (November 2014)	Sets out the long terms vision for transport to 2029 for Bath. During consultations, around three quarters of respondents supported proposals to increase EVs within the city.	Supports investment in charging infrastructure.
Balancing Your Needs: A parking strategy for Bath and North East Somerset (Feb 2018)	This strategy supports an increase in on-street charge points and within car parks, and the provision of appropriate charge point for electric taxis.	Supports investment in charging infrastructure.
On-Street Electric Vehicle Charging Strategy (July 2020)	Sets the vision to facilitate the switch to low-emission vehicles and commits to the provision of a network of public on-street charging points by 2030.	Supports investment in charging infrastructure.
Draft Local Plan Partial Update and associated Supplementary Planning Documents (Aug 2021)	Sets out requirements for charging provision in new developments, detailed in an accompanying Transport and Developments Supplementary Planning Document (SPD).	Requires charging infrastructure provision at new developments.

South Gloucestershire Council

SGC declared a climate emergency in July 2019 and pledged for South Gloucestershire to become carbon neutral by 2030. Facilitating EV uptake and investment in charging infrastructure are recognised as key actions, and a draft EV strategy open for public consultation until October 2022.

Table 45: South Gloucestershire Council Policies

Policy document	Summary	Support for the scheme
Climate Emergency Strategy	Recognises that a very high uptake of EVs and a reduction of mileage will be needed to meet 2030 goals (from 380 to around 220 kt CO2e). Actions include producing an area-wide assessment of EV infrastructure need, developing a plan to transition taxis to low carbon alternatives, and exploring potential for electric school minibuses.	Indicates pace of EV uptake required and support for expanding charging infrastructure, targeting market failures and rural areas.
South Gloucestershire Electric Vehicle (EV) Charging Strategy	Sets out ambitions for the provision of charging infrastructure. Includes an intention to ensure the vast majority of households in South Gloucestershire are within one mile of reliable and accessible charging infrastructure and forecasts of charge points needed.	Supports investment in charging infrastructure, highlight forecasted demand, current and planned installations, and the council's position on on-street charging technologies. Does not include specific targets for EV uptake.
Draft Local Plan 2020 Phase 1 Issues and Approaches (November 2020)	Updates to the parking requirements includes provision for charge points for all types of development.	Requires charging infrastructure provision at new developments.

APPENDIX 3: INVESTMENT PROPOSAL REPORT

Report developed in May 2022 by WSP as a precursor to the Final Business Case, which it is appended to for reference (with Appendices and Financial information removed as these have been superseded). Please note some of the references to future work (car clubs – removed from scope from the FBC) and grant funding schemes (LEVI – the details and indicative funding amounts have now been released) are now out of date, but still shown for context.

3.1 Introduction

Purpose of this document

The purpose of this report is to set out key targeted investment proposals for the West of England Combined Authority to prioritise in order to accelerate the rollout of EV uptake across the region. The report will provide an evidence base to inform funding discussions, providing high level concept feasibility, timescales and indicative cost ranges for the projects. This investment proposition sits alongside a wider commission that WSP is delivering to forecast EV uptake and charging demand alongside recommendations for the CA's role in supporting the implementation of EV charging infrastructure throughout the region.

Background to the study

The West of England Combined Authority and its constituent Unitary Authorities are committed to supporting the uptake of zero emission vehicles through the provision of charge point infrastructure, as one of the main ways to reduce transport emissions. To do this, the Combined Authority is developing an Electric Vehicle (EV) charging strategy that will define the long term aims, objectives and actions regarding EV charging, working closely with key stakeholders across the sub-region.

This work is currently underway, however, there is also an immediate need to identify projects which can be actioned in the short term, to support the immediate uptake of electric vehicles in the region. These will take advantage of a short-term funding opportunity which has arisen (Green Recovery Fund) and provide quick wins whilst progress is being made towards achieving the medium to longer term actions.

A number of more immediate term projects and potential quick win schemes have been identified that could be set in motion whilst the long-term strategy is in development, as set out in **Table 46** overleaf. These schemes are split into four key investment areas: policy and guidance; residential charging; destination charging; and innovative transport schemes. These proposals were developed with the support of the joint officer working group (with representation by Combined Authority and Unitary Authority officers) and are intended to complement investment in infrastructure which is planned / considered by the Unitary Authorities. Four schemes were selected for initial investment. This document outlines a detailed investment proposal for each of the four schemes, which will form the basis for future funding opportunities.

Table 46: Electric Vehicle Charging Investment Options

Type of scheme	Investment Option	Chosen for initial investment
Policy and Guidance	Create a regional EV Working Group	In development
Policy and Guidance	Greening the council vehicle fleets	
Policy and Guidance	Green procurement	
Policy and Guidance	Change planning policy to require EV chargers are installed in new developments	
Policy and Guidance	Electrify private hire vehicles	
Residential Charging	Trials of innovative low cost on-street residential charging (e.g. lamp column charging)	Yes
Residential Charging	Take a proactive approach to trailing cables	
Residential Charging	Trial residential charging hubs	Yes
Residential Charging	Public engagement	
Residential Charging	Rural charging provision	
Destination Charging	Install destination chargers in public car parks	Yes
Destination Charging	Rapid Charging Hubs	
Destination Charging	Rapid chargers for electric taxis and delivery vehicles	
Destination Charging	Deploy Mobility Hubs with EV charging	
Destination Charging	Engage with tourist destinations to help them provide EV chargers for their customers.	
Innovative schemes	Pay as you go card payments	
Innovative schemes	Support the introduction of EV car clubs	Yes
Innovative schemes	Clear Air Zones (CAZ) and Zero Emissions Zones (ZEZ)	
Innovative schemes	Emissions based parking tariffs	

Structure:

This investment proposal is structure as follows:

- Strategic case for EV charging investment – policy fit and case for change
- Forecasting EV uptake and charge point requirements – detailed analysis and modelling has been carried out to forecast the number and location of chargers required
- Schemes for investment – investment propositions for the four preferred EV schemes shortlisted by the Combined Authority
- Next steps – the next stage of the project

3.2 Strategic Case for EV Charging Investment

The strategic case sets out the need for investment in EV charging and the substantial benefit this investment will bring to the West of England.

3.2.1 Policy Fit

Investment in the creation of a comprehensive network of publicly accessible EV charge points is closely aligned with international, national, regional and local policy, as well as national legislation. Key policy and legislative documents are summarised below.

The Paris Declaration (2015) set an international goal of keeping global average temperatures to well below 2°C above pre-industrial levels, and ideally within 1.5°C. Reducing carbon emissions and consumption of fossil fuels are recognised as key steps for achieving this goal.

Decarbonisation of the transport sector is critical for the UK meeting the Paris goals. The Government has committed to achieving net zero emissions across all transport modes by 2050 within the Decarbonising Transport, Setting the Challenge (2020) report, which sets out supporting the transition to zero emission vehicles through provision of charging infrastructure as a strategic priority. Later in 2020 the Government set out its Ten Point Plan for a Green Industrial Revolution, announcing a commitment to end the sale of new petrol and diesel vehicles by 2030, and that all new cars and vans will be required to be fully zero emissions at the tailpipe by 2035. In this plan the Government commits to investing £1.3 billion to accelerate the roll out of charging infrastructure.

The Government released its Transport Decarbonisation Plan in June 2021 setting out actions needed to decarbonise the entire transport system in the UK to deliver net-zero emissions across all transport modes by 2050. The Government commits to phasing out all new non-zero emission road vehicles, from motorbikes to HGVs, by 2040, and ensuring infrastructure is not a barrier in the transition to net-zero vehicles.

Building upon The Ten Point Plan for a Green Industrial Revolution, the Government's Net Zero Strategy: Build Back Better (2021) contains policies and proposals which aim to

decarbonise the UK and reach net zero by 2050. The transition to EVs is identified as central to decarbonising transport, and a key policy of the strategy is introducing a zero-emission vehicle mandate, which will set targets for a percentage of manufactures' new car and van sales to be zero emission from 2024.

Regional and local level policies also support the transition to zero emission vehicles. The Combined Authority and all the local authorities have declared a Climate Emergency, with the goal to be carbon neutral by 2030. The Joint Local Transport Plan 4 (2020), produced by the Combined Authority in partnership with the local councils, identifies supporting the uptake of zero and low emission vehicles as one of the main ways to reduce transport emissions, with a commitment to provide infrastructure to support the use of electric vehicles.

The Combined Authority declared a climate emergency in July 2019 with a target of the West of England reaching carbon neutrality by 2030. Following the declaration, the Combined Authority published its Climate Emergency Action Plan, which sets out the priorities and next steps to achieve this goal. Decarbonising the transport system is one of these priorities, including working with partners to identify and address the barriers to the uptake of ULEVs. The plan also supports unitary authorities considering the expansion of car-share/ car club services and facilitating ULEV car clubs.

Legislative changes are also occurring to support the delivery of electric vehicle infrastructure through updates to the Building Regulations announced in December 2021. The new legislation means that all new residential development, including dwellings created from a change of use, must have at least one charging point per dwelling if they are built with associated parking, and all new non-residential buildings with more than 10 parking spaces must have a minimum of one charge point and cable routes for one in five of the total number of spaces. The new regulations also cover residential and non-residential uses undergoing major renovation. These changes mean that developments must legally install EV charge points wherever they provide parking.

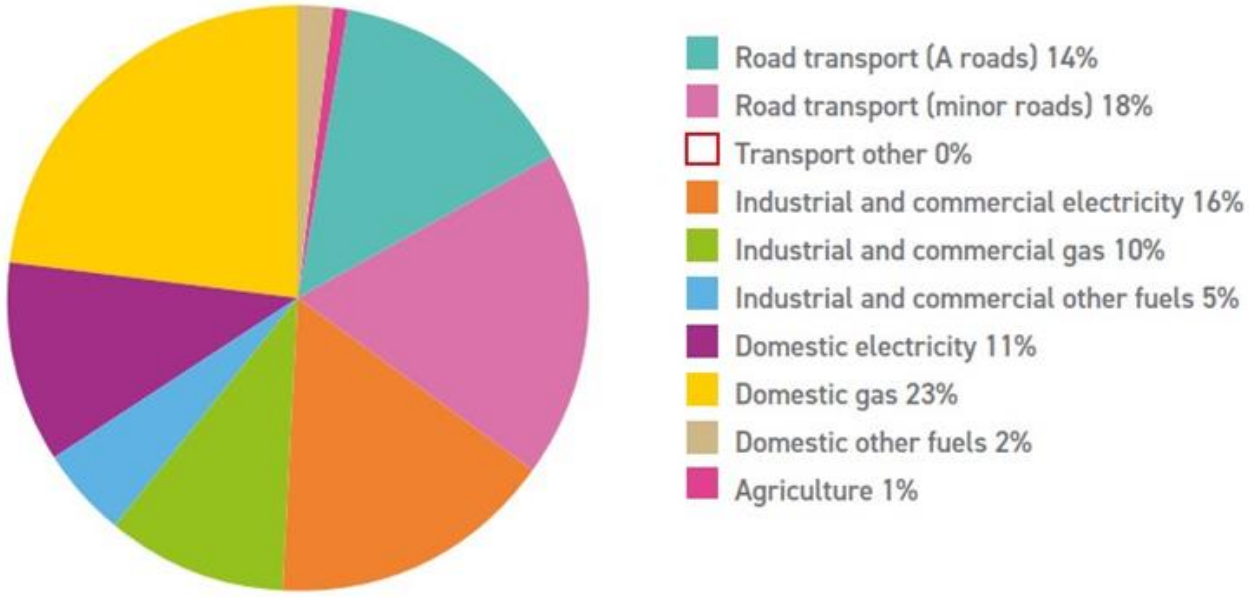
The policy review shows there is significant support for investment in EV infrastructure.

3.2.2 Case for Change

Decarbonising the transport sector:

With the signing of the Climate Emergency Declaration, there is a pressing need in the West of England to reduce carbon emissions. Road transport is a key contributor of carbon emissions. In the West of England, road transport is responsible for 32% of all carbon emissions.

Figure 23: Current carbon dioxide emissions, by sector, in the West of England



A key mechanism for reducing transport emissions is through shifting trips to active and sustainable modes of transport, or via travel demand management and behaviour change. However, for those journeys which cannot be readily made by walking, cycling or public transport, or removed altogether, the solution is to transition to zero-emission vehicles, of which EVs will make up the vast majority. As shown in the Policy Review, there is clear government policy support for to decarbonise the transport sector to tackle climate change, with the transition to EVs identified as central.

Improving air quality:

Air pollution is the top environmental risk to human health in the UK, being linked to increased rates of respiratory infections and other illnesses. Long-term exposure to man-made air pollution is responsible for between 28,000 to 36,000 deaths in the UK annually and costs to the NHS could reach £5.3 billion by 2035. Road traffic is a major contributor to air pollution.

In the West of England there are a number of Air Quality Management Areas (AQMAs) – areas in which air pollution levels have exceeded the national air quality objectives – in places such as Bath, Bristol and hot spots at major roads. The Government also directed

Clean Air Zones (CAZs) to be delivered in Bath and proposed in Bristol to reduce nitrogen dioxide (NO2) levels to legal levels. CAZs are primarily intended to tackle air pollution rather than carbon emissions. However, as CAZs require vehicles that do not meet emission standards to pay a daily charge, there will be indirect benefits in tackling climate change by reducing all tailpipe emissions

The CAZ in Bath was launched on 15 March 2021, charging high-emission taxis, buses and other large vehicles to travel through the city centre. As a class C CAZ, charges are not applicable to private cars and motorbikes and apply to buses, coaches, taxis, private hire vehicles, heavy goods vehicles, vans, minibuses. The emissions standards are Euro 6 for diesel vehicles and Euro 4 for petrol.

Bristol's CAZ is scheduled to begin in Summer 2022 and will apply a daily charge to all non- compliant vehicles. The CAZ will be class D, meaning that all vehicle categories are covered by the emissions standards for Euro 4 petrol vehicles and Euro 6 diesel vehicles.

By supporting the transition to EVs with zero tailpipe emissions, NO2 emissions will be reduced resulting in significant health benefits.

The need for EV charging infrastructure

Whilst the number of EVs registered in the West of England is currently relatively low as a share of total vehicle numbers, registrations have been growing rapidly, and are forecast to increase significantly over the coming years. This trend has been accelerated by the UK Government's ambition to end the sale of ban on new internal combustion engine vehicles (ICEs) from 2030 and the measures to improve air quality and lower vehicle emissions locally, such as the Bath and Bristol CAZs. Within the combined authority area, there are currently 801,867 vehicles, of which 2% are currently electric. Modelling carried out for this study indicates that between 20-40% of vehicles will be EV by 2030. To support these EVs, it is forecast that between 3,000 and 11,000 publicly accessible EV chargers will be required.

The majority of charging will continue to happen at home, but publicly accessible charge points will take on greater importance in the future, as the number of prospective EV owners without off-street parking and the simple means of charging at home increases. Currently 21% of properties do not have access to off-street parking. At present, EV ownership is heavily skewed toward those on higher incomes, with access to company car leasing schemes, and with access to off-street parking. In the longer term, as EV prices continue to fall, the makeup of EV owners will begin to reflect more closely the wider population, which includes those without access to off-street parking.

A survey by IPSOS found that whilst more than half of drivers had a favourable view of EVs, 64% stated that insufficient charging infrastructure is preventing them from making the change. Key concerns are the inability to charge at home, for those without off-

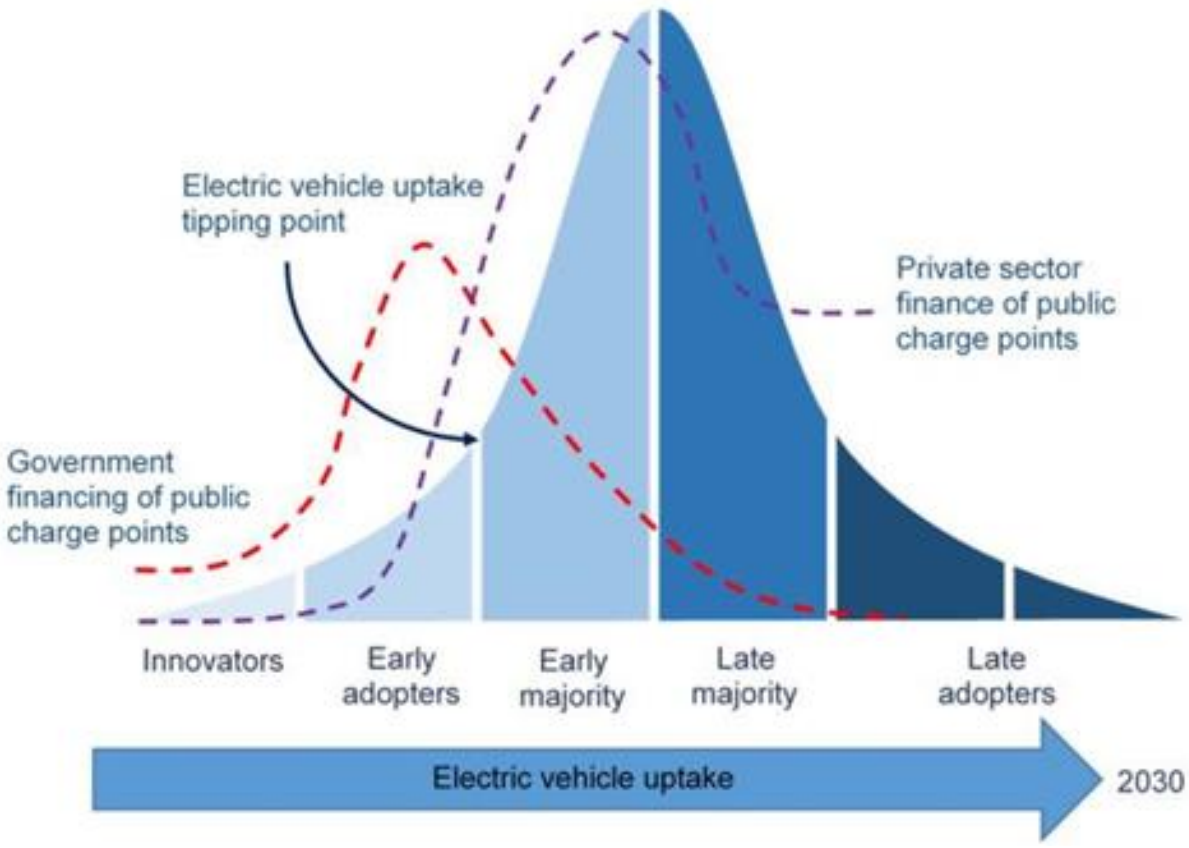
street parking, and range-anxiety, the fear of being unable complete a journey due to lack of chargers with which to top-up mid-journey.

Therefore, the provision of effective and easy to use public charging infrastructure is widely recognised as being fundamental in encouraging drivers to transition from ICEs to EVs.

The public sector's role in providing electric vehicle charging infrastructure

Whilst the private sector has shown a significant appetite to invest in EV charging infrastructure, and this is expected to grow as the number of EVs on the road increases, it is likely there will be areas that are left behind without public sector intervention. An analogy can be drawn with high-speed broadband roll-out, which has been slower to reach more remote, lower density areas, and has required public funding to promote more equitable access. **Figure 24** shows how public sector funding can accelerate the tipping point from early adopters to early majority in the uptake of EVs through the government financing of public charge points.

Figure 24: EV tipping points



Where left to commercial operators alone, investment is inevitably heavily focused on the most profitable locations, where high utilisation can be guaranteed and where the highest return on investment can be achieved. This is predominantly in urban centres and more affluent communities where residents are more likely to adopt EVs. Similarly,

rapid chargers at destinations with high footfall and regular turnover have the most profitable business models, whereas residential on-street charging is a weaker commercial proposition. As a result, gaps in provision are created where the potential to generate revenue is low, or where expensive infrastructure enhancements are required to improve grid capacity.

There is a clear role for the public sector to intervene to plug these gaps in the evolving EV charging ecosystem in the short to medium term until the market matures, to avoid a lack of charging infrastructure stifling the transition to EVs.

The Combined Authority therefore has a key role to encourage the uptake of EVs by providing or incentivising the market to provide EVCPs (electric vehicle charging point) in areas that would otherwise be underserved.

Table 47: The case for change

Case for change	Summary
Decarbonising the transport sector	With the signing of the Climate Emergency Declaration, there is a pressing need in the West of England to reduce carbon emission, of which road transport is a key contributor. Transition to EVs to is critical to decarbonise trips that cannot be switch to active and sustainable modes.
Improving air quality	Air pollution is the top environmental risk to human health in the UK, being linked to increased rates of respiratory infections and other illnesses. The Bath and Bristol Clean Air Zones require vehicles that do not meet emission standards to pay a daily charge. By supporting the transition to EVs with zero tailpipe emissions, NO2 emissions will be reduced resulting in significant health benefits.
The need for electric vehicle charging infrastructure	EV registrations have been growing rapidly in the West of England and will continue, accelerated by ban on new ICEs from 2030 and the Bath and Bristol CAZs. The majority of charging will happen at home; however, currently 21% of properties do not have access to off-street parking. It is forecast that between 3,000 and 11,000 publicly accessible EV chargers will be required. 64% of drivers have stated that insufficient charging infrastructure is preventing them from making the change.
The public sector's role in providing electric vehicle charging infrastructure	Where left to commercial operators alone, investment is inevitably focused on the most profitable locations i.e. high utilisation resulting in the highest return on investment, little power upgrades are required. As a result, gaps in provision are created and there is a clear role for the public sector to intervene to plug these gaps to avoid a lack of charging infrastructure stifling the transition to EVs.

3.2.3 Strategic considerations for local authorities

Throughout the transition to electric vehicles, it is vital that a focus is still maintained on reducing private vehicle mileage and encouraging modal shift to active travel and sustainable transport. In isolation electric vehicles are not capable of meeting the levels of decarbonisation required to meet climate goals, although they are a vital contributor which minimise the impact of journeys which cannot be taken by other modes.

Taking a 'travel hierarchy' approach, residents and visitors should be encouraged to undertake their journey by walking, cycling and public transport wherever possible, with only the remainder of journeys undertaken by private vehicle, including EVs. As EVs become increasingly mainstream, offering free or heavily discounted EV charging tariffs or parking is unlikely to be financially sustainable or prudent for councils due to the signal this sends on continuing car use. However, there should be consideration of disadvantaged user groups to ensure an equitable EV transition over the next decade.

When installing EV chargers, local authorities should seek to mitigate the potential drawbacks, for example selecting sites and charge point designs that minimise street clutter and the risk of trailing cables. Authorities should also seek to 'future-proof' their investment when selecting locations, charge point suppliers and charger units during procurement to reducing the likelihood of redundant or low-quality provision.

There is a risk that installing EV charging infrastructure on the public highway will remove the space required to introduce other green transport initiatives such as cycle lanes. This could inadvertently lock in car travel and therefore it is vital to carefully consider the wider impacts of all EVCPs and to collaborate closely with all stakeholders to ensure the overall strategic goals are achieved.

3.3 Forecasting EV uptake and charge point requirements

See *Section 2.4 The scale and pace of change required* within the EV Charging GRF Final Business Case (main document) for an updated look using the same forecast data from the Investment Proposal.

3.4 Schemes for investment

This section sets out investment propositions for the four preferred EV schemes shortlisted by the Combined Authority from a long list of options (Table 43).

- On-street charging, including trials of innovative low cost on- street residential charging
- Trial community charging hubs
- Install destination chargers in public car parks
- Support the roll-out of a more comprehensive car club network

For each project, an analysis of the strategic case, concept level scheme outline, potential deployment timescales, and indicative cost ranges are set out. The rollout of the schemes across the Unitary Authority areas, and some initial consideration of their spatial deployment is summarised.

3.4.1 Trials of innovative low cost on-street residential charging

The issue to solve: Across the West of England approximately 29% of households (**Table 48**) do not have access to off-street parking where a charger could be installed to charge an EV. This proportion is greater in urban areas and particularly affects social housing tenants.

Table 48: Reliance on on-street parking

Area	Reliance on on-street parking
South Gloucestershire	23%
Bristol	37%
Bath and North East Somerset	27%
North Somerset	22%
West of England	29%
UK	33%

Provision of convenient and low cost on-street charging in residential areas, for people without off-street charging, forms an important component of an effective EV charging network and is essential for encouraging the uptake of electric vehicles. However, across the region there is currently limited access to this type of charge point in many areas.

Requests submitted via the Travelwest website show that there are already pockets of existing demand for residential charging, and modelling shows that this will increase rapidly up to 2030.

Benefits of on-street residential charging: Residential on-street chargers are typically slow to fast AC chargers, positioned at the kerbside and serving a dedicated EV only bay.

Located at or close to where vehicles would be already parked, this allows for long dwell times and the ability to charge overnight when demand on the grid is less. This is more convenient for the user and is more affordable than rapid charging. With the added benefit that less degradation to the battery occurs compared to rapid charging.

Residential charging technology options: There are a number of suppliers currently operating in the on-street residential charging sector, including: Ubitricity, Source London, Char.gy, Electric Blue, Urban Electric, BP Pulse, CityEV, Connected Kerb, and Liberty Charge. Each supplier provides a different solution to the same problem.

The traditional approach is to install floor mounted fast chargers in residential areas. This is the same technology as used for destination charging. This requires a DNO connection to be made to the national electricity grid, which can be costly and time consuming. For context, throughout the life of the Revive network 120 units have been installed, and these units have been sited in public car parks which tend to be more readily deliverable than on-street locations.

There are also alternatives to traditional floor mounted fast chargers that provide low cost, and potentially quick win solutions; lamp column chargers and satellite bollards. In both cases, the chargers piggyback off of existing power connections installed under the highway meaning that costly DNO connections are not required.

Lamp column chargers are becoming an increasingly common means of delivering on-street residential charging due to their lower costs and reduced street clutter. Alternatively, satellite bollards fed from lamp columns provide a solution where the column is set back from the kerb. Lamp column chargers typically charge at 4.5 to 5.5 kWh. Ubitricity currently operates the greatest number of residential charge points, around 50% using this model. Similarly, Char.gy and CityEV provide lamp column chargers.

Liberty Charge are partnered with Virgin Media and are permitted to connect chargers to the existing power connections within their network of street cabinets and ducts. This approach also allows them to install bollard chargers, without the need for costly DNO connections.

Another low-cost option which could be piloted, would be to permit trailing of charging cables across the footway. This would allow residents to charge their vehicles parked on street, from a home power source. This could be achieved either through the introduction of cable channels in the footway or more simply covering cables with protective matting. However, after engagement with the UAs it is felt that these options would not be appropriate due to possible legal and safety issues and focus should remain on public charge points for the time being.

The role of local authorities: Local authorities have responsibility for the public highway, as well as the parking restrictions and street furniture located upon it. It is

therefore the role of local authorities to unlock this part of the charging network for residents.

In addition, local authorities are able to apply for grant funding from the Office for Zero Emission Vehicles (OZEV), via the On-Street Residential Charging Scheme (ORCS). For applications drafted or submitted after 1 April 2022, this can provide 60% of the capital costs of procuring and installing the charge point and an associated dedicated parking bay (up to £7,500 per charge point, or £13,000 where electrical connection costs are exceptionally high). While there is no longer a cap on project size, OZEV may prioritise funding to areas which have not received Go Ultra Low Cities Scheme or other sources of funding previously.

Investment and implementation: In order to encourage the uptake of electric vehicles and to support residents without access to off-street home charging, the Combined Authority, in partnership with the UAs should install on-street residential chargers. In order to meet existing demand as quickly as possible, innovative low-cost charging technologies should be trialled, with a view to rolling them out more widely if successful.

Revive officers have carried out extensive planning for a roll out of lamp column chargers in residential areas. This has included site selection, using their established site priority framework and soft market testing with six providers.

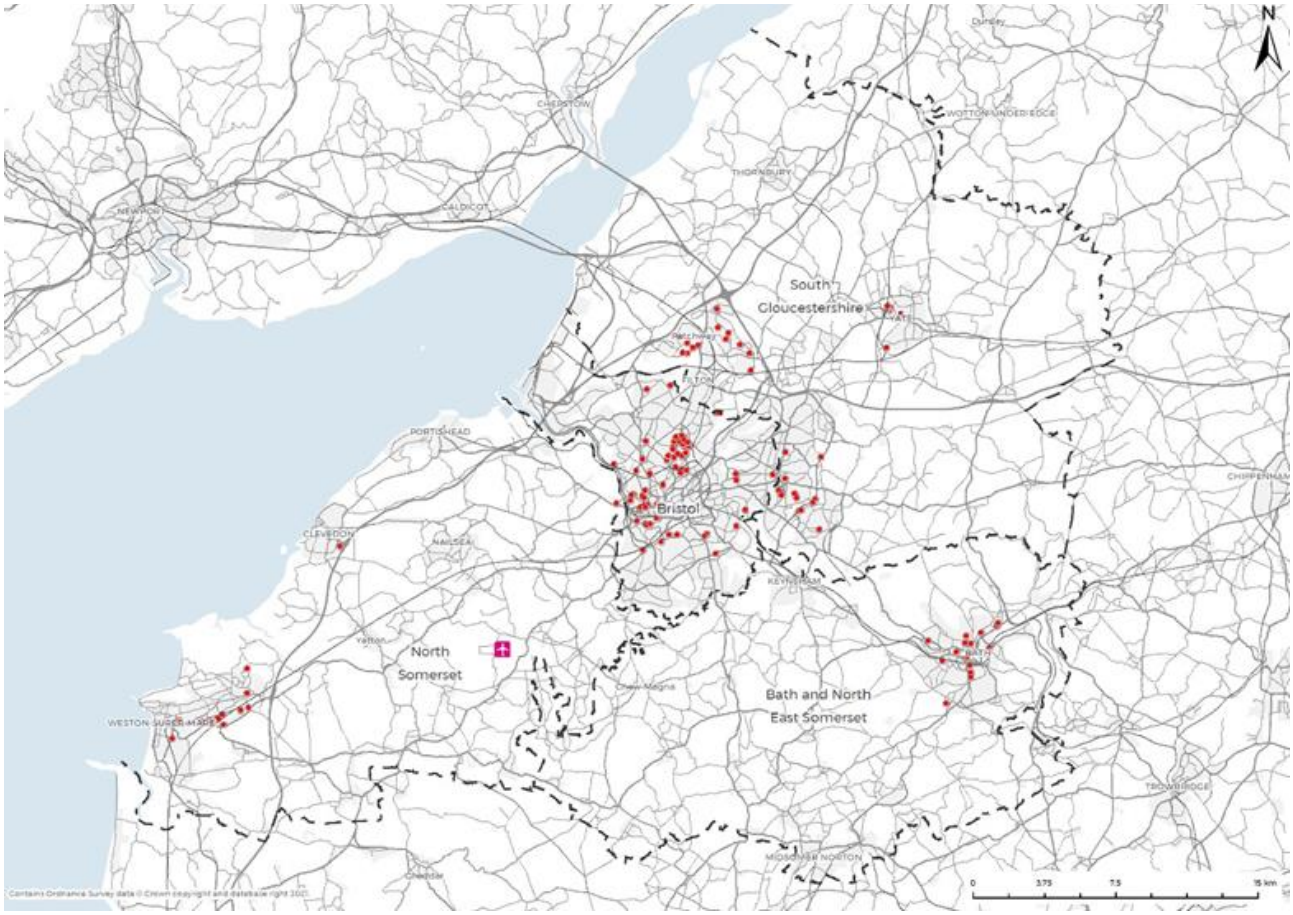
A proposal for a lamp column charging scheme has been developed by Revive for the BCC area and is considered to be 'shovel ready', pending funding local match funding becoming available. This first phase of a wider rollout would act as a trial for the technology. The intention is to install 150 chargers across 50 roads within Bristol, in Autumn / Winter 2022. An ORCS funding bid is currently being prepared but match funding is yet to be obtained. A sum of £271,980 as match funding would be required to complete the trial in full.

South Gloucestershire Council are also pursuing an ORCS funding application and intend to install charge points at 7 sites in 2022/23 if local match-funding of £50,000 can be secured.

As stage 2, there is potential to roll-out further on-street chargers across the other Unitary Authority areas, subject to local endorsement of these proposals and confirmation of emerging proposals for on-street charging infrastructure by the respective councils. Additional Revenue expenditure for officer time may be required for the site selection and design of chargers in these locations.

Analysis was carried out to identify high priority sites which should be considered as locations for on-street charging in phase 2. **Figure 25** shows the results of this analysis.

Figure 25: High priority locations to be considered for lamp column chargers



3.4.2 Trial community charging hubs

Residential or community charging hubs provide chargers for residents who do not have access to off-street parking where they can charge their vehicles. This concept presents an alternative and complementary approach to providing on-street charging. This section will outline how the Combined Authority can invest in trails of this innovative approach, which can become a blueprint for wider rollout across the region.

What is a residential charging hub: Residential charging hubs can take a variety of forms, but are primarily made up of standard/fast AC chargers (7-22kW), set in a residential or suburban environment, within an off-street car park. They are intended to cater for a catchment area where residents typically park on-street, without access to a driveway, but could make use of the off-street car park to charge over night when required. Often residential charging hubs utilise a destination car park which is otherwise underutilised overnight. These hubs ideally work on a booking model, whereby residents can book an overnight charge once or twice a week with confidence, and enable the chargers to be efficiently utilised, whilst minimising the inconvenience of unnecessary trips made to plug in where there is no free space.

Unlike destination or rapid charging hubs, residential charging hubs are more likely to be public-sector led initiatives, as they will often be located in council owned car parks or parcels of land, and given that slower charging rates and lower vehicle turnover, are unlikely to be as attractive to a fully private sector funded solution. They are an example of how local authorities can 'plug the gaps' left by the private sector. However there remains the opportunity to include rapid chargers or other types of mobility services (bike share, ebikes, escooters, car clubs) at the same location to create a mobility hub.

Best practice example - Dundee: Few examples of a residential charging hub model are currently in operation. Dundee's three hubs serve as a good example; however, they do also include rapid chargers. Dundee has a high population density and 51% live in multi-unit dwellings, without access to dedicated off street parking. It also has a high proportion of EVs in the vehicle fleet and 9 out of 10 of the highest used charge points in Scotland is located in Dundee. Dundee is therefore an ideal location in which to implement charging hubs. The hubs provide charging solutions for residents living in flats and tenements who are unable to obtain a dedicated charge point.

The Princes Street hub is a former petrol station which has been redeveloped as a charging hub and a test bed for charging technologies. A solar panel canopy can generate 36kW of power, which is stored in a 90kW of battery storage. In combination this reduces the electricity demand on the national grid and reduces costs. The Queen Street hub has an interactive screen which displays charging information and can generate revenue by showing advertising. An e-bike dock is also installed at the same site.

Figure 26: Best practice example - Lanarkshire: A further example of residential charging hubs is Project PACE, set to deliver 180 new charge points across 40 community hubs in Lanarkshire, delivered through a partnership between the Scottish Government and SP Energy Networks.

Figure 27: Best practice example – Bristol and Bath Science Park: As part of the Revive network, an EV charging hub was installed at Bristol and Bath Science Park, led by South Gloucestershire. This hosts 12 EV charging bays, including 5 rapid chargers and 1 fast charger. The charging bays are covered by a transparent solar glass canopy which both protects users of the hub from the elements and generates electricity. Whilst this is not a residential charging hub, lessons can be learned on how to design a hub effectively.

Figure 28: Best practice example – Milton Keynes community charging hubs: Milton Keynes has successfully rolled out an extensive network of EV chargers, as part of the Go Ultra Low City Scheme, including the UK's first larger-scale rapid charging hub. In October 2021, Milton Keynes completed the first of two planned community charging hubs to serve residents and businesses. The hub is comprised of six charging bays served by 7kW fast chargers and three more rapid charging bays. The hub also hosts a fleet of five electric car club vehicles operated by Enterprise Car Club.

Benefits: There are many benefits of providing residential charging facilities in off-street 'hubs' rather than on-street:

- On-street charging is not always feasible or desirable, for example where on-street parking is limited or where pedestrian footways and road widths may constrain the ability to deliver chargers.
- Off-street chargers are more readily deliverable, with no requirements for the creation of a Traffic Regulation Order and a public consultation process
- Creation of a hub can make use of under-utilised council car parks or land.
- Community charging hubs can be expanded to include other types of mobility services such as car clubs, bike sharing and e-scooters.
- Located in residential areas close to users' homes, a vehicle can book a space and be left to charge overnight. This reduces wasted journeys to find a free space and allows a slower rate of charging which puts less pressure on the grid.

The off-street location allows for better site design, resulting in no street clutter, better lighting and security, and being less prone to vandalism.

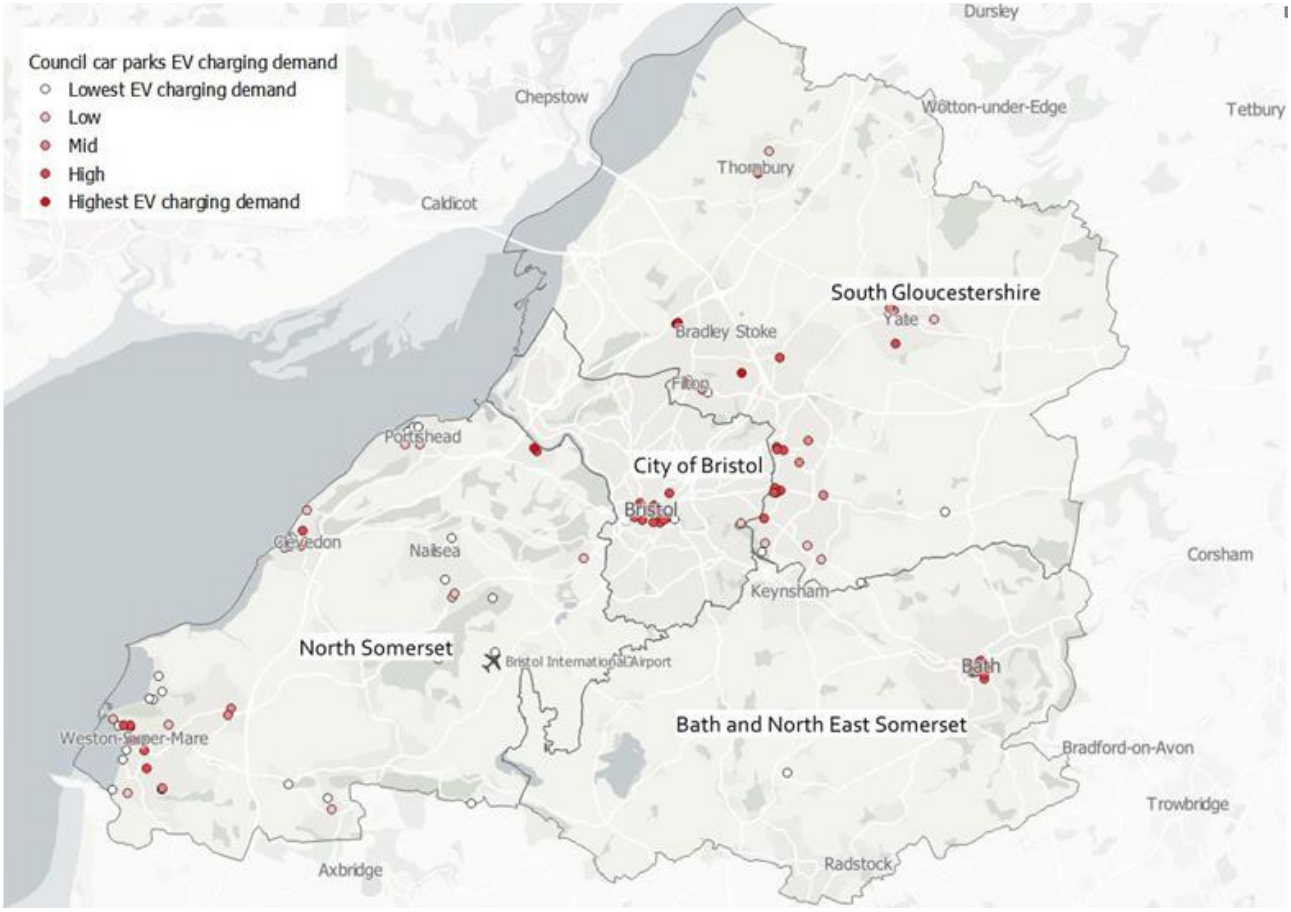
Innovation: Few examples of this residential charging hub model are currently in operation, with the notable exceptions outlined above. A key reason being that they are not a priority for the private sector, which prefers more profitable en-route rapid or destination charging, rather than residential charging. It therefore presents an opportunity for the Combined Authority to lead the way at a regional and national level.

Although it is not without its challenges, notably in identifying suitable sites, as set out below.

There is a further opportunity to integrate novel technologies into the hub, which would not be possible in a typical on street or car park scenario. Prior bookings for overnight charging can be provided via an online booking system. Also, there is scope to trial solar power generation and battery storage. This can be especially useful in rural areas where there are grid constraints which would otherwise make a site unviable.

Location analysis: **Figure 29** represents all of the council owned car parks in the region, ranked by their level of demand for EV charging, as forecast by the EV:Ready modelling.

Figure 29: Council car parks ranked by demand for EV charging



These locations could be considered as potential sites for community charging hubs. However, this indicative analysis will require further feasibility assessments to undertaken to progress further, including the Revive site selection framework assessment, and engagement with DNOs and CPOs, to understand whether a site is viable. Key considerations include grid connection costs, planning constraints, and car park utilisation.

In order for the hubs to be successful and well utilised, there must be sufficient demand from EV drivers in the immediate area. Drivers can be reluctant to use such a facility if it is more than a few minutes' walk from their home. Partly due to the practical difficulties of walking from charge point to home carrying shopping or other baggage, especially for the mobility impaired. Secondly, there is a behavioural shift which needs to take place for those accustomed to parking in close proximity to home. As well as personal security considerations, lighting, natural surveillance etc. of the selected car park, and whether users would feel safe walking to and from site alone.

There may also be other land available, identified via engagement with the UAs, such as council depots or potentially land owned by community groups such as parish councils, which could be repurposed.

Investment and implementation: It is recommended that the Combined Authority install community charging hubs, following the model successfully developed in Dundee, and building on the success of the Bristol and Bath Science Park hub built by South Gloucestershire. To achieve this the following would have to be carried out:

Define a specification: There are a number of key decisions to be made on the design, which will impact the cost. This includes number and speed of chargers and also whether additional technology for online booking and off-grid energy generation will be included.

As an initial trial a basic design should be employed, which consists of simply a group of fast and rapid chargers in an off-street location. This will allow the concept to be tested for minimal cost, and the greatest number of sites to be installed.

However, if the initial trials are successful, then further investment should be made to install hubs with a more ambitious design. These would innovative technologies such as solar charging canopies and battery storage. There is the opportunity to create the gold standard exemplar which can be replicated across the region.

Identify possible locations: A key challenge is to identify suitable parcels of land which could be developed for this purpose. This could either be council owned carparks and land with the surrounding area having a high reliance on on-street parking. The character of this area would be predominantly residential and would not be classed as a 'destination'. The reason being that high streets, retail or leisure and other 'destinations' traffic from elsewhere, generating a higher demand for charging which would be attractive for private CPO investment. The modelling carried out as part of the wider strategy work indicates areas of highest demand, which can form a priority list of locations for consideration. A further consideration should be that the site affords the opportunity for the charging infrastructure to be scaled efficiently in the future in line with future requirements.

Engage a charge point operator: If sufficient funding can be obtained then charging hubs could be developed as part of the Revive network. However, the opportunity remains to engage a private operator on a concessionary basis who could install the chargers, in return for the opportunity the run the hub on a commercial basis. The addition of rapid chargers may present a more attractive commercial proposition.

Identify funding: Grant funding for this scheme could be applied for via the OZEV's ORCS scheme. From April 2022, this scheme can provide up to 60% of the capital costs of procuring and installing the charge point up to 22kW and an associated dedicated parking bay (£7,500 limit per charge point or £13,000 per charge point where electrical connection costs are exceptionally high). Funding for the remaining costs could be requested from charge point operators (depending on the commercial attractiveness of the sites and acceptability of the commercial terms).

Partial grant funding could also be sought from the Local EV Infrastructure Fund for local authorities. In April 2022, a £10m pilot was launched, with applications due by June 2022. Funding will be awarded on a competitive basis to large scale projects that can leverage significant private sector investment and which demonstrate technological or commercial innovation. Depending on the outcome of the pilot, the full scheme (£450m) will open for applications in spring 2023. An alternative could be the DfT Zero Emission Transport Cities (ZETC) fund.

Costs: Indicative capital costs for a basic hub design, using average prices provided by Revive, are calculated to be £160,500. This assumes the use of an existing council car park, and the installation of six bays with 7kW charge points, two bays with 50-150kW rapid chargers and average DNO connection costs. Project management costs (revenue funding) are estimated to be an additional £1,300 per site. It is proposed that 1 hub is installed in South Gloucestershire within the first year (estimated cost £85,000), followed by the remaining sites split equally across subsequent years. The initial feasibility study and site selection would require an additional cost of £30,000.

The costs of an innovative hub design are heavily dependent on specification, and technologies utilised. However, indicative costs, based on previous projects in Dundee and South Gloucestershire are in the region of £500,000 per site.

3.4.3 Install destination chargers in public car parks

What is destination charging: A successful EV charging network needs to accommodate the different ways in which vehicles are charged. There are four broad categories of EV charging: home, workplace, destination and intermediate charging. Destination charging occurs mid-journey when drivers are visiting a location such as a supermarket, railway station, shopping centre, cinema or hotel and take the opportunity to charge the vehicle and 'top-up' the batteries. This can be either on or off-street and utilise either a fast or rapid charger.

Benefits of utilising council-owned public car parks: The forecasting carried out indicates that by 2030 there will be a requirement for 3,289 publicly funded charge points to be installed across the West of England region. The installation of destination chargers in public car parks presents a key opportunity for the Combined Authority and the UAs to make progress towards this target, and to ensure that they are not inhibiting the uptake of EVs through a lack of charging provision.

The UAs own a large portfolio of council-owned car parks, which are potentially ideal locations for fast and rapid destination chargers. They are generally located to serve a destination such as a town centre, train station or leisure centre. These prime locations are more likely to attract the higher utilisation rates required for charge points to be commercially viable.

When compared to on-street chargers, the costs and time required to install chargers is typically lower. This is because, unlike on-street locations, there is no requirement to produce a Traffic Regulation Order or to conduct a public consultation.

Benefits of expanding the Revive network: There are a range of potential business models and funding options available for rolling out destination chargers, however given the presence of the Revive network in the region, where sufficient funding can be attracted to continue to grow this network, it would be beneficial to utilise the existing Revive network as a means of rapidly deploying the infrastructure in targeted locations and market segments, to ensure good coverage, whilst also ensuring a consistent and co-ordinated approach.

The Revive network is fully owned and operated by the Local Authorities, with a supply agreement in place with Siemens Mobility (using Siemens rapid chargers and Alfen standard/fast chargers). Engie are contracted to operate the chargers on behalf of the councils, with service white labelled and branded as Revive. Registration to use the network is free, meaning drivers only pay for the electricity they use, and as the Revive network operates on the same platform as the national GeniePoint network, users can also use GeniePoint chargers. This initiative aims to deliver a unified public charging network, building on the existing network and adding additional chargers to a common format.

Using Go Ultra Low Cities (GULCS) funding, the Revive network has already installed 60 7kW fast chargers in council owned car parks.

Investment and implementation: As a long-term aim the Combined Authority and its constituent Unitary Authorities should notionally look to install at least some chargers in all of the 141 council owned car parks in the region, though these deployments would need to be tailored to the most suitable quantum and combination of chargers for each, based on locally specific characteristics.

This could be implemented in phases, over a number of years, addressing the highest priority sites first. This investment would build on the initial success of Revive and benefit from the knowledge and well-established processes which have been developed by the project team. Allowing costs to be minimised and the timescale for installation to be as short as possible.

A phased approach should be taken, starting with the 30 highest priority sites completed in year 2 and 30 more in the subsequent year. Each site should include a minimum of four chargers, using a ratio of 75% fast and 25% rapid chargers. Indicative costs to achieve these aims have been calculated using the prices provided by Revive officers.

Grant funding for the 7-22 kW charge points in this scheme could be applied for via the OZEV's ORCS scheme. While there is no longer a cap on project size by local or unitary authority, from the Financial Year 2022/23, OZEV may prioritise funding to local authorities which have not previously received Go Ultra Low Cities Scheme funding or ORCS funding for other installations. Alternatively, further funding could be sought through the DfT Zero Emission Transport Cities (ZETC) fund or the Local EV Infrastructure Fund (£450m) when the full scheme launches in early 2023 (a £10m pilot was launched in April 2022, with an application deadline of 17 June).

3.4.4 Support the introduction of electric car club vehicles

Strategic importance of EV Car Clubs: The West of England's Climate Emergency target is to be carbon neutral by 2030. In order to meet this aim, it is imperative that firstly, vehicle miles are reduced, and that secondly, journeys which cannot be undertaken via sustainable modes of transport utilise EVs. The introduction of electric car club vehicles will help to achieve both these goals.

In addition, EV car clubs offer a useful mechanism for opening up opportunities to those who cannot afford the higher upfront costs of purchasing an EV while also providing an alternative to private vehicle ownership.

What is a car club: A car club is a form of short-term car rental service that provide members access to vehicles parked locally on public roads and in car parks. They are self- service, typically accessed via an app and charged at an hourly rate. All car clubs are run by private operators, generally with the consent of local authorities, who give permission to park on the highway and provide dedicated bays or parking permits.

Car clubs can operate in several ways:

- 'Back to base' - The traditional model, where the vehicle has a dedicated parking bay to which the vehicle is returned after each rental.
- Floating or one-way – Under this model, areas are defined in which the vehicle must be parked, such as a CPZ (controlled parking zone), rather than a dedicated bay. Vehicles can be driven from zone-to-zone and do not need to return to their start point.
- Peer-to-peer car sharing – Provision of a platform for private individuals to share their vehicles.

EV car club vehicles are best suited to the 'back to base' model as it simplifies the process of charging, as they are simply charged whilst parked in their own dedicated bay.

Benefits of car clubs: Car-sharing allows users to have access to a car without the need to own a private vehicle. It encourages the user to make journeys by active or sustainable travel where possible, whilst allowing the use of a car when required. Converting the vehicles to EVs mitigates the remaining climate impacts further by removing tail pipe emissions. Fewer vehicles parked on-street also frees up space for walking and cycling infrastructure.

Previous research on the car club scheme in Bristol estimated that car clubs in led to 342 car purchases being deferred in 2014/15. This has likely increased in subsequent years as use of car clubs has increased. In 2020, CoMoUK found that across Great Britain approximately 18.5 private cars are taken off the road by each car club vehicle.

Nationwide, members of car clubs report driving 793 fewer miles per year than private car owners. The miles they did drive were on average less polluting, as car club vehicles tend to meet the highest emissions standards or be EVs. In 2020, the average C02 emission from car clubs vehicles were 26.5% lower than the average UK car, and NOx emission 89% lower.

Another key benefit of car club vehicles is that they increase familiarity with electric vehicles. The CoMoUK Car Club Annual Report England and Wales 2020 surveyed users of car clubs and its findings on EV car clubs were that:

- 42% of respondents reported having used an electric vehicle.
- 10% of the car club fleet are electric, compared with 1% of all cars in England and Wales.
- Over 80% were satisfied with the electric car club experience and only 32% were satisfied with charging points.

Existing car clubs within the West of England: There are currently 138 car club vehicles in operation across the West of England area, managed by four separated operators, the majority of which are located in Bristol and a small number in Bath. Of these vehicles, most are ICEs but there are 9 electric vehicles in the fleet.

There are currently four car club operators working within the West of England area: Co-Wheels, Enterprise, HiyaCar and Zipcar, all of which could be engaged to expand the car club offering to residents. There was also some initial work carried out to introduce a car club in South Gloucestershire. However, due to the impact of COVID-19 the EV car club scheme was withdrawn and the funding reallocated to other EV projects. These plans could be revisited. In addition, Volvo has recently engaged with the Combined Authority to discuss possibilities for funding a car club.

Best practice example – Wandsworth, London: Wandsworth is an example of London borough that has seen success in the uptake of car clubs by residents. Between 2015 and 2020 car club membership has grown from 11,000 to just under 30,000 – this now represents one in seven of those with drivers' licences living in the borough. This is also the highest car club membership for any authority in the country. These members have access to a total of 313 vehicles in the borough.

The success of car clubs in the borough is attributable to its multi-operator approach and introduction of universal permits for one-way car club operators. Wandsworth Council's car club framework is multi-operator and so car club operators are able to join throughout the framework period. In order for a car club company to operate in the borough, the council requires:

- Provision of usage data from the operator
- Accreditation by CoMoUK
- Ability for the Council to recover costs in event of withdrawal
- Public and employer liability insurance
- Council to identify car parking bays
- Purchase of a car club parking permit

Infrastructure requirements for electric car club vehicles: **Table 49** below, derived from engagement with car club operators in 2015, provides estimates for the charging requirements of an EV car club, depending on the operating model. In the back-to-base model a dedicated charge point is required for each vehicle at its car club bay. Fixed one- way requires between 2 and 2.5 chargers per vehicles, which provides some contingency and allowances for tidal flows of vehicles. Floating one-way requires widespread provision of public EVCP bays, particularly in the longer term where the aspiration is for users to charge the vehicles and minimise artificial redistribution. For peer-to-peer operators each vehicle's host manages the charging of the EV, and as such existing EV infrastructure is not considered to be a barrier to growth. Operators have found that EVs tend to be a selling point for car clubs as people want to try them out. Operators have also found that some members will only drive EVs.

Table 49: Electric car club requirements

Car club operating modes	Minimum EVCP requirement	Desirable EVCP requirement	Charge point occupancy	Charge point availability for other users
to-Base / Return/ Round Trip	1:1	75-100%	Typically Dedicated – some may allow limited access via booking systems	to-Base / Return/ Round Trip
Fixed One-way (Point-to-Point)	1:2	1:2.5	50-75%	Some access via booking systems
Floating One-way/ Flexible	1:2.5	1:10	<25%	Fully Accessible

Commercial case for electric car club vehicles: In order for a car club to provide electric vehicles to its customers, the operator has to take into consideration the practicalities of charging the vehicle and the financial implications of a different business model. Overall, it is more expensive to deliver electric vehicles for customers. EVs have higher up-front costs to purchase. This often necessitates strong relationships with OEMs, or pump priming via a Local Authority or private organisation. Initial discussions with car club providers held by the UAs suggest that £10-15,000k of public subsidy may be required per vehicle for its first 2-3 years in locations which are not deemed commercially viable.

Managing an electric fleet is also more complex than for ICEs. In the floating model, vehicles travel shorter distances and are less likely to require recharging between trips. However, unless customers are incentivised to do so then staff time and vehicle down time is required to charge and redistribute the vehicles. EVs are taken out of service when charge falls below a threshold (varies by operator between 15%-50%) – vehicle removed from listings on apps. In Paris, when operational (prior to its withdrawal), less than 5% of the Autolib car club fleet were out of action at any time. In the back to base model, journeys are on average longer, and whilst there is likely an EV at the base bay, longer charging time is required between trips, resulting in lower utilisation.

The role of local authorities: Whilst there is demand for car clubs to provide EVs, running an e-car club is more challenging for operators and there remain barriers to electrification.

Local authorities can support operators by providing the infrastructure and policies required to support electrification. The Combined Authority could work with operators to 'prime the pump' and make it commercially viable to electrify existing car club fleets. This would allow the expansion into new areas and help to enable an equitable distribution of vehicles across more and less affluent neighbourhoods.

Investment and implementation: The operation of a car club is carried out by a private operator, who will take on the majority of the investment and risk. To introduce EV car club vehicles within the region it is therefore necessary to find one or more charge point operators with which to partner.

Co-Wheels currently operate nine existing EV car club vehicles in Bristol. As such they are well placed to roll out additional EVs in the short term. It is proposed that the Combined Authority work with Co-wheels to expand their offering in Bristol to 20 electric car club vehicles. In addition, South Gloucestershire Council are planning to introduce 3 car club vehicles, either with Co-Wheels or another provider, subject to funding availability.

This will provide a quick win whilst work is under way to prepare a larger scale introduction of EV car clubs. To support this, the Combined Authority could fund the introduction of car club bays and associated charge points and provide a subsidy in the

region of £10-15,000 per vehicle for several years to overcome commercial viability constraints where necessary.

In total, it is estimated that the charging infrastructure will cost £129,500 (excluding TRO costs) across the 14 bays (11 in Bristol, 3 in South Gloucestershire) and a subsidy for the EVs of £140,000 to £210,000 a year may be required. Additional revenue funding of £15,000 would be required for officer time to complete engagement with Co-Wheels and project management.

An initial feasibility study would need to be carried out fully understand the requirements of a wider roll out of EV car clubs. This would involve extensive engagement with suppliers to understand the commercial arrangements which could be entered into, define the level of investment required by the Combined Authority to achieve this and additional work to identify locations where car club chargers would be required and define the level of investment required. This would require revenue funding of £30,000.

If the viability of such a scheme was established, then further investment would then be required to install dedicated car club EV charge points and parking bays. If the Combined Authority were to invest in 50 such sites, £512,000 would be required. This assumes the cost of retrofitting an existing car club bay with a 7kW single socket fast charger would be £9,250. The creation of new bays would also require a TRO and public consultation which would cost approximately £1,500 per site (not included in cost estimates).

Depending on commercial arrangement, additional subsidies to compensate operators to run the service may be required. This is an unknown until the feasibility study has been completed but could be in the region of £500,000 per year based on preliminary discussions.

3.5 Next Steps

In order to secure the required capital and revenue funding business cases will have to be developed for each of the schemes outlined in this report.

In addition, the Combined Authority is developing an Electric Vehicle (EV) charging strategy that will define the medium and long term aims, objectives and actions regarding EV charging.

3.6 Modelling of EV uptake and EVCP demand

The following maps show the inputs and outputs of the EV:Ready forecasting model.

Figure 30: Households with access to off street parking where a vehicle can be charged

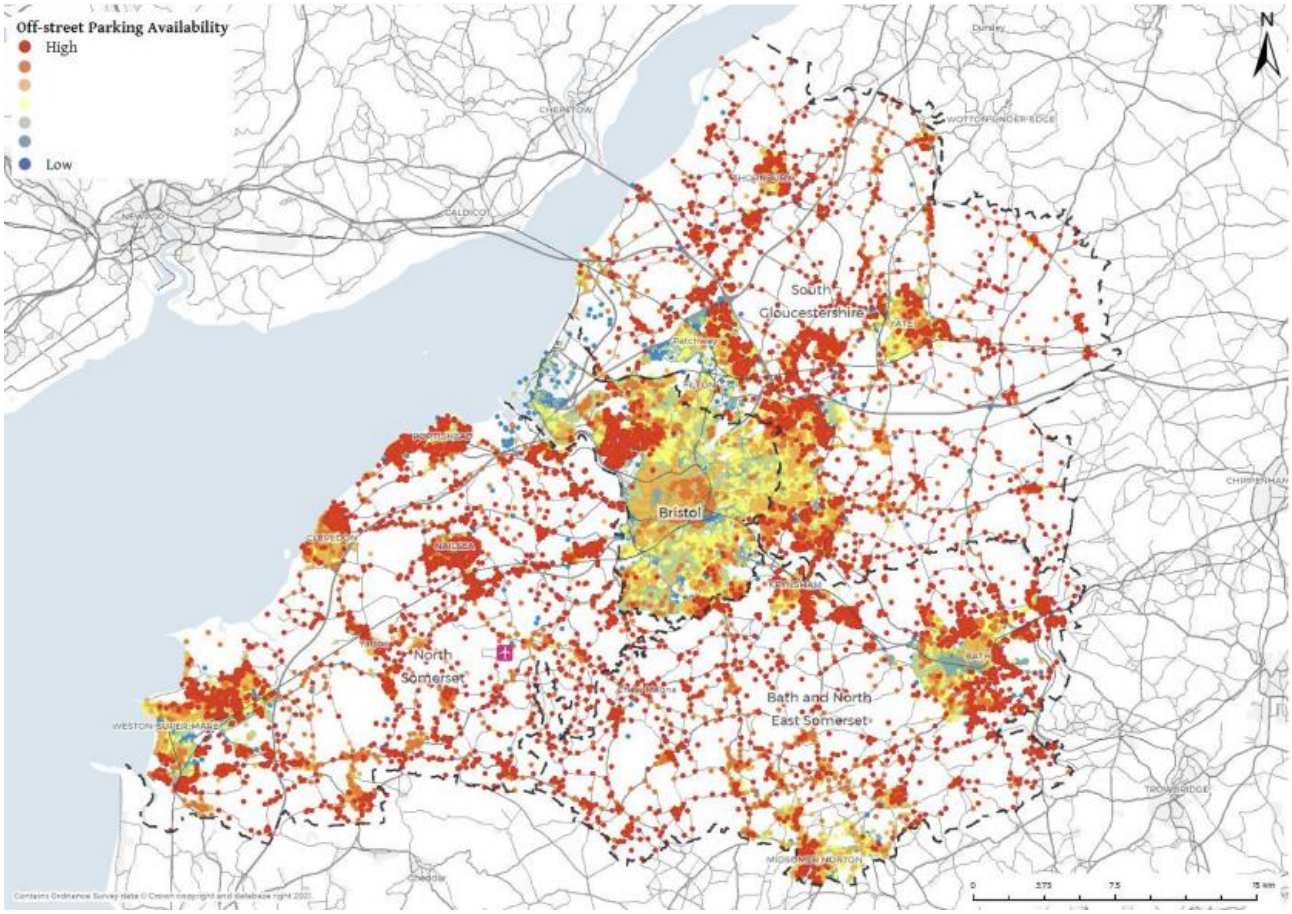


Figure 31: Propensity of households to purchase an electric vehicle

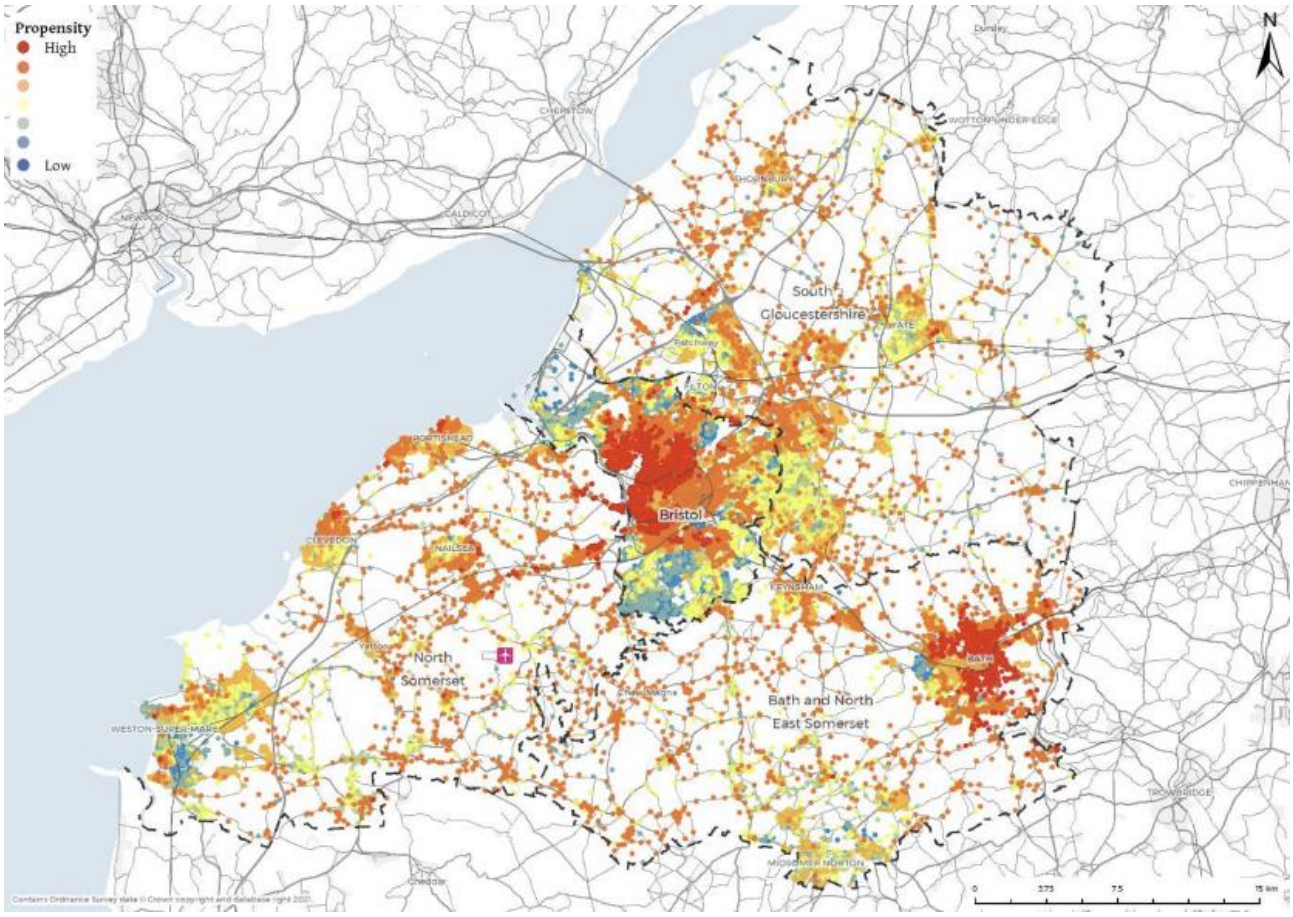


Figure 32: Forecast EV uptake 2020 & 2025

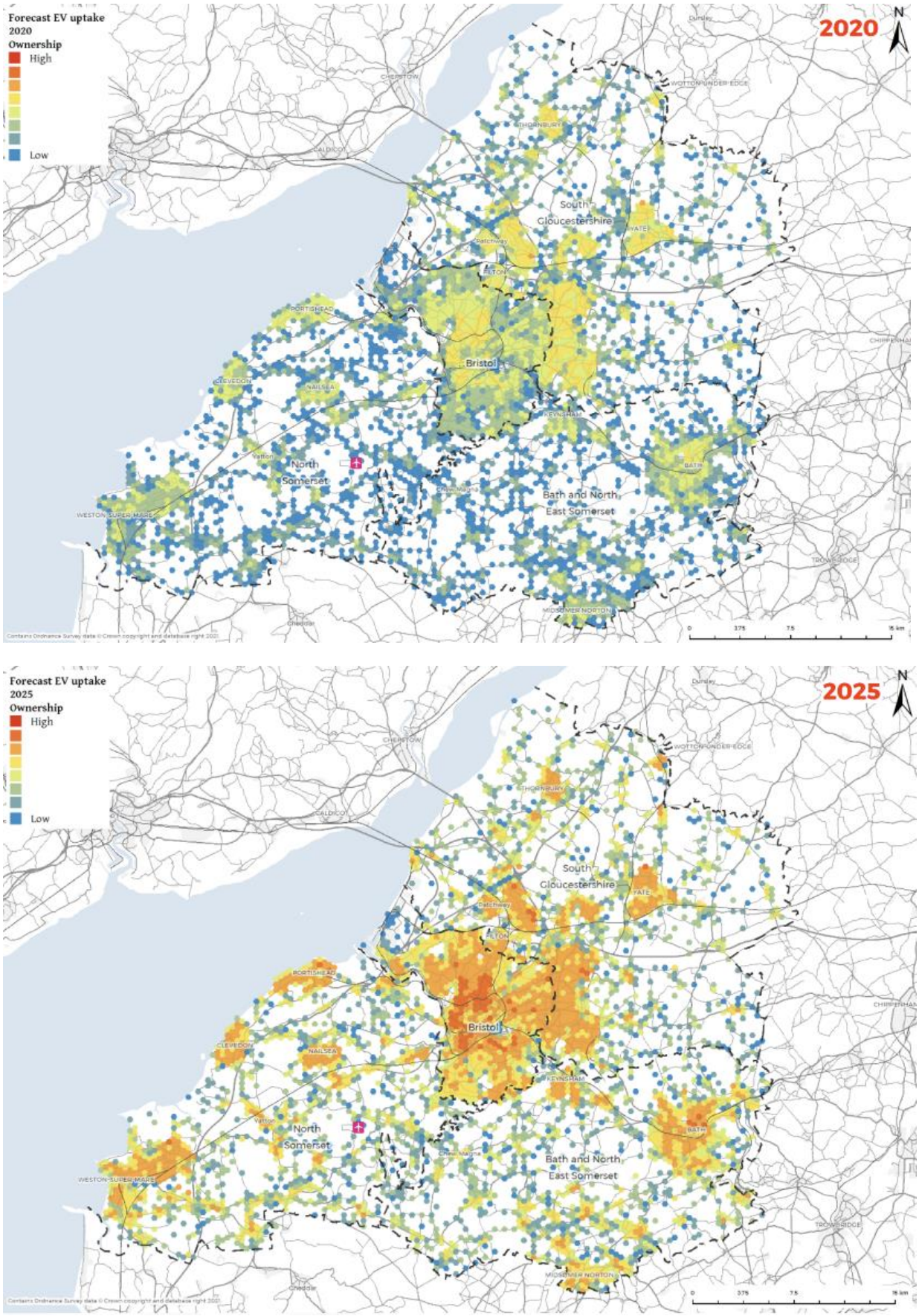


Figure 33: Forecast EV uptake 2030

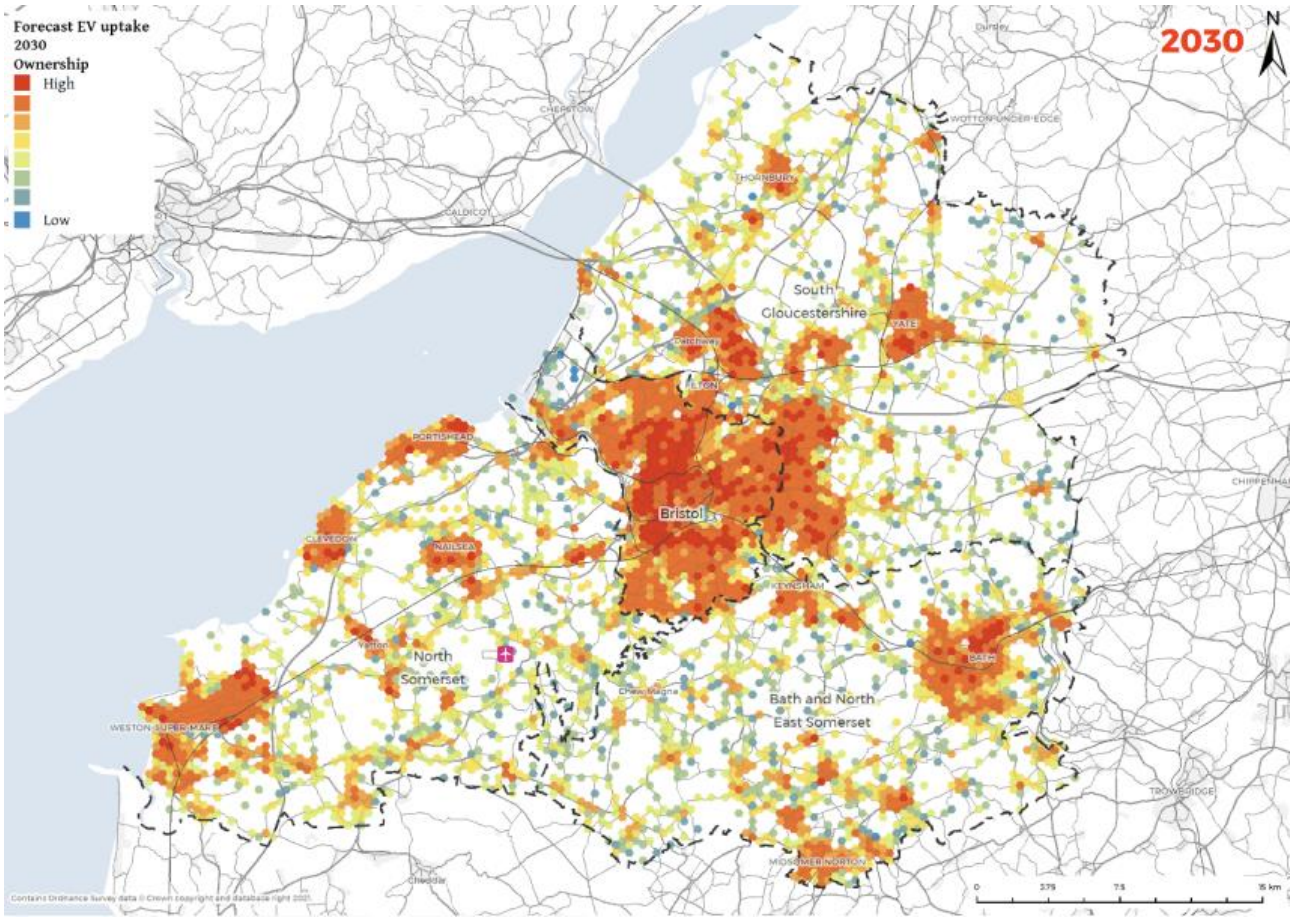
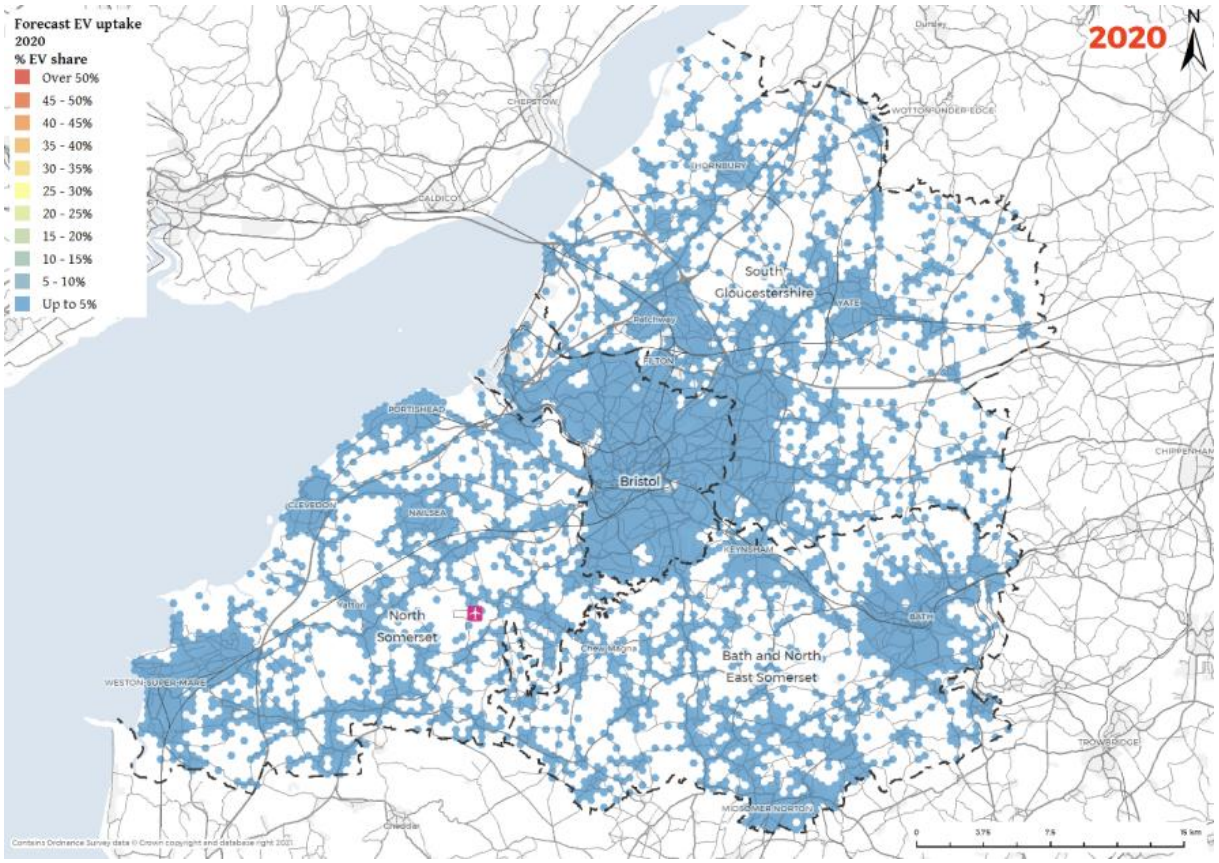


Figure 34: Forecast share of EVs in the total vehicle fleet 2020 & 2025



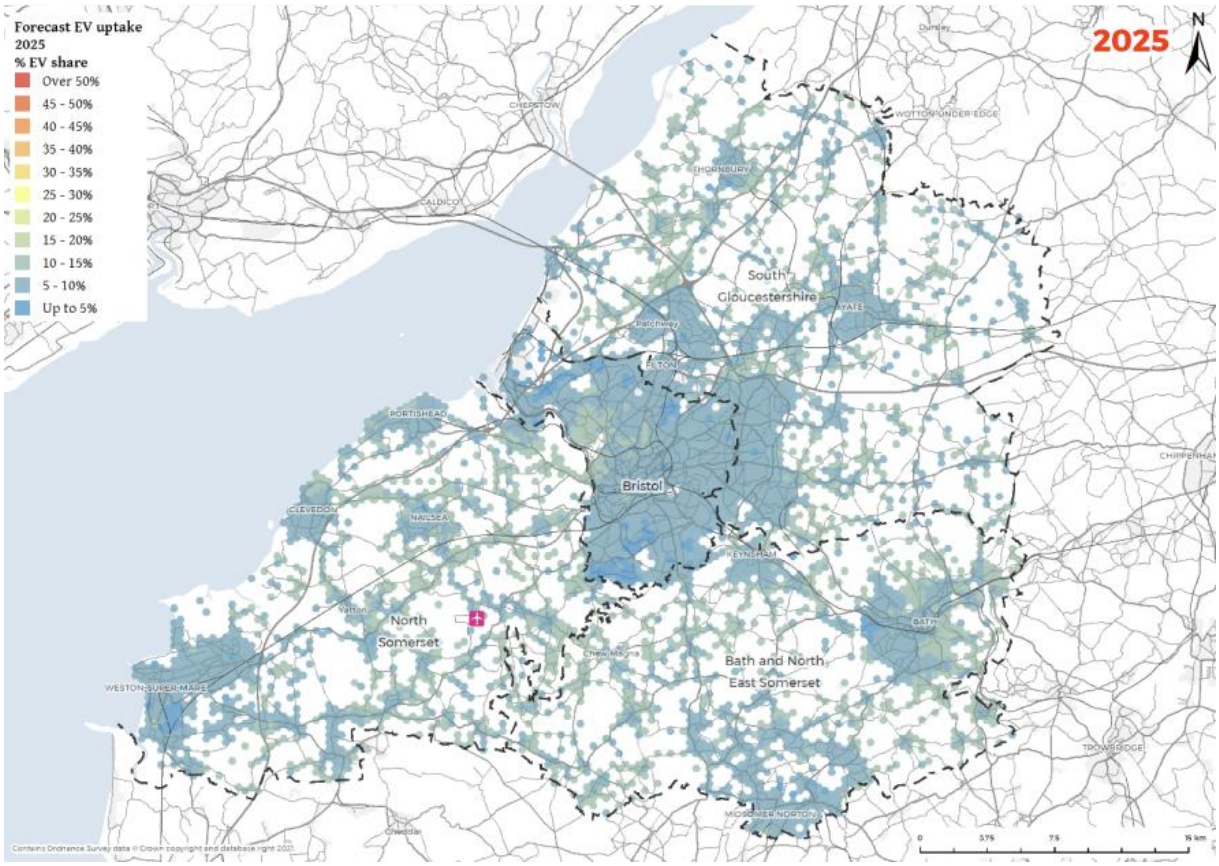


Figure 35: Forecast share of EVs in the total vehicle fleet 2030

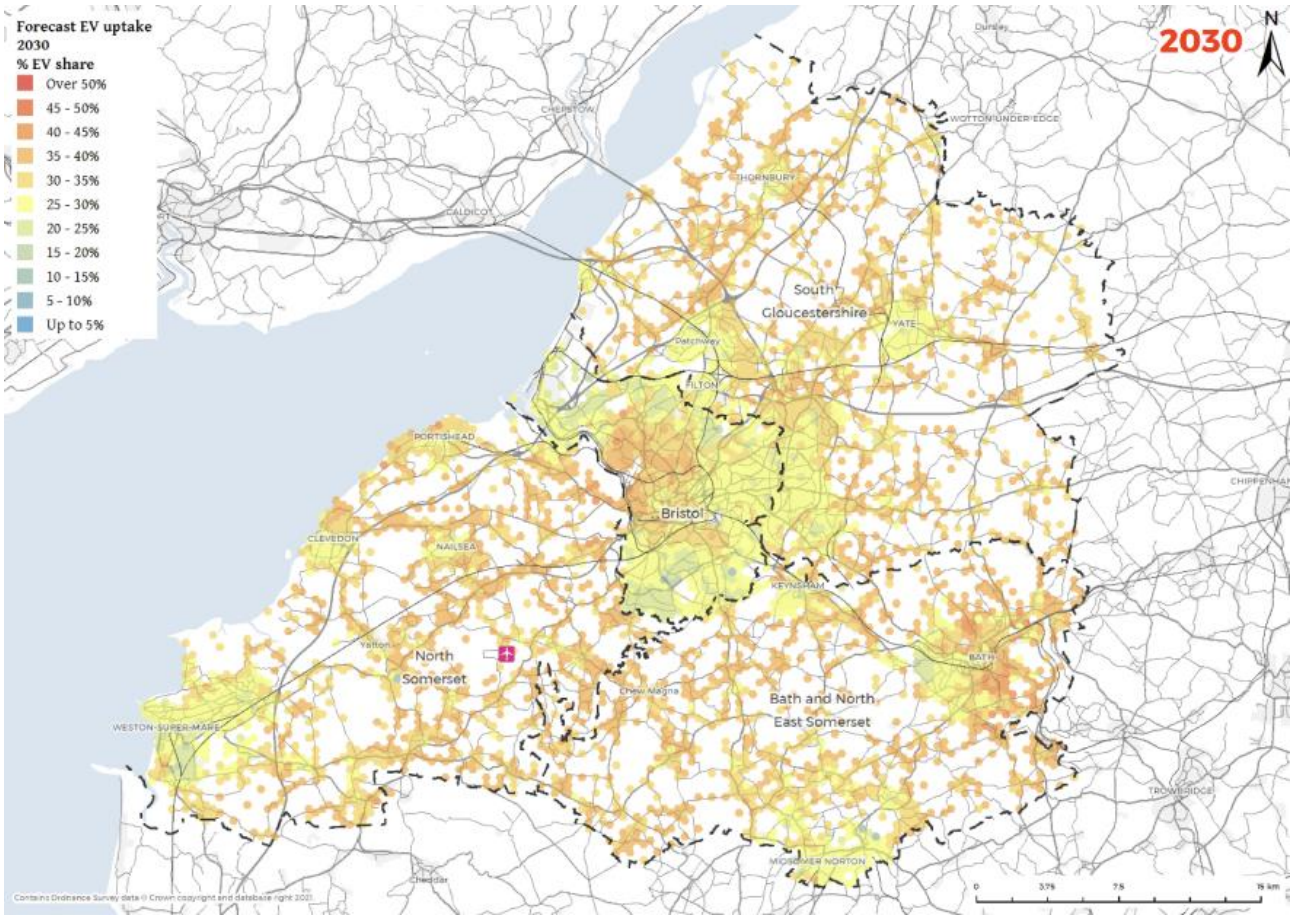
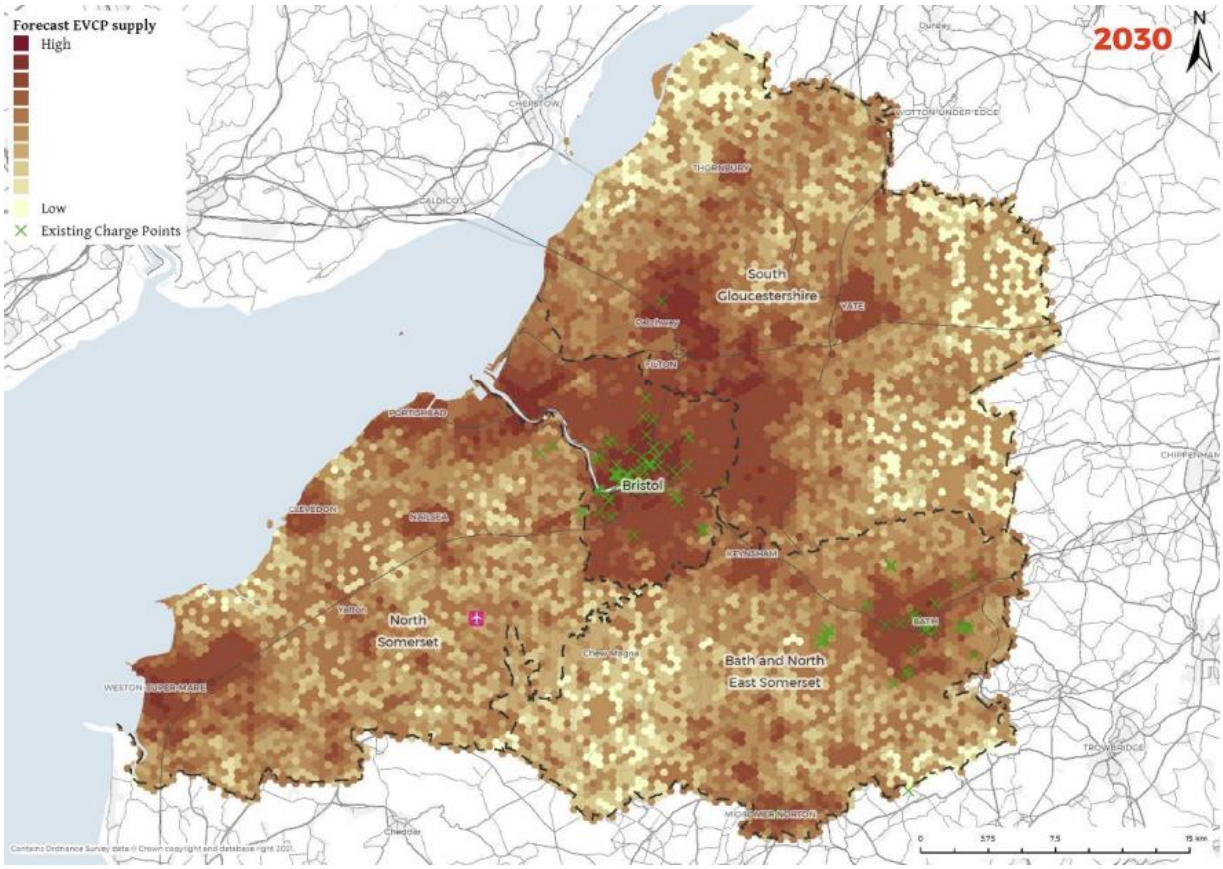


Figure 36: Forecast supply and demand for EVCPs in 2030



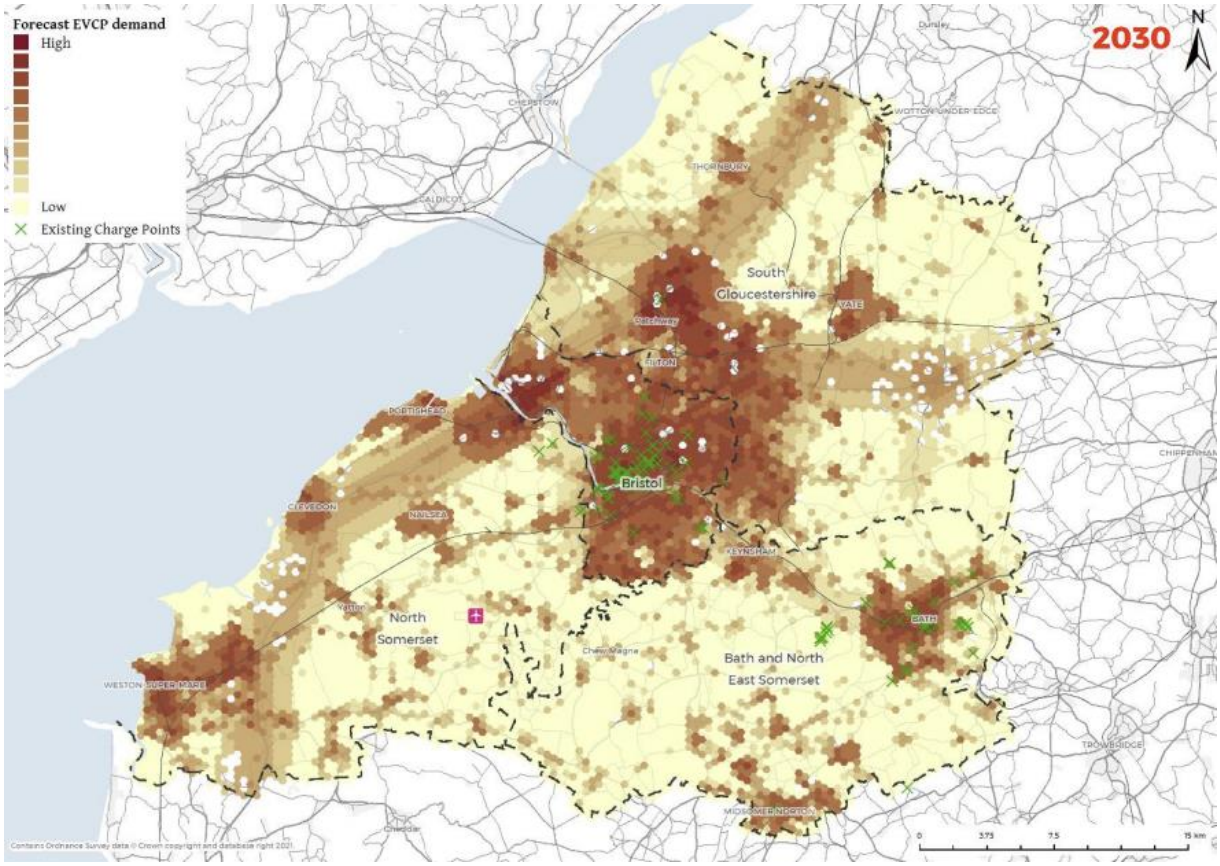
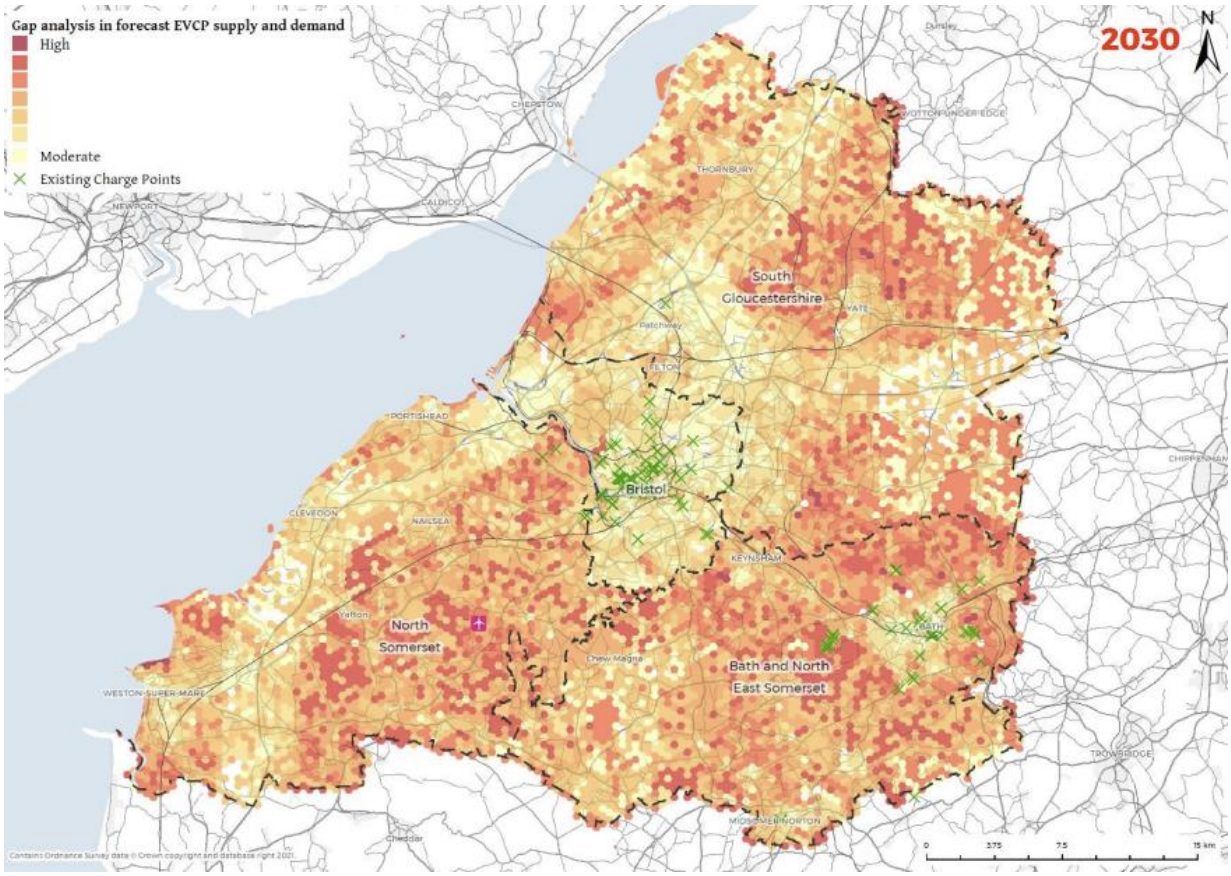


Figure 37: Areas identified as highest priority for public sector funded EVCPs



APPENDIX 4: QUANTITATIVE RISK ASSESSMENT

According to CA and the UAs assessment, the most likely contingency cost scenario for the identified risks would be the most likely or average cost scenario. While the highest cost solution totals shown here are double the value of the programme, it should be noted that the programme will only look at implementing a one or two of these high-cost solutions at a maximum, if the site is a high priority and high scoring site. Otherwise, an alternative long-listed site will be substituted in (as per the change management controls set out in Section 6.2).

Table 50: Quantitative risk assessment

Risk	UA	Scheme	No. of sites	Ave. CPs per site	Ave. cost per site	Current Mitigation	Prob %	Low Cost Solution	Ave. Cost Solution	Highest Cost Solution	L x Prob x No. Sites	Ave. x Prob x No. Sites	H x Prob x No. Sites
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	SGC	On-street	8	1 x 22kw Twin	£64,200	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets. Revive working with supplier Yunex Traffic.	25%	£500	£1,000	£2,500	£1,000	£2,000	£5,000
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	SGC	Community	14	1.93 x 22kw Twin	£68,600	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	25%	£500	£1,000	£5,000	£1,750	£3,500	£17,500
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	SGC	Destination	3	0.33 Rapid 2.33 x 22kw	£78,000	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	50%	£500	£1,000	£5,000	£750	£1,500	£7,500
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	BCC	On-street	150	1 lamp post	£4,650	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	25%	£0	£500	£1,000	£0	£18,750	£37,500
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	BCC	Community	5	2 x u-rapid 2 x fast	£200,000	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	50%	£750	£1,500	£3,750	£1,875	£3,750	£9,375

Risk	UA	Scheme	No. of sites	Ave. CPs per site	Ave. cost per site	Current Mitigation	Prob %	Low Cost Solution	Ave. Cost Solution	Highest Cost Solution	L x Prob x No. Sites	Ave. x Prob x No. Sites	H x Prob x No. Sites
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	BCC	Destination	7	1 x rapid 3 x fast	£144,000	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	50%	£750	£1,500	£3,750	£2,625	£5,250	£13,125
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	B&NES	On-street	4	1 x 22kw Twin	£55,000	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	25%	£750	£1,500	£3,750	£750	£1,500	£3,750
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	B&NES	Community	11	1.33 x 22kw	£26,300	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	25%	£750	£1,500	£7,500	£2,063	£4,125	£20,625
Supply chain delays - both for EV Charger components, enclosures & for associated materials (electrical etc.)	B&NES	Destination	3	2 x 22kw	£80,000	Revive Network will manage supply chain risks related to EV charger components. Local operational teams will manage the risks associated with as cabling and electrical assets.	25%	£750	£1,500	£7,500	£563	£1,125	£5,625
Grid connection risk - not enough capacity / no connection to grid on-site	All	All	10	Sites with Rapids/ 4+ fast	£17,502	Programme wide contingency pot / Long-list of sites developed to allow for back-up sites.	25%	£400	£20,000	£500,000	£1,000	£50,000	£1,250,000
Grid connection risk - not enough capacity / no connection to grid on-site	All	All	45	Everything else		Programme wide contingency pot / Long-list of sites developed to allow for back-up sites.	10%	£400	£3,500	£500,000	£1,800	£15,750	£2,250,000
Grid connection risk - not enough capacity / no connection to grid on-site	BCC	OS LPs	150	Clusters of two		Programme wide contingency pot / Long-list of sites developed to allow for back-up sites.	10%	£400	£3,500	£500,000	£6,000	£52,500	£7,500,000
Land usage changes in life of project	All	All - apart from BCC OS LPs	55			The CA & UAs will engage with landowners to get a wayleave agreement. If preferred sites cannot be used, back-up sites have already been identified.	10%	£400	£800	£50,000	£2,200	£4,400	£275,000

Risk	UA	Scheme	No. of sites	Ave. CPs per site	Ave. cost per site	Current Mitigation	Prob %	Low Cost Solution	Ave. Cost Solution	Highest Cost Solution	L x Prob x No. Sites	Ave. x Prob x No. Sites	H x Prob x No. Sites
Permission from landowners	SGC & B&NES		12			The CA & UAs will engage with landowners to get a wayleave agreement. If preferred sites cannot be used, back-up sites have already been identified.	75%	£400	£800	£50,000	£3,600	£7,200	£450,000
Traffic Regulation Order newly mandated	BCC	OS LPs	34			Start process to acquire TRO early, as soon as FBC has been approved. NB TRO not required for delivery of the charger -- but show to improve utilization / stop internal combustion engine vehicles blocking (ICE'ing) bays	75%	£1,000	£2,500	£5,000	£25,500	£63,750	£127,500
Traffic Regulation Order issues / objections	B&NES & SGC	OS	12			Start process to acquire TRO early, as soon as FBC has been approved. NB TRO not required for delivery of the charger -- but show to improve utilization / stop ICE'ing of bays	25%	£400	£2,000	£2,850	£1,200	£6,000	£8,550
Traffic Regulation Order issues / objections	All	Public Car Parks	33			Start process to acquire TRO early, as soon as FBC has been approved. NB TRO not required for delivery of the charger -- but show to improve utilization / stop ICE'ing of bays	10%	£400	£2,000	£2,850	£1,320	£6,600	£9,405
Buried Services discovered during construction	All	All - apart from BCC OS LPs	55		£17,502	First mitigation -- Utilities drawings provided by UA to their design team, then site survey. Final mitigation portable scan unit during construction (in RAMS).	10%	£1,000	£5,000	£20,000	£5,500	£27,500	£110,000
Design changes / product changes needed due to reflect the recent EV Charging accessibility standards update (BSI PAS1899:2022) depending on Revive Board adoption of standard	All	All - apart from BCC OS LPs	55			Previous learnings from installations & BSI standard best practice, not legal standard. If preferred sites cannot be used, back-up sites have already been identified.	15%	£400	£2,000	£5,000	£3,300	£16,500	£41,250

Risk	UA	Scheme	No. of sites	Ave. CPs per site	Ave. cost per site	Current Mitigation	Prob %	Low Cost Solution	Ave. Cost Solution	Highest Cost Solution	L x Prob x No. Sites	Ave. x Prob x No. Sites	H x Prob x No. Sites
Design changes / product changes needed due to reflect the recent EV Charging accessibility standards update (BSI PAS1899:2022) depending on Revive Board adoption of standard	All	BCC OS	150			Previous learnings from installations & BSI standard best practice, not legal standard. If preferred sites cannot be used, back-up sites have already been identified.	15%	£100	£400	£2,000	£2,250	£9,000	£45,000
Stop works notice on site for breach of HSE or other complaint (noise, dust etc.) by contractors	All	All - apart from BCC OS LPs	55			RAMS appropriate & reviewed	5%	£400	£1,000	£10,000	£1,100	£2,750	£27,500
Stop works notice on site for breach of HSE or other complaint (noise, dust etc.) by contractors	All	BCC OS	150			RAMS appropriate & reviewed	5%	£0	£200	£500	£0	£1,500	£3,750
Additional Detail Design needed due to issues on site	All	All - apart from BCC OS LPs	55		£64,200	Back-up sites have already been identified.	5%	£400	£2,000	£5,000	£1,100	£5,500	£13,750
										Risk sub-total:	£67,245	£310,450	£12.231m

Table 51: Inflation scenarios and allowances for Year 1

Risk	UA	Scheme	No. of sites	Average cost per site	Total Cost	Low Inflation (5.2%)	Likely Inflation (7.2%)	High Inflation (12%)
Inflation - Year 1	BCC	OS	150	£5,367	£805,000	£41,860	£57,960	£96,600
Inflation - Year 1	BCC	Community	4	£45,555	£182,220	£9,475	£13,120	£21,866
Inflation - Year 1	BCC	Destination	12	£31,906	£382,870	£19,909	£27,567	£45,944
Inflation - Year 1	SGC	OS	14	£33,038	£462,536	£24,052	£33,303	£55,504
Inflation - Year 1	SGC	Community	0	£0	£0	£0	£0	£0
Inflation - Year 1	SGC	Destination	1	£75,809	£75,809	£3,942	£5,458	£9,097
Inflation - Year 1	B&NES	OS	0	£0	£0	£0	£0	£0
Inflation - Year 1	B&NES	Community	0	£0	£0	£0	£0	£0
Inflation - Year 1	B&NES	Destination	0	£0	£0	£0	£0	£0

Table 52: Inflation scenarios and allowances for Year 2 & 3

Risk	UA	Scheme	No. of sites	Average cost per site	Total Cost	Low Inflation (2.6%)	Likely Inflation (4.6%)	High Inflation (8%)
Inflation - Year 2	BCC	OS	0	£0	£0	£0	£0	£0
Inflation - Year 2	BCC	Community	2	£93,604	£187,208	£4,867	£8,612	£14,977
Inflation - Year 2	BCC	Destination	5	£22,274	£111,368	£2,896	£5,123	£8,909
Inflation - Year 2	SGC	OS	0	£0	£0	£0	£0	£0
Inflation - Year 2	SGC	Community	10	£37,288	£372,875	£9,695	£17,152	£29,830
Inflation - Year 2	SGC	Destination	2	£39,865	£79,729	£2,073	£3,668	£6,378
Inflation - Year 2	B&NES	OS	4	£48,792	£195,167	£5,074	£8,978	£15,613
Inflation - Year 2	B&NES	Community	9	£48,792	£439,125	£11,417	£20,200	£35,130
Inflation - Year 2	B&NES	Destination	0	£0	£0	£0	£0	£0

Risk	UA	Scheme	No. of sites	Average cost per site	Total Cost	Low Inflation (2.6%)	Likely Inflation (4.6%)	High Inflation (8%)
Inflation - Year 3	BCC	OS	0	£0	£0	£0	£0	£0
Inflation - Year 3	BCC	Community	5	£75,932	£379,658	£9,871	£17,464	£30,373
Inflation - Year 3	BCC	Destination	6	£60,198	£361,190	£9,391	£16,615	£28,895
Inflation - Year 3	SGC	OS	0	£0	£0	£0	£0	£0
Inflation - Year 3	SGC	Community	17	£29,735	£505,491	£13,143	£23,253	£40,439
Inflation - Year 3	SGC	Destination	2	£27,517	£55,035	£1,431	£2,532	£4,403
Inflation - Year 3	B&NES	OS	0	£0	£0	£0	£0	£0
Inflation - Year 3	B&NES	Community	4	£33,354	£133,417	£3,469	£6,137	£10,673
Inflation - Year 3	B&NES	Destination	6	£27,517	£165,104	£4,293	£7,595	£13,208

	Low-cost scenario	Average cost scenario	High-cost scenario
Inflation sub-total:	**£176,858**	**£274,734**	**£467,842**
Total (risk + inflation tables):	**£244,103**	**£585,184**	**£12,699,547**
Percentage:	**5%**	**12%**	**259%**

APPENDIX 5: LAMP COLUMN CHARGER SITE SELECTION

5.1 Demand Assessment

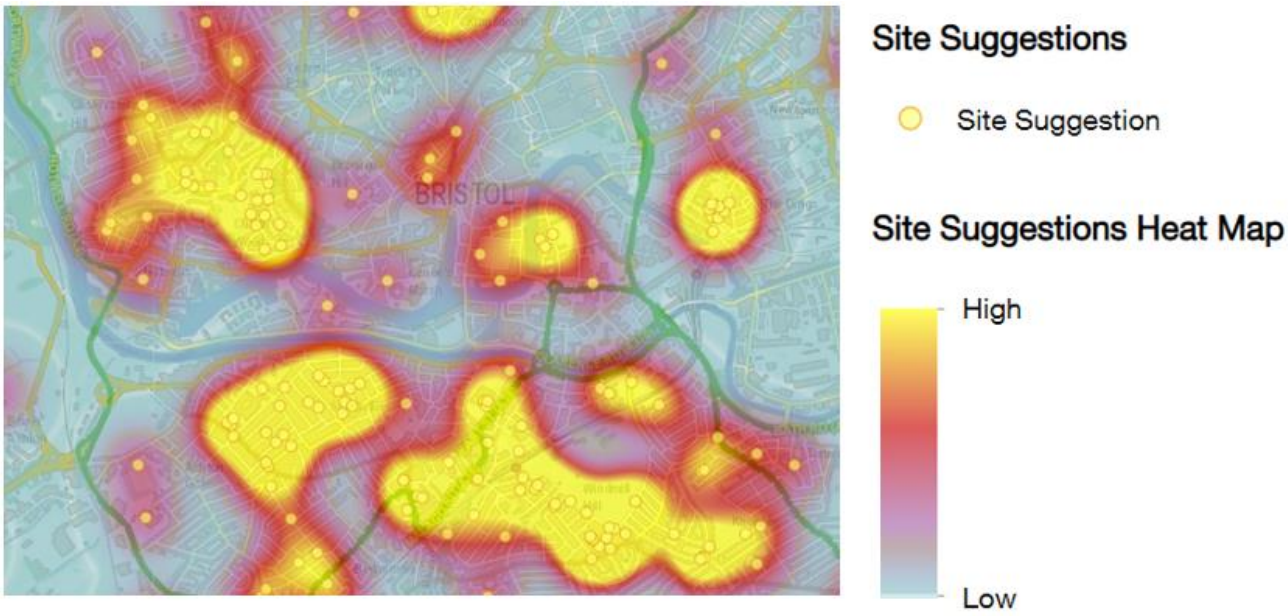
Demand for residential charge points has been assessed by a combination of two methods/data sets.

The first method uses a data set purchased through EMU analytics. The EMU data set analyses each building on a street and depending on the length of the driveway associated with that building assigns them a probability of having off-street parking, i.e. either High (> 5m), Medium (between 3 and 5 m) or Low (< 3m). Whilst not all areas with low availability of off-street parking will have an immediate high demand for EV charging due to various socio-economic factors, these areas will require access to charging infrastructure to transition to electro-mobility (in addition to active travel and Public Transport), and hence we expect to see strong demand growth in these areas in the next 5 years. This method ensures this project will encourage EV uptake in areas where immediate demand is low by improving access to charging infrastructure.

Figure 38: EMU data set visual example

The second method relies on site suggestions made by members of the public through the online suggestion form located here: Charging points - Travelwest. At the time of analysis there were over 400 site suggestions entered via this form. See below, by heat mapping these suggestions in our GIS system, areas of high current demand become apparent. Whilst the EMU analytics data set does not account well for buildings with multiple households, this second method will better take this into account at least in terms of immediate demand.

Figure 39: Heatmap constructed from site suggestions through the Travelwest website



As described, a combination of the two methods was chosen to identify areas of both current and expected demand. Lower Super Output Areas (LSOAs) were chosen as a suitable size geographical area to prioritise. LSOAs were designed to have roughly consistent population sizes as of the census in 2011. In most areas of inner Bristol this correlates with residential areas that are short walking distance to cross, meaning we can aim to satisfy demand within an LSOA by installing residential charging infrastructure within that LSOA, without necessarily targeting the exact same street as site suggestions from the public.

LSOAs were prioritised by the following two methods:

- The EMU data set was used to calculate the average % of buildings within an LSOA with low probability of off-street parking. The top twenty LSOAs by this method were identified as high priority.
- The Travelwest site selection data set was applied to the LSOAs, and the LSOAs were ranked by number of public suggestions

These sites are displayed in Table 53 and Table 54 overleaf.

Table 53: Short-list of LSOA areas from the EMU data set

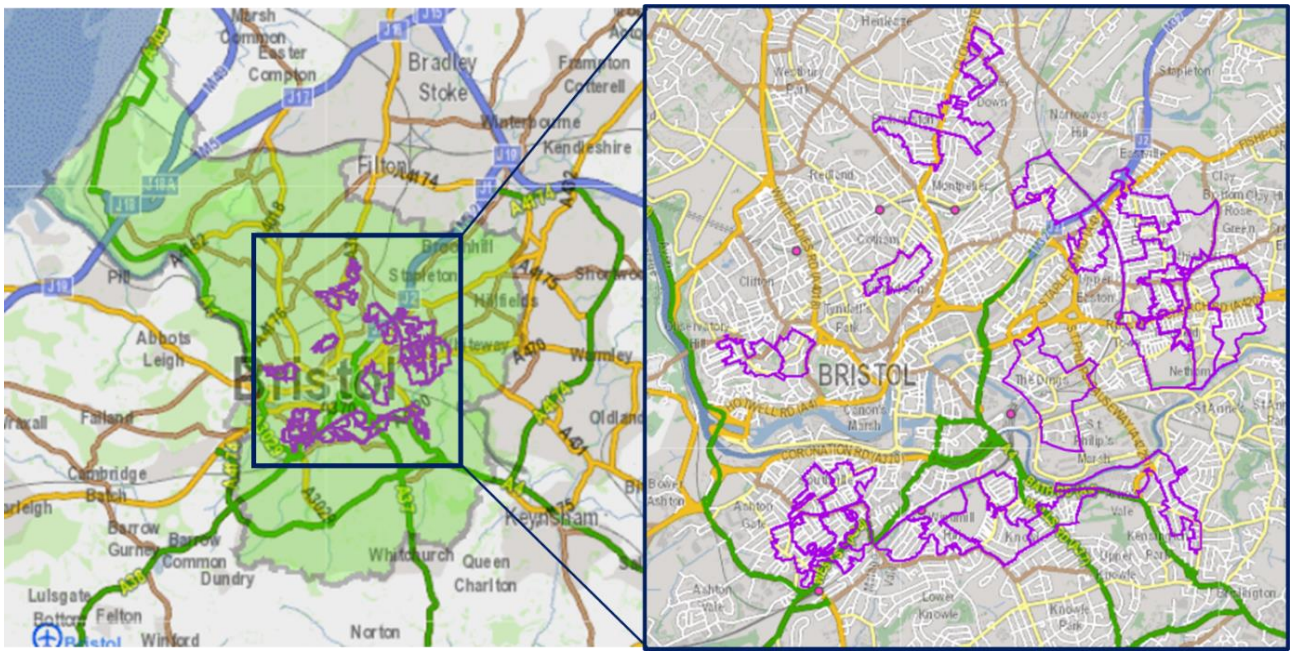
LSOA Local Name	Ward	Average % of buildings with a low probability of off-street parking
Chessel Street	Bedminster	80.85
Church Road	Easton	74.49
Gilbert Road	Easton	72.39
St Georges Park	St George West	71.98
Upper Totterdown	Windmill Hill	71.95
Stackpool Road	Southville	69.74
Luckwell Road	Bedminster	69.40
Chelsea Park	Easton	68.31
Stapleton Road	Lawrence Hill	68.08
Windmill Hill West	Windmill Hill	64.84
St Marks Road	Easton	64.45
West Street West	Bedminster	62.65
Whitehall	Easton	62.33
Netham	Easton	62.32
Robertson Road	Easton	61.73
West Street East	Bedminster	61.43
Windmill Hill East	Windmill Hill	61.38
Mina Road	Ashley	59.10
Wells Road	Windmill Hill	59.10
Seymour Road	Bishopston	57.61

Table 54: Short-list of LSOA areas from the Travelwest website public suggestions

LSOA local name	Postcode	Ward	Total Site suggestions
Bedminster East	BS3	Southville	12
Berkeley Road South	BS7	Redland	17
Clifton Central	BS8	Clifton	8
Hamilton Road	BS3	Southville	7
Kingsdown Parade	BS6	Cabot	8
Lower Clifton Hill	BS8	Clifton East	8
Mina Road	BS2	Ashley	8
Sandy Park Road	BS4	Brislington West	7
Somerville Road	BS7	Bishopston	7
Stackpool Road	BS3	Southville	7
The Dings	BS2	Lawrence Hill	9
Victoria Park	BS3	Windmill Hill	10
Windmill Hill East	BS3	Windmill Hill	17

The two lists were combined and mapped to produce our thirty priority LSOA areas (note three LSOAs were prioritised by both methods).

Figure 40: Combined priority LSOA areas



5.2 Detailed site selection

We intend to use existing streetlighting supplies as described below. Within the priority LSOAs lighting columns were identified which were

- Kerbside
- Not directly outside resident's front doors
- >1.6m pavement width

We have engaged with Western Power Distribution (WPD) – now National Highways – our own highways electrical assets team and Elexon approved street lighting compatible charge point suppliers to assess whether there is adequate supply for 3.5 kW charge points using existing Bristol streetlighting circuits.

To summarise:

- Most lighting columns in Bristol are fed by individual WPD circuits, which may be rated up to 90A. However, the WPD cut-outs used in lighting columns are rated to ≤ 25A (= 5.75kW).
- The 3.5 kW charge points we have investigated require only 16A load.
- There is sufficient load available within the columns. The lighting columns have a second cut-out rated at 6A for the streetlighting load (the actual load may be less than 0.5 A where LED lighting has been installed).
- Local network constraints will be assessed on a site-by-site basis. We have opened a line of communication with WPD to progress this, however conversations to date have suggested the network will cope with the low level and distributed loads we are requesting without upgrades.
- Where WPD confirm capacity is available there will be no cost for grid upgrades.
- In the unlikely event that network constraints are encountered for the lighting columns identified, we will:
    i. Utilise group load-balancing solutions to minimise grid impact. The charge point solutions we have investigated offer this via over the air comms, so we may limit total load to stay below WPD's requirements
    ii. Co-ordinate with the council's highways maintenance programme to progress required grid upgrades. Limited funding to improve streetlighting in poorly lit areas has already been identified to support
    iii. Substitute the location for an alternative with sufficient grid capacity in another area identified as high priority

Furthermore:

- On-site assessments undertaken in the priority areas indicated lighting columns there are almost entirely fed by individual WPD circuits and would be suitable. Lighting columns fed by looped supplies cannot be used, but this is rare in the areas we have investigated.
- WPD policy approves the use of earth fault detection devices. Therefore, as long as a compliant device is installed, a charge point does not have to have separation from other electrically fed street furniture to prevent touch potentials. The device will protect against any dangerous touch potentials which can be prevented.

APPENDIX 6: EV FORECASTING METHODOLOGY

6.1 Introduction

Disclaimer
The EV tool is based on propensity modelling and cannot be relied upon as a forecasting tool for financial investment. The decisions made using the outputs need to allow for the uncertainty inherent in the approach. The tool cannot be relied on directly for predicting the use of EV charge points (individually or collectively) or the associated revenue stream.

Why focus on EV Forecasting?
It is widely recognised that to achieve the UK's target of being net zero by 2050 (as set out in the Climate Change Act 2008), more needs to be done to decarbonise the transport sector. A key pathway to achieving this is the shift from petrol and diesel vehicles to:

- Less polluting active (walking and cycling) and public transport modes where possible, and
- Ultra-low and zero emission vehicles where vehicle trips will continue to be made.

The purpose of this report is to describe the methodology used by WSP's EV:Ready tool.

EV:Ready approach and methodology:
The report is structured as follows:

- **Part A - Opportunity to shift modes**. Before thinking about likely EV uptake, it is worth understanding which existing car trips could be made by active and sustainable modes (walking, cycling and public transport).
- **Part B** – Electric vehicles forecasting methodology. Sets out the projected growth in electric vehicles up to 2050.
- **Part C** – Electric vehicle charge points forecasting methodology. Sets out the requirement for electric vehicle charge points, including private/public investment split up to 2030.

The following sections of this report provides further detail on each process.

6.2 Part A – Opportunity to Shift Modes

Overview

Before thinking about likely EV uptake, it is worth understanding which existing car trips could be made by active and sustainable modes (walking, cycling and public transport).

Using transport model trip matrices and data from Google Maps, the origins and destinations of trips within a set study area are analysed to understand which trips could be:

- Walked (based on travel time)
- Cycled (based on travel time)
- Completed by public transport (based on a travel time comparison with car)

From this analysis, two scenarios have been developed:

- **Scenario 1: High mode shift** – which has ambitious thresholds for trips to be made by sustainable modes – two miles for walking, five miles for cycling (which aligns to Gear Change), and 2.4x (or less) slower for public transport (when compared to driving).
- **Scenario 2: Lower mode shift** – which has a more conservative set of journey time limits for trips to be made by sustainable modes – one mile for walking, three miles for cycling, and 1.5x slower for public transport (when compared to driving).

Further detail on the scenarios is presented within **Table 55**.

Table 55: Opportunity to shift modes scenarios

Scenario	Walk	Cycle	Public Transport
Scenario 1 High Mode Shift	Under: 2 miles 3.2km **40 mins**	Under: 5 miles 8km **30 mins**	Less than **2.4x slower**
Scenario 2 Lower Mode Shift	Under: 1 mile 1.6km **20 mins**	Under: 3 miles 4.8km **15 mins**	Less than **1.5x slower**

The Process

Opportunity to shift modes uses data from a range of sources to quantify the opportunity for current car trips to be shifted to sustainable modes. These sources include: •

- Modelling outputs, recording the origins, destinations and daily trip numbers of car journeys across the study area
- Google Maps data, giving the distance, duration and route shape for a sample of these modelled outputs.
- Government travel statistics and other research, which gives insight into how far people would be willing to travel by different modes.

A transport model is used to obtain daily trip numbers by origin and destination (O-D pairs) in a single modelled year. From here, a sample is taken of the O-D pairs with the highest trip numbers to collect Google Maps data. This is because there are often many pairs with such small trip numbers that it would be unfeasible to test all pairs.

The results from Google Maps are then analysed and compared against the travel time thresholds for each mode and each of the two scenarios described previously. This gives a figure for the proportion of driving trips which could shift to public and active modes.

Vehicle kilometres and carbon emissions as a result of both scenarios is also calculated using the journey distance which Google Maps provides and UK government conversion factors. This shows the outcome of possible mode shift in the context of decarbonisation.

Outputs

Opportunity to Shift Modes provides the following outputs:

- Proportion of baseline car trips which could be shifted to walking, cycling & public transport – **Figure 41**
- Proportion of baseline vehicle kilometres travelled (VKT) which could be shifted to walking, cycling & public transport – **Figure 42**
- Proportion of baseline CO_2e emissions which could be reduced by shifting to walking, cycling & public transport – **Figure 43**

Figure 41: Mode shift potential by number of trips (Transport East)

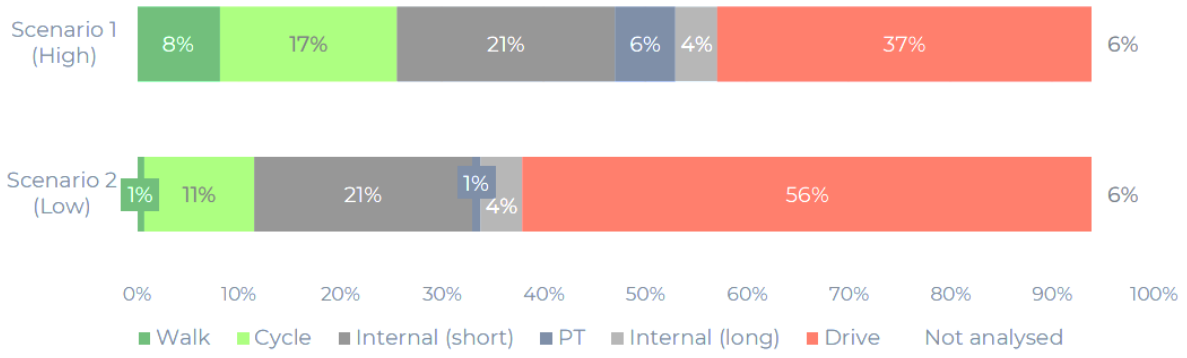


Figure 42: Mode shift potential by kilometres travelled (Transport East)

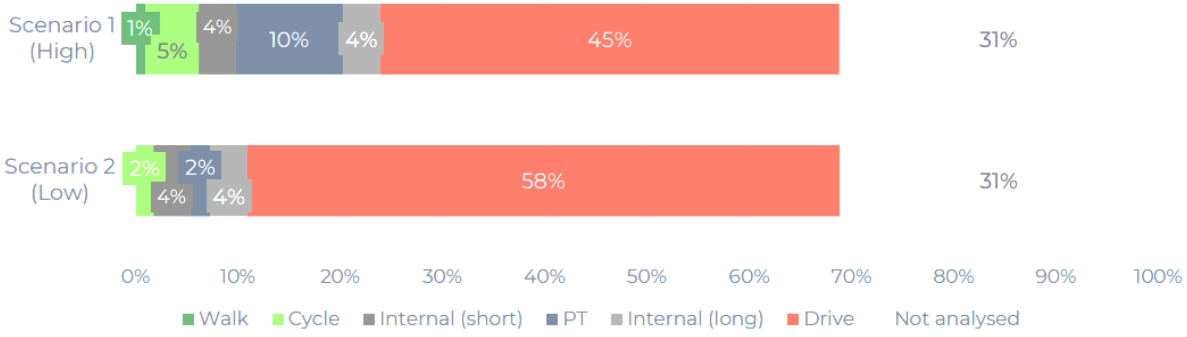
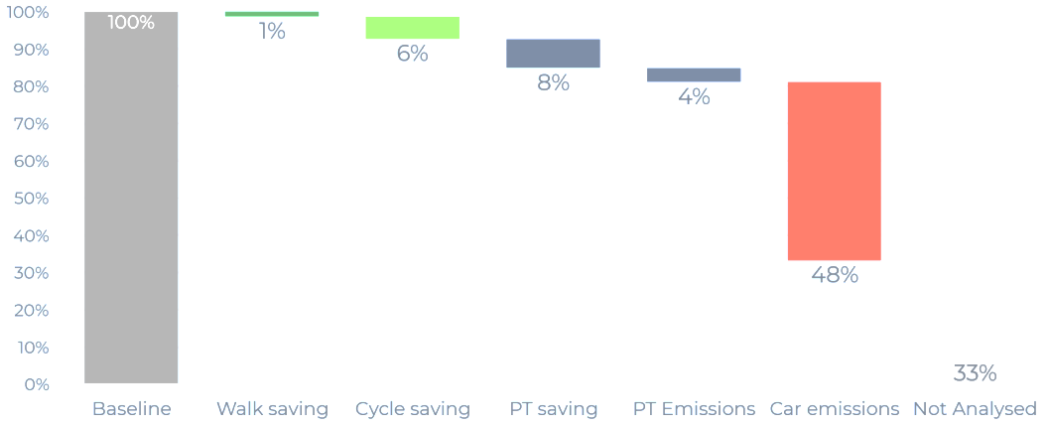


Figure 43: Carbon emissions and savings (Transport East Scenario 1)



6.3 Part B – EV Uptake Forecasting

Overview

WSP's in-house EV:Ready tool is used to derive forecasts for future electric vehicle (EV) uptake, the approach of which is summarised in **Figure 44** overleaf. This section focuses on the following steps of the process:

- Baselining: what is the baseline situation?
- UK EV sale trends: how might EV uptake increase into the future?
- Uptake scenario development: what are the likely EV growth scenarios going forward?
- EV uptake forecast: how might this translate into EV growth at a local level?

EV:Ready enables sophisticated EV uptake forecasting and scenario testing. It generates granular forecasts at a neighbourhood level, accounting for highly localised spatial variations in the key determinants of EV uptake rates, including:

- Consumer profiles
- Socio-demographics
- Availability of off-street parking
- Vehicle ownership
- Vehicle sales and turnover rates
- Vehicle ownership trends

This tool has been successfully applied within a range of public authorities and private organisations across the UK, such as North Yorkshire County Council, the City of London and Somerset County Council.

Figure 44: The EV:Ready approach

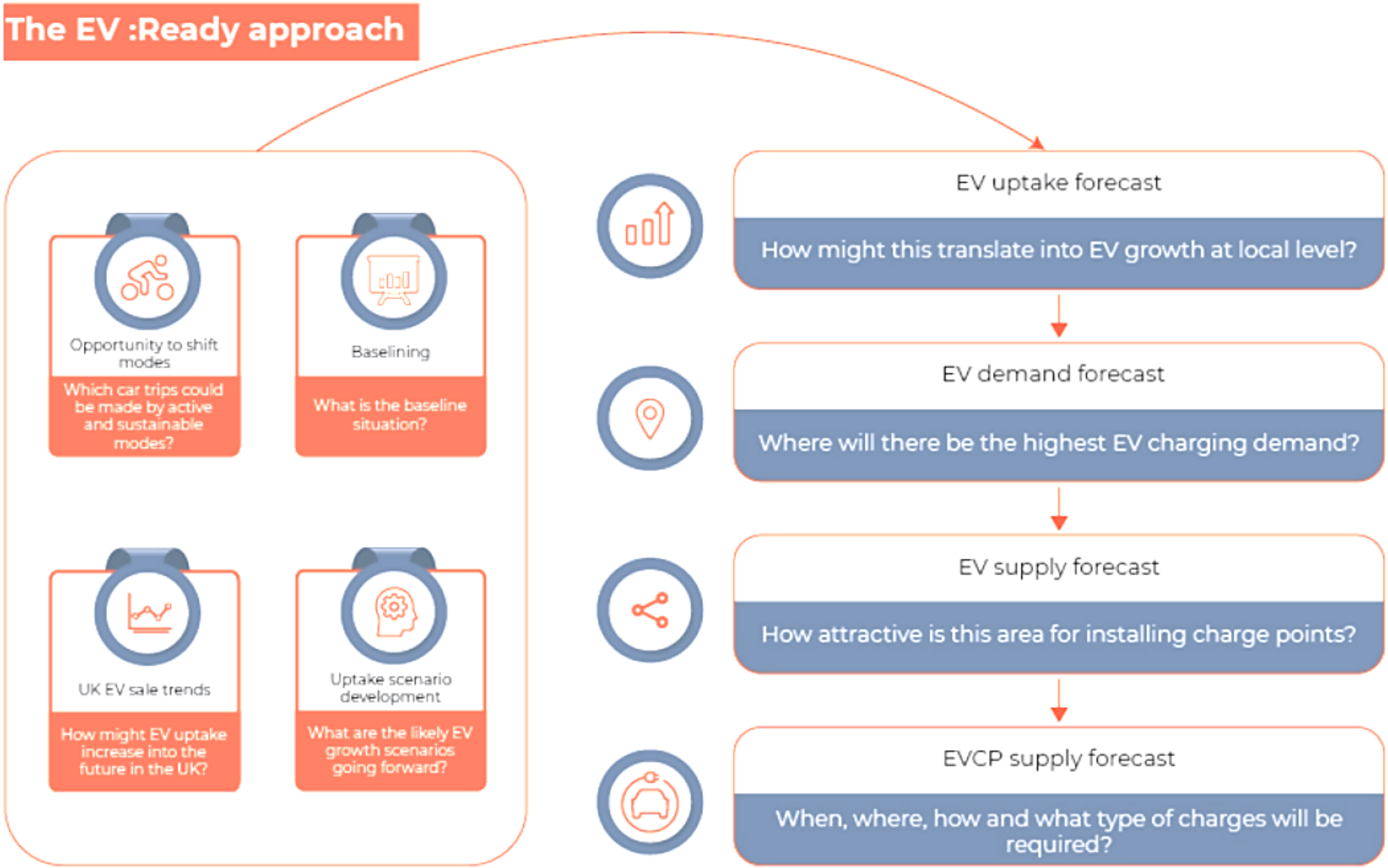
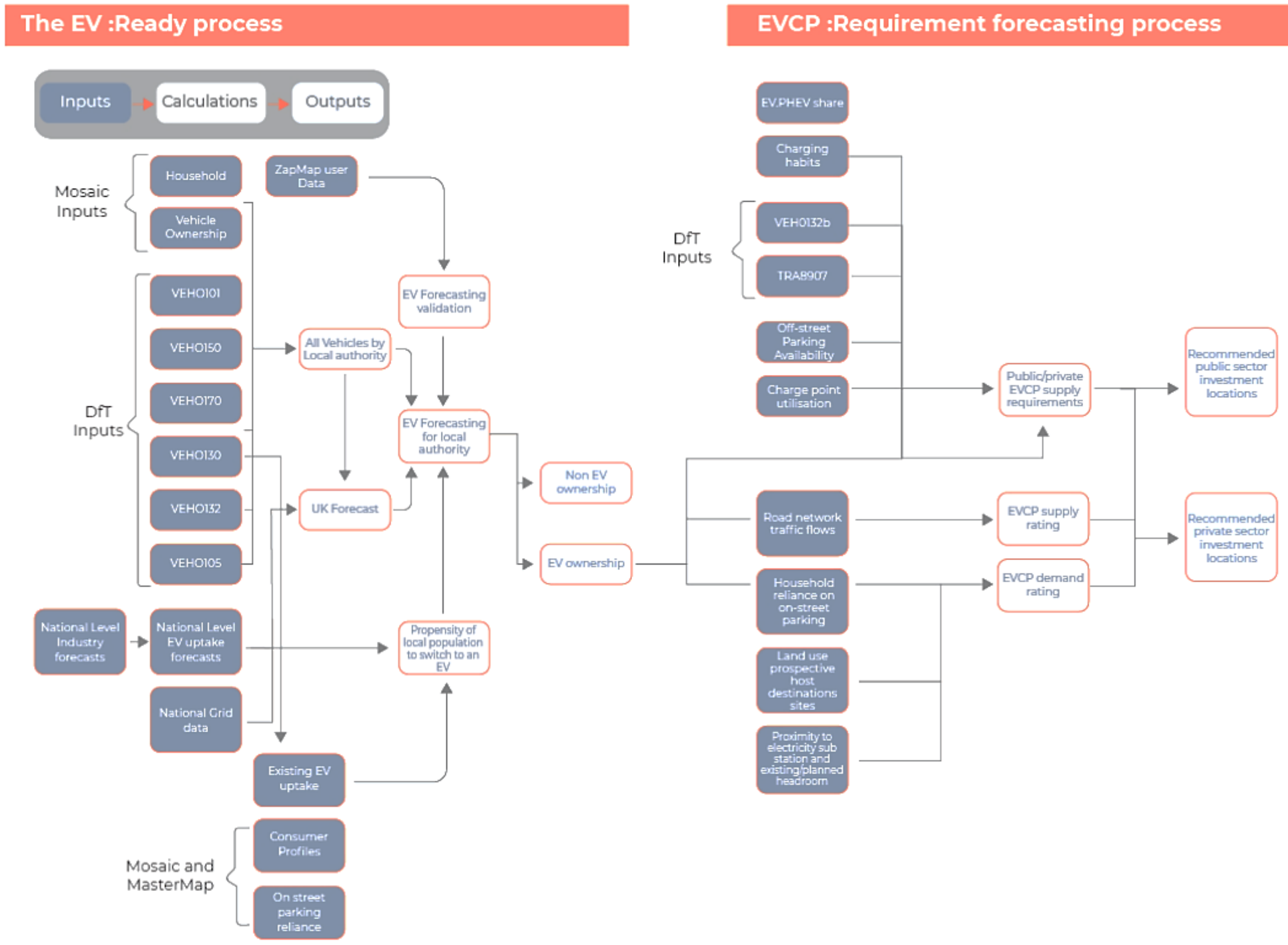


Figure 45: The EV:Ready process



National EV Sales, Trends and Forecast Growth

A comprehensive review of available literature and other key determining factors for uptake has been undertaken with a range of industry forecasts being assembled and reviewed. These include:

- Bloomberg New Energy Finance (NEF 2022)
- DfT WebTAG and Common Analytical Scenarios (CAS 2022)
- National Grid Future Energy Scenarios (FES 2022)
- Various articles published by the Society of Motor Manufacturers and Traders (SMMT)
- International Energy Agency (IEA) Global EV outlook 2022
- International Council on Clean Transportation (ICCT) UK charging gap report (2020)
- Deloitte EV sales trends report (2022)

The forecast uptake of EVs varies significantly, and in many cases each source is referring to a slightly different scenario. Some are closely aligned to targets for reducing emissions and predicated on a sustained supportive policy environment, whilst others reflect market assessments. Several of the forecasts are for sales of total EVs or mileage splits, rather than as a share of total vehicles, which would then require some interpretation to be translated into comparable figures. Many also only report figures for Europe, which presents a large source of uncertainty due to the fact that the UK has a much higher rate of EV ownership in comparison to most of Europe. A few other sources of data were examined, however in many cases there was a lack of clarity in the methodology used to draw their conclusions, and so it was decided these forecasts would not be considered.

Considering that using the other sources examined would only provide more uncertainty in results, the National Grid FES 2022 data-book was determined to be the most relevant and comprehensive source for determining a UK based uptake forecast, with a clear indication of how forecasts were made.

Weightings have been derived by examining each of the assumptions in the FES 2022 scenarios, considering their relevance in the market today and forecasted uptake rates until 2050.

Scenarios & their assumptions

Leading the Way Assumptions:

- Consumer pull and policy support accelerates private EV adoption.
- High demand for autonomous shared mobility and public transport in urban areas.
- Vehicle 2 Grid (V2G) is pushed as part of enabling more renewable generation, accelerating engagement.
- Charging in the future happens similarly to today, with innovation enabling consumers without access to off-street parking to slow charge overnight.
- Stable government and regulatory policy/legislation for decarbonisation in transport, with decisions made in the early 2020s
- Clear effective policy/pricing on carbon by early 2020s creating clarity for zero carbon technologies
- Very high carbon tax

Consumer Transformation Assumptions:

- Consumer pull accelerates private EV adoption
- More consumer demand for both autonomous vehicles and public transport
- Buses and HGVs are predominantly electric
- Consumers are highly engaged in smart charging and V2G
- Charging predominately happens at home
- Stable government and regulatory policy/legislation for electrification in transport, with decisions made in the mid 2020s
- Clear effective policy/pricing on carbon by mid 2020s - creating clarity for zero carbon technologies
- High carbon tax

System Transformation Assumptions:

- Consumer resistance and other barriers slow the uptake of EVs
- Low growth in public transport due to a lack of consumer willingness for modal shift
- Lower consumer engagement in smart charging and V2G is a niche technology
- Charging at home is limited by a lack of viable solution for those without off-street parking
- Stable government and regulatory policy/legislation for hydrogen in transport, with decisions made in the mid 2020s
- Clear effective policy/pricing on carbon by mid 2020s - creating clarity for zero carbon technologies
- High carbon tax

Falling Short Assumptions:

- ULEV uptake requires further policy support to accelerate
- Growth in public transport is lower than other Net-Zero scenarios due to lower consumer willingness for modal shift
- Consumers are more engaged in Smart Charging however adoption of V2G is slowed, by concerns over battery degradation for example
- More rapid and fast public charging is demanded from consumers
- Current policy support with some enhancement assumed
- Unpopular, difficult, uncertain or expensive decisions delayed or not taken at all
- Low carbon tax

National EV Sales Trends & Forecast Growth

The Leading the Way and Consumer Transformation forecasts are both very optimistic in their assumptions compared to the other two forecasts and show very similar uptake curves. As such, it was decided that for WSP's high uptake scenario, some weighting should be given to the System Transformation scenario to reflect uncertainty around government targets being met and the level of public engagement required to achieve those targets.

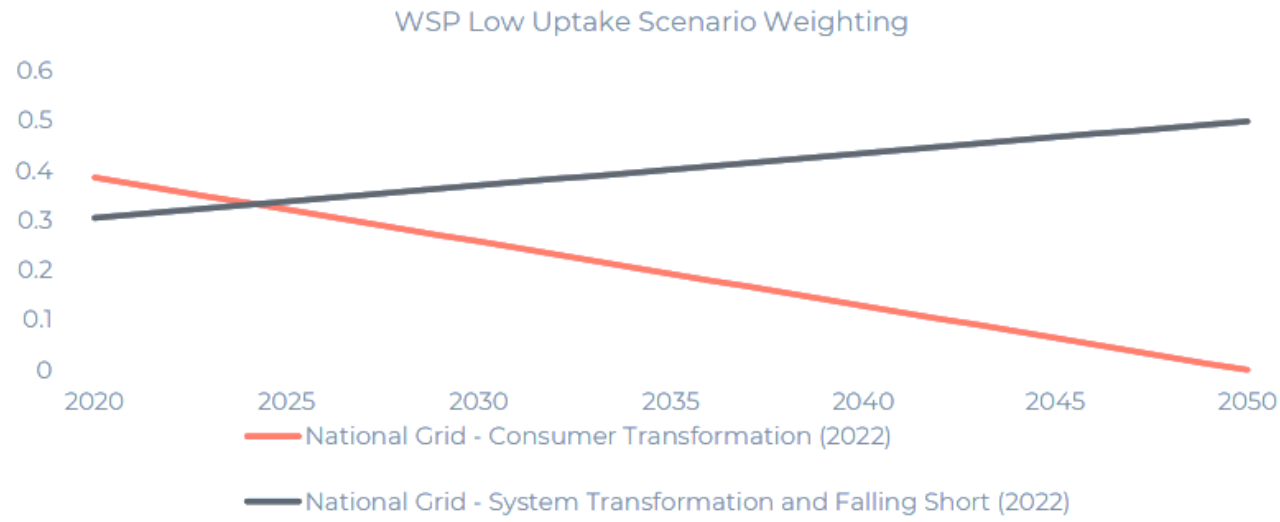
For the low scenario, the assigned weightings differ over the forecast period, to provide an appropriate balance between optimistic and pessimistic assumptions made in the three FES scenarios that predict the lowest uptake rates. Part of the rationale behind the higher weighting given to Consumer Transformation at the start of the time period was due to recent volatility in oil prices which could promote consumer appeal for EVs in the short term. The higher weighting for the two most pessimistic FES scenarios in WSP's low uptake scenario reflects the expectation that consumer engagement is more limited in this case.

The resulting weighting system for the two scenarios is presented in **Table 56** below, and a graphical representation is shown in **Figure 46** overleaf.

Table 56: Weighting for FES scenarios for the EV:Ready low and high uptake scenarios

Future Energy Scenario	High EV uptake weighting	Low EV uptake weight
Leading the Way	35%	0%
Consumer Transformation	35%	40% to 0%
System Transformation	30%	30% to 50%
Falling Short	0%	30% to 50%

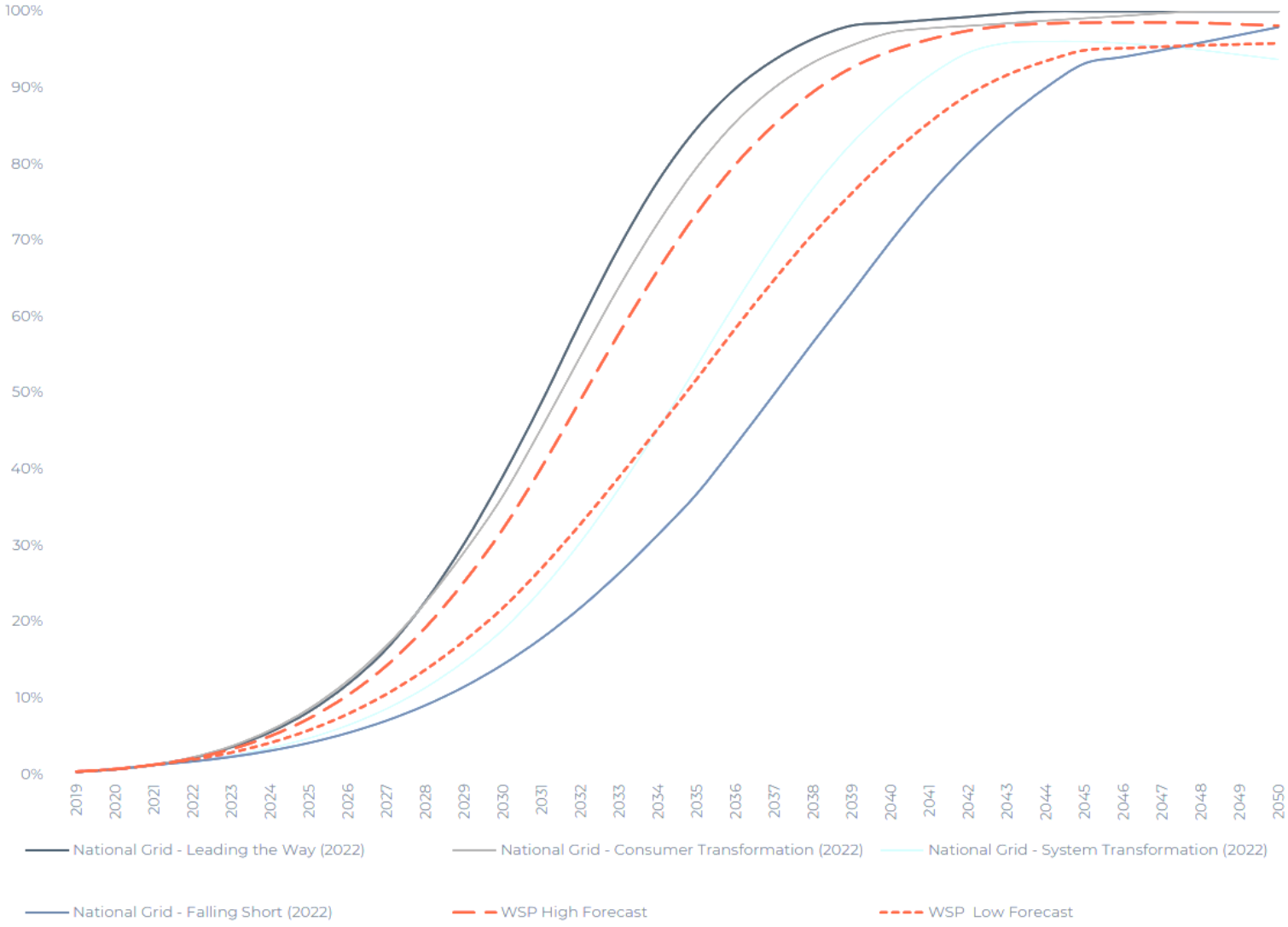
Figure 46: Graphical weight of FES EV forecasts for the low uptake scenario



Based on the preceding analysis, the weighted average forecast of EV uptake at a macro level (UK -wide) is estimated to range from between 22% of the total vehicle fleet by 2030 in a low range forecast, to 32% in a high -range forecast.

The synthesised forecast uptake curves are presented in Figure 47 overleaf. It should be noted that there is a drop in fleet share in the high forecast scenario due to the weighting given to the System Transformation FES scenario, which assumes that there will be a small fleet share allocated to hydrogen vehicles in the final years of the forecast.

Figure 47: Comparison of FES scenarios – low to high forecasts



Accounting For Local Factors

To provide more granular and area specific forecasts, the EV:Ready tool uses a variety of datasets from the Department for Transport (DfT), national EV related growth forecasts, and Experian Mosaic Data to provide population propensities as well as population demographic information for the study area. Several DfT datasets are used to understand the number of vehicles and EVs already in service in the chosen local authority.

These datasets are outlined in **Table 57**. Experian Mosaic, including ONS and DVLA data, is used to understand the population demographics for the local authority, summarised in **Table 58** overleaf. Using the datasets in the tables, a number of local factors are considered in determining localised variations in EV uptake, which include:

- Baseline EV ownership and sales trends
- Reliance on on-street parking
- Vehicle ownership
- Wider fleet and vehicle turnover trends
- Propensity of local populations to switch to an EV
- Based on socio demographics and consumer attitudes

Table 57: Department for Transport (DfT) inputs

Dataset	Description	Source	Update Frequency
VEH0101	Total number of licenced vehicles in Great Britain	DfT	Quarterly
VEH0130	Total number of registered Ultra -Low Emission Vehicles (ULEV) in the UK	DfT	Quarterly
VEH0132	ULEV vehicles registered for each LA in the UK	DfT	Quarterly

Table 58: Experian Mosaic, ONS and DVLA inputs

Dataset	Description	Source	Update Frequency
Household numbers	Provides the number of households per postcode	Census, Royal Mail Postcode Address File (PAF), ONS	Annually
Postcode Mosaic group	Each postcode in the UK is assigned a Mosaic type, which provides demographic details on the population	Experian	Annually
On -street parking	Provides an estimate of the % of households with a driveway within a postcode	Experian	Annually
EV propensity	Likelihood of a person to buy an EV in the base year, when compared with a fossil fuel car, compared to the national average. This is presented by postcode	Experian	Annually
Average vehicle age	The average age of vehicles in a given postcode, compared with the national average	DVLA	Annually
Average vehicle ownership	Likelihood of a person within a given postcode owning a car compared to the national average	DVLA	Annually

Baseline EV Ownership & Sales Trends

Baseline data published on a quarterly and annual basis by DfT data provides the initial EV registrations and EV shares for the study area. The latest sales data is reviewed alongside other near-term trends in year-on-year sales growth.

However, it is not sufficient to use the DfT data at smaller scales without accounting for possible distortions introduced by company registered EVs. These distortions can be caused when large numbers of EVs appear to be based in the local authority their business registered them in, while the true distribution is similar to that of other private vehicles across the region.

To account for this, the company vehicles are redistributed across the UK with the same distribution as the private vehicles. For some data it was also necessary to redistribute vehicles separately by type as the proportion of the total vehicles these types made up differed greatly between company and private data. For instance, buses and coaches made up a much smaller proportion of the private vehicles than they did of the company vehicles.

Reliance on On-Street Parking
A further important factor is the extent to which areas have access to off-street parking, or are reliant on on-street parking.

At present, 93% of EVs are estimated to have access to home charging by NextGreenCar in the Committee on Climate Change's 'Plugging the Gap' (2018) study, despite between 20-40% of vehicles nationally having no such access to off-street parking. The detrimental impact of a lack of off-street parking is, however, expected to lessen over time as EV ranges increase, recharging times shorten, and public infrastructure improves.

The likelihood of an area having access to off-street parking is determined based on the typical property types of the predominant Mosaic group at a postcode level, and assumes that terraced dwellings and converted flats would be reliant on on-street parking. All other housing types, such as detached dwellings, semi-detached dwellings and purpose-built flats, are assumed to have dedicated off-street parking and therefore not reliant on on-street parking. It should be noted however, that car ownership is much lower amongst households without off-street parking.

An on-street parking deflator is applied to reflect the impact on EV sales if a household does not have access to a driveway. This forecast is then applied to the EV sales profile by comparing the estimated proportion of households with a driveway and factoring this by the average number of houses with a driveway, relative to the national mean. The degree of reliance on on-street parking, and the negative impacts to EV uptake, is expected to reduce over time as access to public charging infrastructure, battery range and consumer awareness improves.

Vehicle Ownership
Vehicle ownership is based on ONS data within Mosaic, which provides estimates by household. The vehicle ownership by household factor is scaled to ensure the combined estimate for vehicle ownership across all households in the study area, to ensure they match the DfT data for the base year. This allows the proportion of vehicles owned by each Mosaic type to be calculated.

Wider Fleet & Vehicle Turnover Trends
In order to forecast the number of EVs it is also necessary to assess current and future vehicle fleet sizes, vehicle replacement rates, range of ages at which vehicles are scrapped and the average vehicle age when scrapped.

The macro level forecasts are translated into yearon-year EV sales growth rates, and a sales profile representing the percentage of EVs amongst new vehicle sales, and tracks the number of vehicles in circulation. This method models some limitations of the real world which can prevent incorrect forecasts being produced. For example, if a scenario required that the overall annual vehicle sales rate to exceed the forecasts based on the current replacement rate and levels of annual sales.

Propensity of Local Populations to Switch to an EV

The differing attitudes and socio-demographic circumstances of local populations were analysed to identify their likely propensity for registering (purchase or lease) an electric vehicle, using the 2019-2020 version of Experian's Mosaic UK. This includes a wealth of richly detailed demographic data for the whole of the UK, detailed to full postcode level as well as property and tenure information, economic indicators and census data. As well as earnings, demographics and lifestyles, the data accounts for technology adoption and attitudes to environmental issues, as well as likelihood to buy a new vehicle and have vehicle, and hybrid vehicle ownership (derived from DVLA data).

Mosaic classifies the entire UK population into one of 66 consumer groups, based on the above data. Each postcode in the UK is assigned one of 66 Mosaic types by Experian. Each Mosaic group has a separate propensity for each of the metrics described in the inputs section. We identified a selection of 10 key indices amongst the Mosaic data reflecting traits in early EV adopters, which in turn provide a statistical measure of variation across a representative group of individual data points.

The base year EV propensity, or the likelihood a person of a given Mosaic type will buy an EV compared to a fossil fuel vehicle, is created from a weighted average of a selection of Mosaic propensities, reflecting characteristics such as their attitudes to new technology, income and likelihood to purchase a new vehicle.

The propensity assessments are validated against data purchased from ZapMap of anonymised EV registrations to a postcode level, for a sample size of 1,000. The distribution of EVs across the Mosaic groups associated with these postcodes was assessed to inform key input parameters to the model. As EVs reach price parity with conventional vehicles, and public acceptance of the vehicles increases, the difference in EV purchase propensities between Mosaic types is expected to decay exponentially. In the long term converge of the national average, as EVs become the norm, a decay rate is applied to the differing propensities over the forecast period.

EV Uptake Forecasts Combining Propensity, Vehicle Ownership and Parking

Based on a combination of the factors previously outlined, the propensity for people to buy electric vehicles, vehicle ownership and the likelihood of a person to have a house with a driveway, a final EV sales profile is then provided for each Mosaic type.

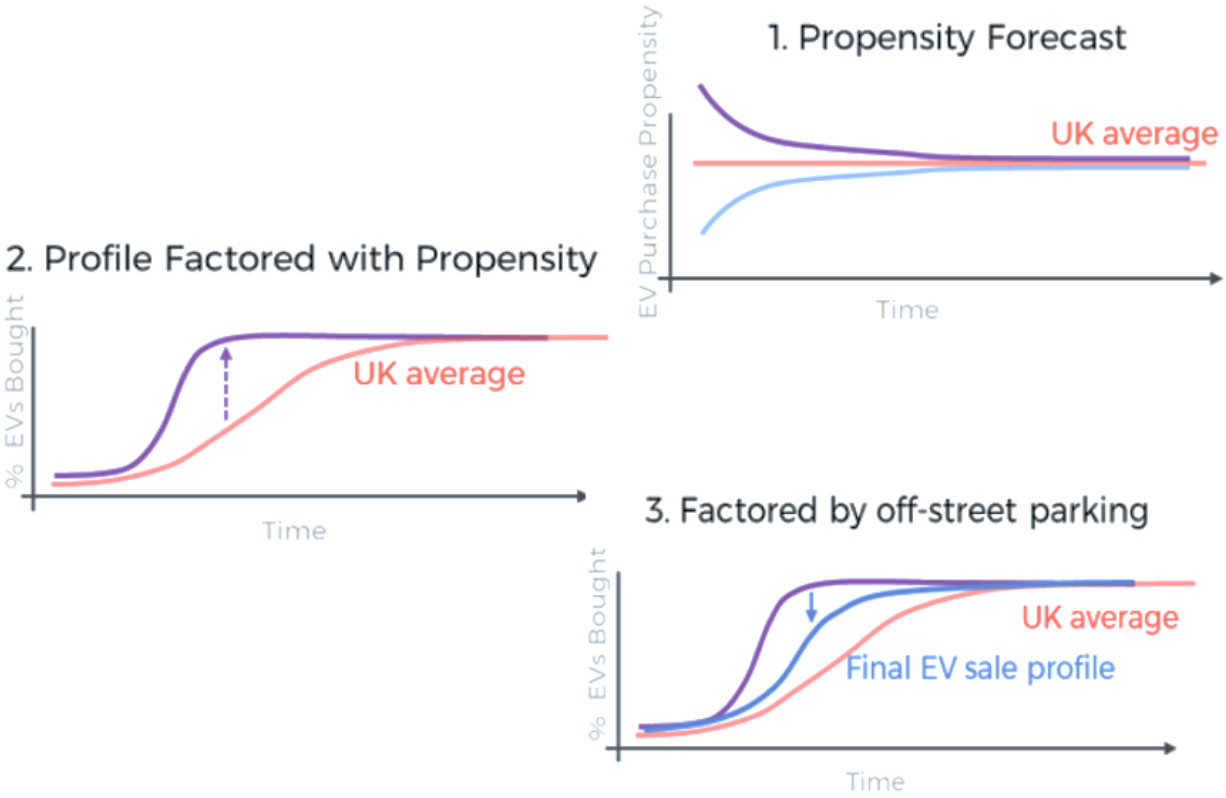
By deriving a bespoke EV sales profile for each Mosaic type this means that for each postcode, there is an estimate for the likelihood of a person from that postcode purchasing an EV.

This forecast is then applied to the estimated number of vehicles owned by that Mosaic type across the local authority. The total number of EV vehicles for each Mosaic type is then divided by the number of households to provide the number of EVs per household, which can then be multiplied by the number of households per postcode to calculate the number of EVs per postcode in the study area. These results are calibrated to ensure the base year matched the DfT data.

Following updated data from DfT in April/May 2021, there is a greater focus on reporting where vehicles are expected to be kept and in use, based on forecast vehicle ownership, as opposed to where existing EVs are formally registered within the baseline data. This effectively corrects for some of the distortions arising through the baseline DfT vehicle registration data, and assumes differences between the initial baseline figures level off slightly more quickly, so if an area is expected to have a higher or lower uptake than the baseline, it will tend towards this more quickly.

Once the most appropriate forecasts are selected, and the weightings applied, a logistic equation is fitted to the data, by optimising the three parameters of the logistic equation to reduce the weighted distance between the calibrated curve, and each forecast. Here the weighted distance is the distance squared between the logistic equation and the given forecast for each year, multiplied by the weighting of the given forecast. This process is illustrated by **Figure 48** overleaf.

Figure 48: Simplified summary of EV sales profile factoring



The first graph illustrates how over time, the differing EV uptake propensities exhibited by differing consumer groups are expected to increasingly converge, as EVs become more common and price and charging barriers are removed. The purple line represents a consumer profile with a higher -than -average propensity for example, and the blue line a lower -than -average propensity.

The second graph illustrates how the EV uptake rates differ between different consumer groups relative to the national mean. For example, if the forecast is for 28% of registered to be EVs by 2030 overall, a consumer segment with a higher propensity towards EV uptake will be above that average (illustrated by the purple line in this case), whilst a group with a lower propensity will be below the average.

The third graph demonstrates how the on -street parking factor also serves to make the EV uptake curve either steeper or shallower, depending on the degree of reliance on on -street parking of a given area. The purple line represents a consumer profile with a higher -than -average access to off-street parking for example, and the blue line is lower, though still above the UK average, and so both result in higher EV uptake amongst those consumer profiles.

Resulting Local Forecasts
The output of the analysis of the above factors is the local, area specific forecasts that account for local socio-demographics, the availability of offstreet parking, vehicle ownership, vehicle sales and turnover rates and vehicle ownership trends.

Assumptions & Limitations
In order to undertake this analysis, it is necessary to make a number of assumptions, which will naturally present limitations. In this analysis, it is assumed that a number of parameters remain constant. The key assumptions that were made are outlined below. For the purposes of this study, an EV is defined as a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) which fulfils the OLEV requirements to qualify as a ULEV, i.e. any vehicle that uses low carbon technologies and emits less than 75g of CO2/km from the tailpipe.

Several factors within a local authority are assumed to remain constant over the study period. Below is a list of factors which are assumed to remain constant, and what limitations this assumption may introduce:

- **Population and population density.** The number of households and the population demographics (Mosaic type) are assumed to remain constant for each postcode. If there are areas with growing/declining populations, or areas where the majority of residents are altering (areas of regeneration or gentrification), this process is likely to be less accurate.
- **Proportion of vehicles in a local authority compared to the UK.** This is assumed to remain constant over the study period. This assumption is made as the removal of vehicles needs to be calibrated each year in the study period, so total vehicle forecast is required to calibrate against. If a region has a changing demographic or age profile it is possible the number of vehicles in a local authority will change relative to the UK.

Mosaic data assigns one-person group to a postcode. This means that results for individual postcodes may not be representative of the entire population of the postcode. However, at a local authority level or greater, where the study area is of a large enough scale, the larger sample sizes typically overcome this issue.

Forecasts are informed by available published vehicle uptake and sales data related to vehicles which are newly registered with the DVLA. For this reason, when the second-hand market for EVs becomes mature this process will be less able to determine EV hotspots. However, by this stage, it is expected that uptake will begin to correlate more closely with areas of higher vehicle ownership, as EVs increasingly become the norm and differential uptake by propensity becomes less pronounced. This limitation means that we assume that when vehicles are registered, they will remain assigned to the same postcode until they are scrapped, and do not account for transfers due to the second-hand market.

6.4 Part C – EVCP Requirements Forecasting

Total EV Power Required:
To understand the electricity requirements of an EV, vehicle mileage and fuel efficiency needs to be estimated.

Vehicle mileage
The average annual mileage of all vehicles is assumed to be 7,400 miles. This is taken from the 2019 DfT National Travel Survey results as 2020 and 2021 data is not likely to be representative of long - term trends due to the impact of COVID -19 and the associated lockdowns. As such, 2019 data is still referred to when considering trends in vehicle mileage. Mileage of EVs is likely to differ to ICEs but there is large variations in reported figures, it was therefore not considered as a factor.

Vehicle efficiency by mode
The efficiency of electric vehicles, measured in miles per kW, affects the power requirements. Research was carried out to understand the average efficiency across modes. It should be acknowledged that there is some uncertainty as vehicle technology is evolving rapidly.

Battery Electric Vehicles (BEV) and Plugin Hybrid Electric Vehicle (PHEV) ratios, and PHEV mileage in electric mode
PHEVs only drive in electric mode for a fraction of their mileage. It must therefore be understood the percentage of EVs which are hybrids and the mileage which they travel in electric mode rather than under their ICE powertrain. PHEVs made up 45% of the UK ULEV fleet at the end of 2020. However, the ratio of BEVs to PHEVs is changing over time, with the proportion of PHEVs decreasing.

Power Delivered by the Public Charging Network:
Charging habits – public vs private charging
Firstly, there is a need to consider the extent to which vehicles will use public chargers, as opposed to private residential or workplace charging. At present, a large majority of charging takes place at homes and workplaces (~85% of kW delivered). However, this ratio may change over time, with implications for the number of public chargers required.

There are some contrasting and often strongly held views amongst the EV industry as to whether in the future, EV charging habits and infrastructure will pivot more decisively away from the current model, towards a far larger proportion of charging at ultra-rapid charging hubs, with quick turnaround times which are more akin to the petrol station model. Others anticipate sustained high levels of home and workplace charging, or greater destination charging, with slow / fast chargers proliferating within car parking spaces and supporting a ‘grazing’ or top-up behaviour.

Workplace charging may sometimes double as publicly accessible charging. There are also diverging views of the extent to which workplaces will accommodate employees wishing to charge, particularly where larger numbers of chargers would be required, triggering electrical upgrades making them more costly to install. A further consideration relates to any wider trends in commuting following the COVID pandemic, and for example whether this serves to accelerate trends towards greater home working.

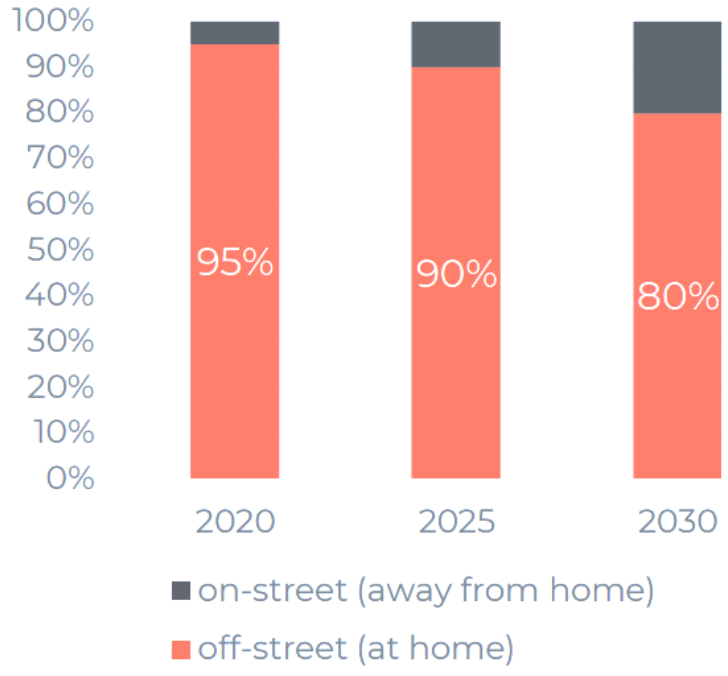
Off-street parking availability

A further challenge in assessing the future trends in EV charging behaviour is that the current sample size of EV ownership is still very small in percentage terms as a part of the overall vehicle fleet (2%), still dominated by early adopters, and not reflective of the wider population.

For example, around 93% of EV owners to date are estimated to have access to off-street parking, yet on average only around 72% of cars are parked in a garage or on private property. This would indicate EV ownership is significantly lower amongst those without access to off-street parking. It should be noted however, that car ownership is much lower amongst households without off-street parking. A study by PWC estimated as many as 78% of UK drivers have access to off-street parking at home.

As the profile of EV owners comes to reflect the wider population, it is expected there will be an increase in the proportion of EVs with no access to home charging, and so more reliant on public infrastructure, as summarised in **Figure 49**.

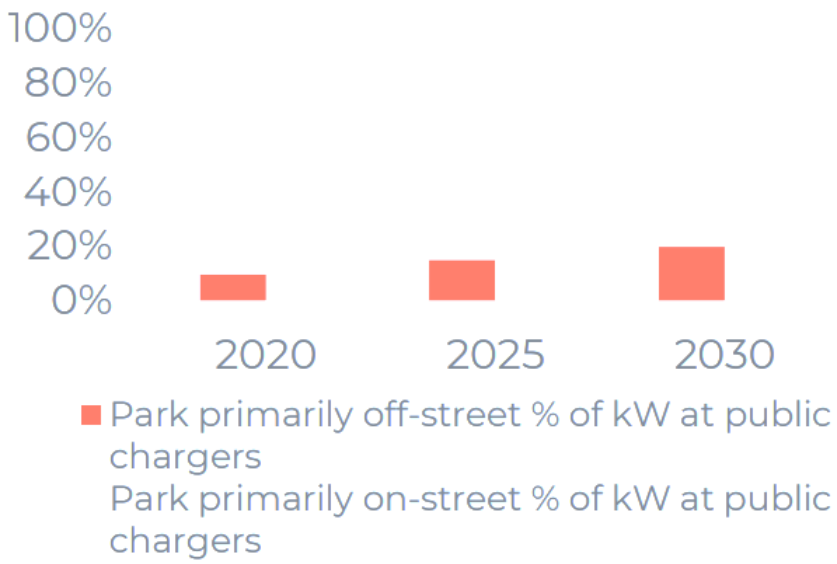
Figure 49: Proportion of EVs with access to off-street parking at home



Proportion of charging (kW) delivered via public chargers

Figure 50 presents the assumed charging behaviours used in forecasting the proportion of charging that will take place off-street, and onstreet, informed by a review of a number of industry publications*, and engaging with charge point operators.

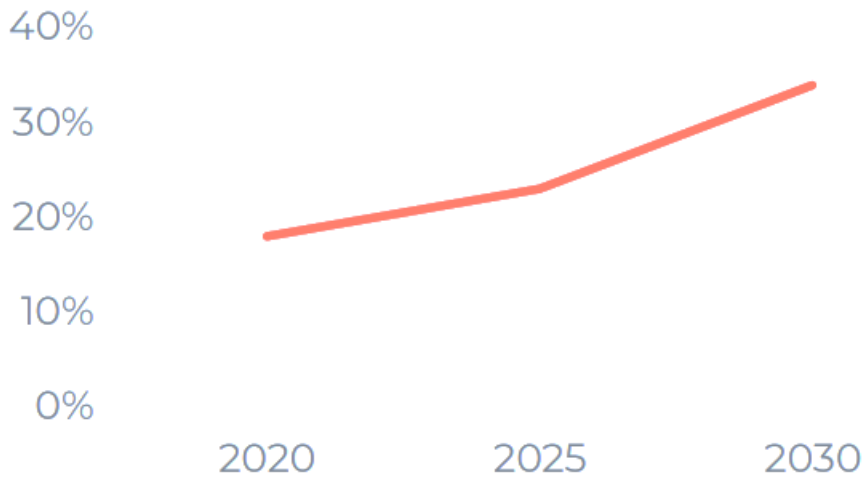
Figure 50: Proportion of EV charge (kW) delivered at public chargers (%)



Proportion of charging (kW) delivered via public chargers

Figure 51 reports the estimated proportion of EV charging assumed to be delivered via public chargers.

Figure 51: Proportion of EV charging (kW) delivered at public chargers (%)



EVCPs Required to Deliver Power

Future charge point requirements will depend on the average charge rates (kWh), and the number of vehicles which can be supported by each unit. Charge rate is dependent both on the speed of the charger and the capability of the car / battery to receive the charge. As the vehicle and charger technology evolves this rate will change.

The average charge rate for fast chargers is forecast to increase from around 6kW/h at present, to between 8-20kW/h by 2030. The average charge rate for rapid chargers is forecast to increase from around 45kW/h at present, to between 75-200kW/h by 2030. Faster charge rates (kWh) and an increasing number of vehicles supporting ultra-rapid charging potentially means a greater share of charging (in terms of energy consumed) could be delivered by fewer ultra-rapid chargers. Equally, however, larger ranges and battery capacities will lessen the need to stop at an intermediate charger on route. Improving vehicle efficiencies (miles per kW) also have implications for charging requirements.

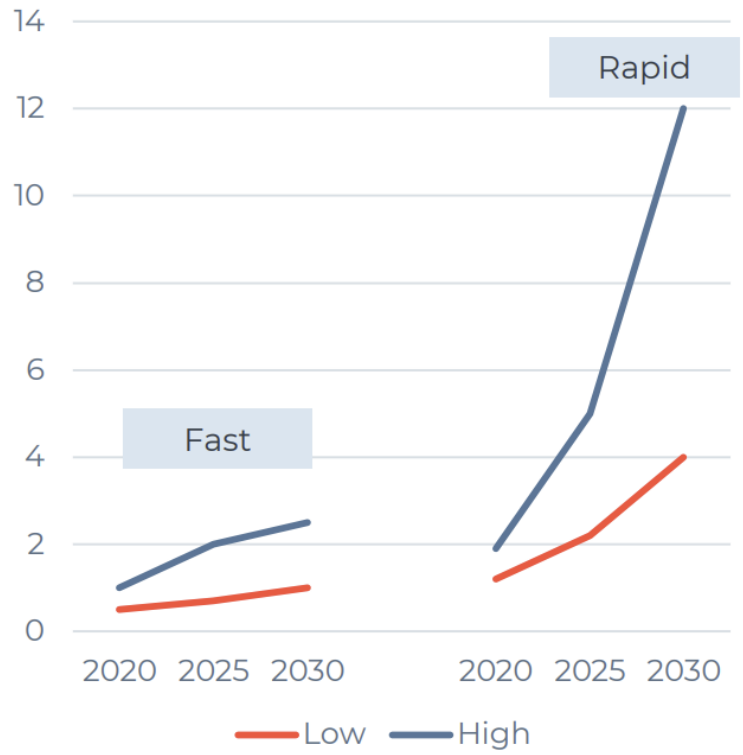
Similarly, the EV charger technology is evolving, with increasing charge rates being delivered at up to 400kWh / 900V+, as well as improved functionality and ease of payment, scalable lower cost deployments and smart loads management. Future charge point requirements will depend on the prevailing average charge rates, and the number of vehicles which can be supported by each unit. A further consideration is the legacy charge points, where these are upgraded, and what these mean for the average charge rate.

Average Charger Utilisation

The utilisation of chargers is a key sensitivity in the model. Values for current and future utilisation rates were established by reviewing the utilisation of existing EVCP networks and through discussions with CPOs. Utilisation is relatively low level at present but is increasing as the number of EVs on the road grows.

Figure 52 overleaf shows the range of possible utilisation scenarios, for both fast and rapid chargers. Fast and Rapid chargers have different utilisation rates. In the case of fast chargers, which currently average around 0.5-1 charges per day, they are forecast to increase to between 1.25 and 2.5 chargers per day by 2030. Rapid chargers are currently utilised around 1-1.5 times per day on average, and this is forecast to increase to between 4 and 12 charges per day by 2030.

Figure 52: Charges per day



Private Sector Investment & the Role of the Public Sector

In order to create a successful EV charging network, that meets the needs of drivers, both the public and private sectors will need to invest in EVCPs. The ratio of change of public to private sector investment will change over time. Currently we are in the early stages of the transition to electric vehicles and the number of EVs which require public chargers is relatively low. As a result, there are many locations where EVCP installations are not commercially viable for the private sector. The contribution required by the public sector is therefore relatively high. As the number of EVs increases, the commercial viability will improve and the public sector contribution will decrease.

There is a keen appetite to invest in EV charging infrastructure from the private sector, with a number of large operators having established themselves, as well as new entrants and acquisitions by major investors.

However, commercial charge point deployments are typically focused on destinations and intermediate sites (i.e. service stations, roadside cafes), where demand is high, with high traffic volumes or reasonable dwell times. Rapid chargers are more likely to be commercially deliverable by the private sector than standard / fast chargers.

Forecasting Demand for EVCPs

Regional transport models are utilised to determine EV demand at three stages of a journey; origin, en-route, and destination. Results from the EV uptake forecasting are provided as input to the transport models to calculate the number of vehicles at origin and destination, and the vehicle kilometres travelled along the route of a journey. Outputs are at transport zone level, which is adjusted to hexlevel to be consistent with other EV:Ready outputs.

It is assumed that those travelling to their destination would require a speedy charge, similar to that of stopping at a petrol station for non EVs, and therefore demand for rapid chargers would be greatest along the route of a journey. Standard chargers are more likely to be utilised at the origin and destination of a journey, where the user generally has a longer dwell time. The hex-level outputs from the transport model are compared against one another, with a score from 0 to 1 being assigned for each origin, en-route and destination demand.

Forecasting supply of EVCPs

A multi criteria assessment is undertaken, bringing together the criteria listed below and normalising each criteria on a scale of zero to one. EV demand, as described in the previous section, is also included as, naturally, whether an area has demand for EV charging is a key indicator

- **EV uptake**, as explained in Part B
- **Reliance** on on-street parking. Areas where reliance on on-street parking is greatest are areas where residents will rely more on publicly accessible charge points rather than privately owned, and so these hex-cells would receive a higher score
- **Grid supply.** Used to account for the relative deliverability of each site based on DNO forecasts for the available headroom of the nearest Primary (and if available from the DNO, also the Secondary) Substation. A RAG status is determined based on available headroom (which varies slightly between DNOs but generally follows this rule, Green: spare capacity >20%, Amber: spare capacity between 5% and 10%, Red: spare capacity <5%). Each hex-cell is then assigned a score based on distance from the nearest substation and which RAG rating the substation has
- **Land use**. A greater score is assigned to hexcells with large areas of relevant land uses such as shopping centres, retail parks, offices, healthcare facilities, and tourist attractions etc.

Supply scores are split into the same three categories as demand and are similarly further refined to determine supply of rapid and standard chargers.

Table 59 below presents the weightings for each criterion for origin, en-route and destination supply scores.

Table 59: Criteria weightings for supply scores

Assumptions & Weightings	En-route / Rapid Supply Score (out of 1)	Origin Supply Score (out of 1)	Destination Supply Score (out of 1)	Standard Supply Score (out of 2)*
EV Uptake		25%		**12.5%**
Reliance on on-street parking		25%		**12.5%**
Modelled Flow (en-route demand)	50%		25%	**12.5%**
Grid supply	50%	25%	25%	**25%**
Land use			25%	**12.5%**
Origin demand		25%		**12.5%**
Destination demand			25%	**12.5%**
EVCP Weighting	Rapid: 0 Standard: 0.5	0.5	0.5	1

**Standard Supply Score is a sum of the origin and destination supply calculations*

Forecasting Gaps in EV Charging Provision

Private sector investors and CPOs are regularly consulted to understand their key considerations when identifying prospective sites that would be commercially viable, and so deliverable by the private sector. To identify areas where gaps are anticipated in the provision of chargers by the private sector, a gap analysis is undertaken which consists of comparing supply and demand scores. Where the resultant score is positive, supply outweighs the demand and so these areas would be commercially attractive to the private sector. Where the score is negative, demand outweighs the supply and therefore it is anticipated that there will be a gap in private sector investment in these areas, so the public sector should 'plug the gap'.

Areas of the highest demand (i.e. the top 100 ranking demand scores in each local authority) are considered alongside the gap analysis to determine the top areas for public or private sector. Using the split of rapid and standard charger supply and demand, the gaps can be refined further, highlighting patterns in private and public sector investment. For example, it is expected that the private sector would prefer to install rapid chargers along high traffic routes such as motorways and A roads, and therefore the public sector is recommended to install standard chargers in town or village centres.

APPENDIX 7: TAG WORKBOOK: GREENHOUSE GASES

The following is a summary of the Output Worksheet from the *Greenhouse Gases Workbook, TAG Unit A3 – Environmental Impact Appraisal v1.20.1 November 2022* which is attached to this Appendices in Excel format.

Present Value Base Year:	2010
Current Year:	2023
Proposal Opening Year:	2023
Project (road/rail or road & rail)	Road

Overall Assessment Score:

Net Present Value of carbon dioxide equivalent emissions of proposal (£):	£68.3m

NB: *positive value reflects a net benefit (i.e. CO_2E emissions reduction)*

Quantitative Assessment:

Change in carbon dioxide equivalent emissions over a 60-year appraisal period:	-608,394 tonnes
Of which traded	24,503 tonnes
Change in carbon dioxide equivalent emissions in opening year:	-4,300 tonnes
Net Present Value of traded sector carbon dioxide equivalent emissions of proposal	-£2.6m

Sensitivity Analysis

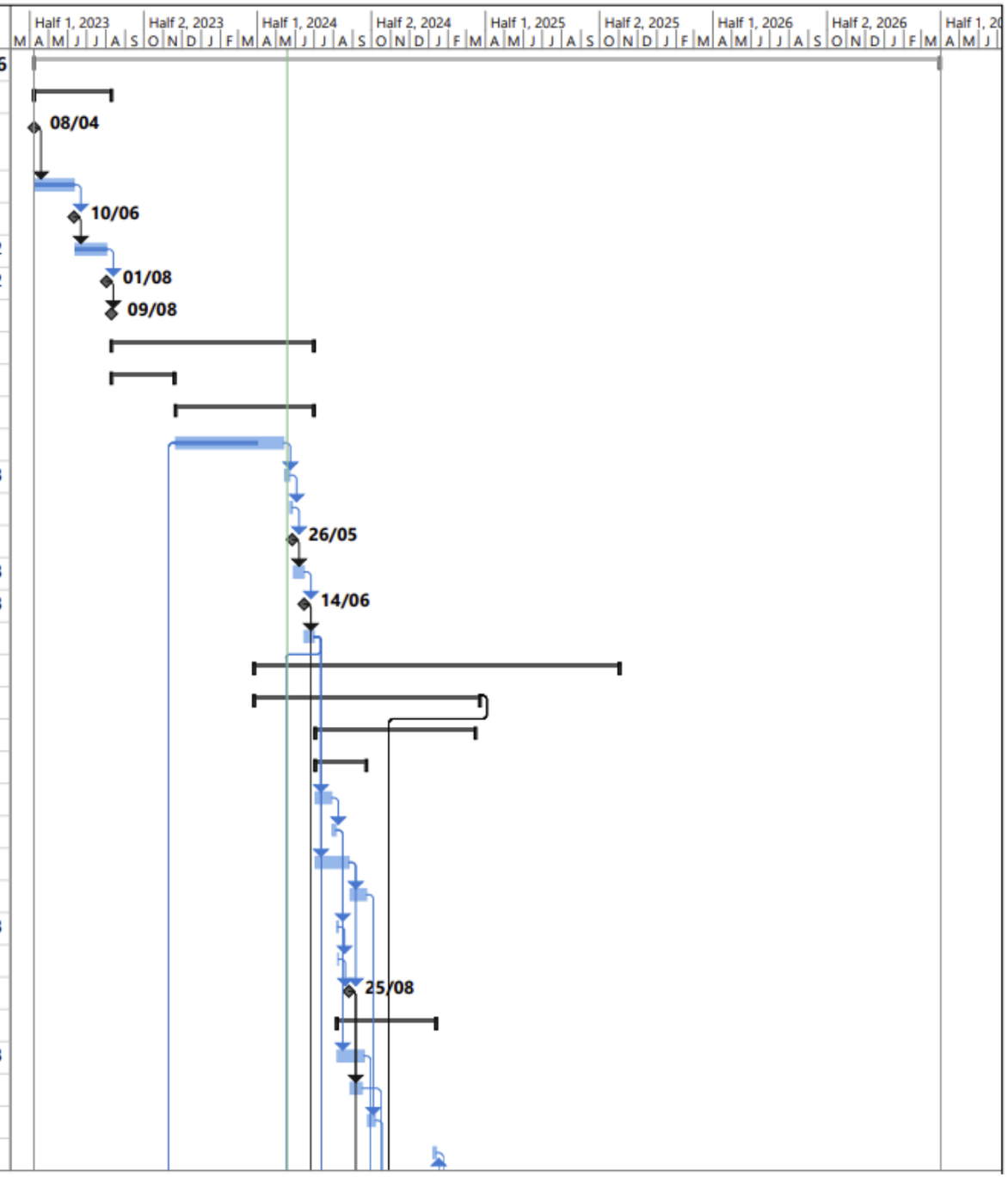
Upper estimate Net Present Value of carbon dioxide emissions of proposal:	£102m
Lower estimate Net Present Value of carbon dioxide emissions of proposal:	£34m

TAG Workbook

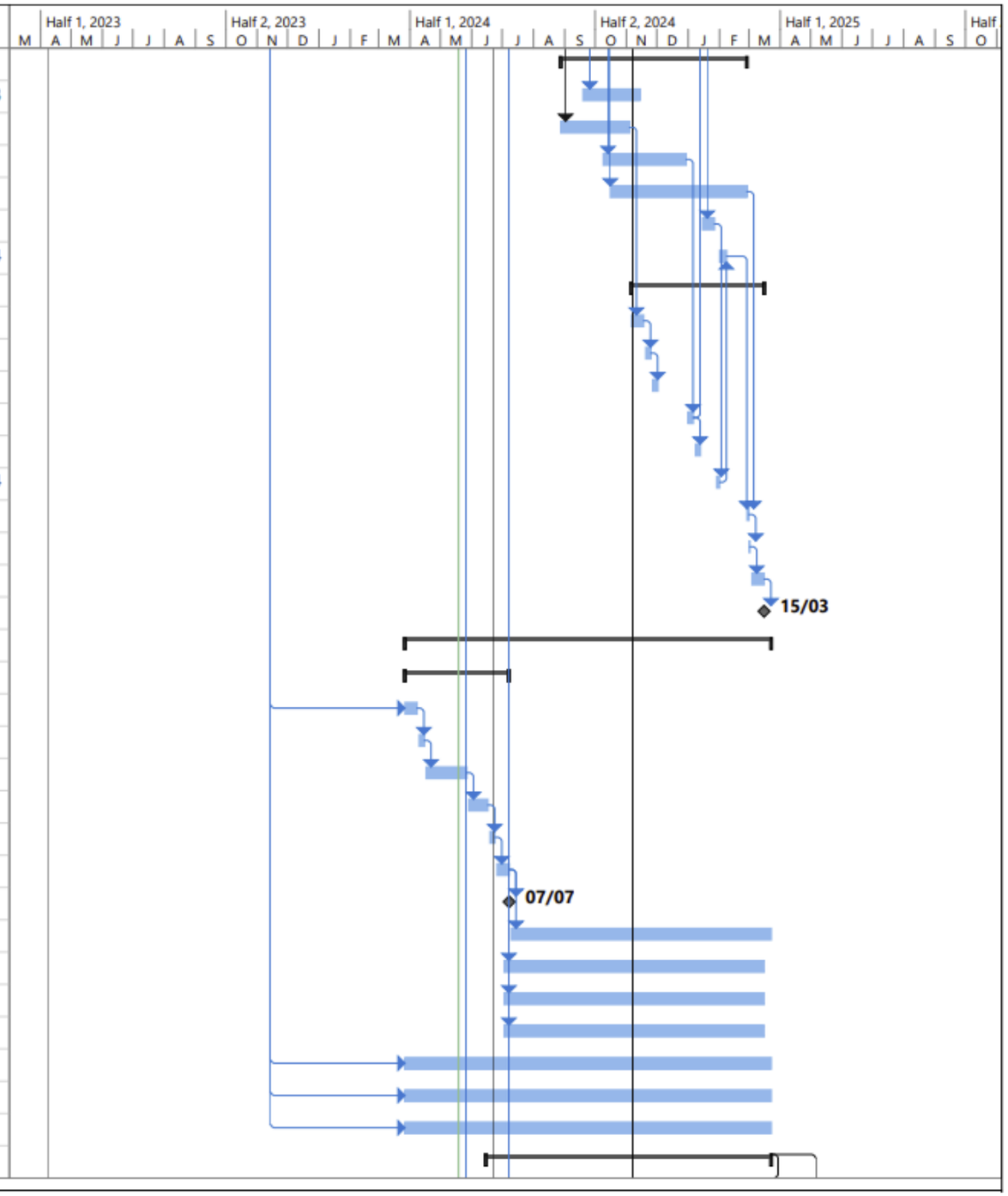
File 1: TAG Workbook: Greenhouse Gases

APPENDIX 8: SCHEDULE

ID	Task Name	Duration	Start	Finish
0	**EVCharging5mGRF_PP**	**1037 days**	**Fri 08/04/22**	**Tue 31/03/26**
1	**Pre-Project Activities**	**88 days**	**Fri 08/04/22**	**Tue 09/08/22**
2	Invesment Proposal for EV Charging Approved by Committee - £5m GRF	0 days	Fri 08/04/22	Fri 08/04/22
3	Work on FBC Brief/Spec	46 days	Fri 08/04/22	Fri 10/06/22
4	FBC Brief Sent to WSP	0 days	Fri 10/06/22	Fri 10/06/22
5	FBC Brief response & negotiation	36 days	Mon 13/06/22	Mon 01/08/22
6	Contract Placed with WSP	0 days	Mon 01/08/22	Mon 01/08/22
7	Project Kick-off (WECA & WSP)	0 days	Tue 09/08/22	Tue 09/08/22
8	**FBC**	**233 days**	**Wed 10/08/22**	**Fri 30/06/23**
9	**FBC development**	**73 days**	**Wed 10/08/22**	**Fri 18/11/22**
39	**FBC Draft 2**	**160 days**	**Mon 21/11/22**	**Fri 30/06/23**
40	Mods / Resolve political & commercial issues	125 days	Mon 21/11/22	Fri 12/05/23
41	Grant Assurance: Second Review	6 days	Mon 15/05/23	Mon 22/05/23
42	Final tweaks / formal signatures	4 days	Tue 23/05/23	Fri 26/05/23
43	Submit to CEOs	0 days	Fri 26/05/23	Fri 26/05/23
44	Reading period	13 days	Mon 29/05/23	Wed 14/06/23
45	WoE CEOs Meeting - FBC Approval	0 days	Wed 14/06/23	Wed 14/06/23
46	Issue Grant Offer Letters	12 days	Thu 15/06/23	Fri 30/06/23
47	**On-street Residential Delivery:**	**420 days**	**Mon 27/03/23**	**Fri 01/11/24**
48	**SGC On-street Residential Sites**	**260 days**	**Mon 27/03/23**	**Fri 22/03/24**
49	Abbotswood [No TRO needed]	**185 days**	**Mon 03/07/23**	**Fri 15/03/24**
50	Detailed Designs	**60 days**	**Mon 03/07/23**	**Fri 22/09/23**
51	DNO connection form to National Grid - form submission	20 days	Mon 03/07/23	Fri 28/07/23
52	National Grid Design & Connection	5 days	Mon 31/07/23	Fri 04/08/23
53	Electrical Design	40 days	Mon 03/07/23	Fri 25/08/23
54	Electrical Estimates	20 days	Mon 28/08/23	Fri 22/09/23
55	Develop Detailed Civil Plans	1 day	Mon 07/08/23	Mon 07/08/23
56	Develop Civils Cost Estimates	1 day	Tue 08/08/23	Tue 08/08/23
57	Issue Works Order	0 days	Fri 25/08/23	Fri 25/08/23
58	Procurement	**115 days**	**Mon 07/08/23**	**Fri 12/01/24**
59	National Grid PO	31 days	Mon 07/08/23	Mon 18/09/23
60	Charge Point PO	15 days	Mon 28/08/23	Fri 15/09/23
61	Electrical PO	10 days	Mon 25/09/23	Fri 06/10/23
62	Meter PO	5 days	Mon 08/01/24	Fri 12/01/24

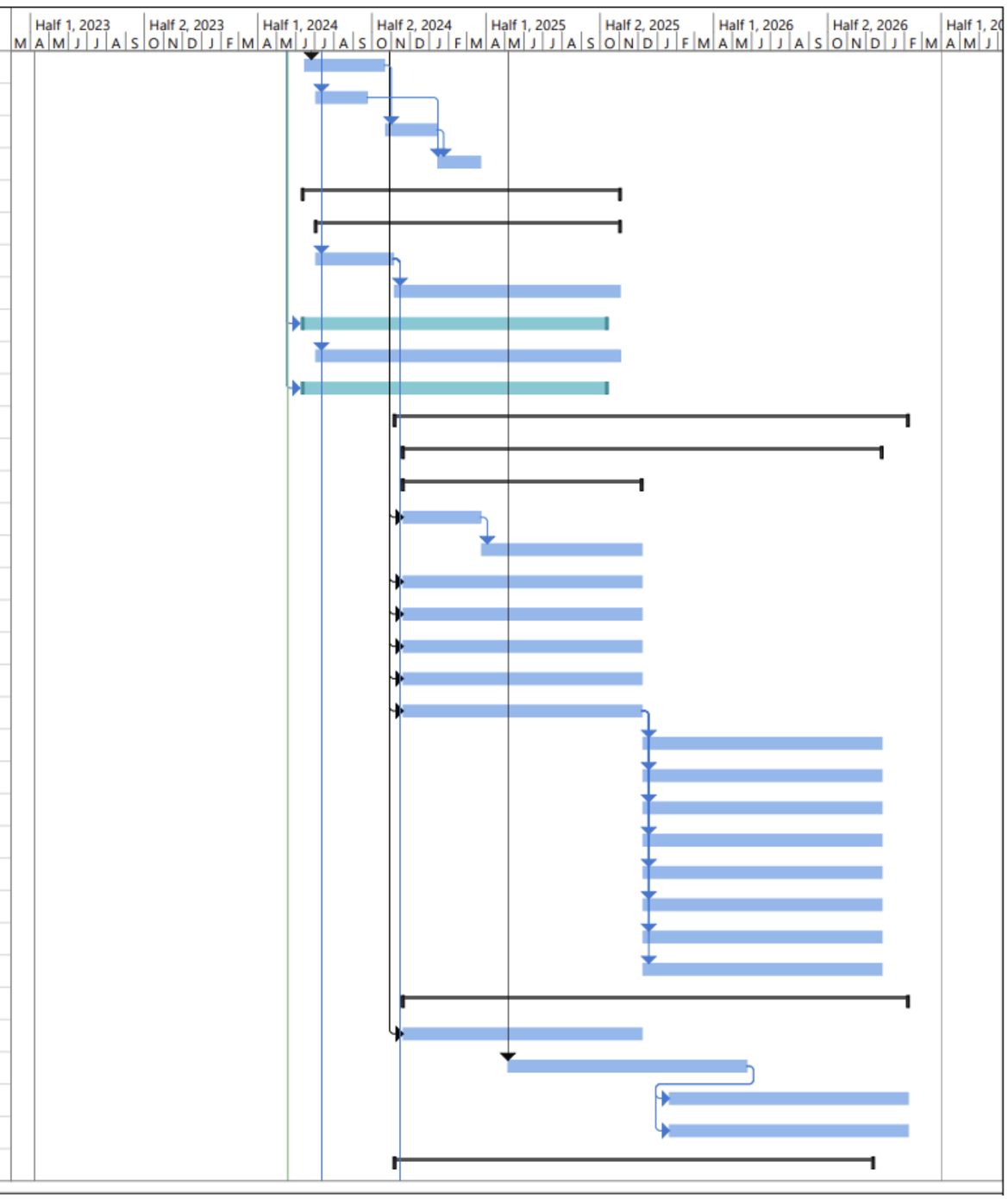


ID	Task Name	Duration	Start	Finish
63	**Mobilisation**	**132 days**	**Mon 28/08/23**	**Tue 27/02/24**
64	National Grid mobilisation	40 days	Tue 19/09/23	Mon 13/11/23
65	Civils mobilisation	50 days	Mon 28/08/23	Fri 03/11/23
66	Electrical mobilisation	60 days	Mon 09/10/23	Fri 29/12/23
67	Charging point mobilisation	97 days	Mon 16/10/23	Tue 27/02/24
68	Meter mobilisation	10 days	Mon 15/01/24	Fri 26/01/24
69	Traffic Management mobilisation	5 days	Thu 01/02/24	Wed 07/02/24
70	**Construction**	**95 days**	**Mon 06/11/23**	**Fri 15/03/24**
71	Implement civils	10 days	Mon 06/11/23	Fri 17/11/23
72	Bay markings	5 days	Mon 20/11/23	Fri 24/11/23
73	Signage & surrounds install	5 days	Mon 27/11/23	Fri 01/12/23
74	Implement Electrical	5 days	Mon 01/01/24	Fri 05/01/24
75	DNO connection	5 days	Mon 08/01/24	Fri 12/01/24
76	Meter installation	3 days	Mon 29/01/24	Wed 31/01/24
77	Charging Units installation	2 days	Wed 28/02/24	Thu 29/02/24
78	Commission & Test	1 day	Fri 01/03/24	Fri 01/03/24
79	Completion	10 days	Mon 04/03/24	Fri 15/03/24
80	Site complete	0 days	Fri 15/03/24	Fri 15/03/24
81	**Hawkesley Drive [TRO]**	**260 days**	**Mon 27/03/23**	**Fri 22/03/24**
82	**TRO**	**75 days**	**Mon 27/03/23**	**Fri 07/07/23**
83	Draft Order	10 days	Mon 27/03/23	Fri 07/04/23
84	Issue to legal team	5 days	Mon 10/04/23	Fri 14/04/23
85	TRO team review	30 days	Mon 17/04/23	Fri 26/05/23
86	Advertise	15 days	Mon 29/05/23	Fri 16/06/23
87	Complete consultation	5 days	Mon 19/06/23	Fri 23/06/23
88	Feedback report finalised	10 days	Mon 26/06/23	Fri 07/07/23
89	TRO issued	0 days	Fri 07/07/23	Fri 07/07/23
90	Detailed Design, Procurement, Mobilisation & Construction	185 days	Mon 10/07/23	Fri 22/03/24
91	Rock Street [no TRO]	185 days	Mon 03/07/23	Fri 15/03/24
92	Coniston Road / Derwant Close [no TRO]	185 days	Mon 03/07/23	Fri 15/03/24
93	Boulton Road [no TRO]	185 days	Mon 03/07/23	Fri 15/03/24
94	Marlborough Drive [TRO]	260 days	Mon 27/03/23	Fri 22/03/24
95	Perry Close [TRO]	260 days	Mon 27/03/23	Fri 22/03/24
96	Bevan Court [TRO]	260 days	Mon 27/03/23	Fri 22/03/24
97	**BCC On-street residential lamppost chargers**	**202 days**	**Thu 15/06/23**	**Fri 22/03/24**

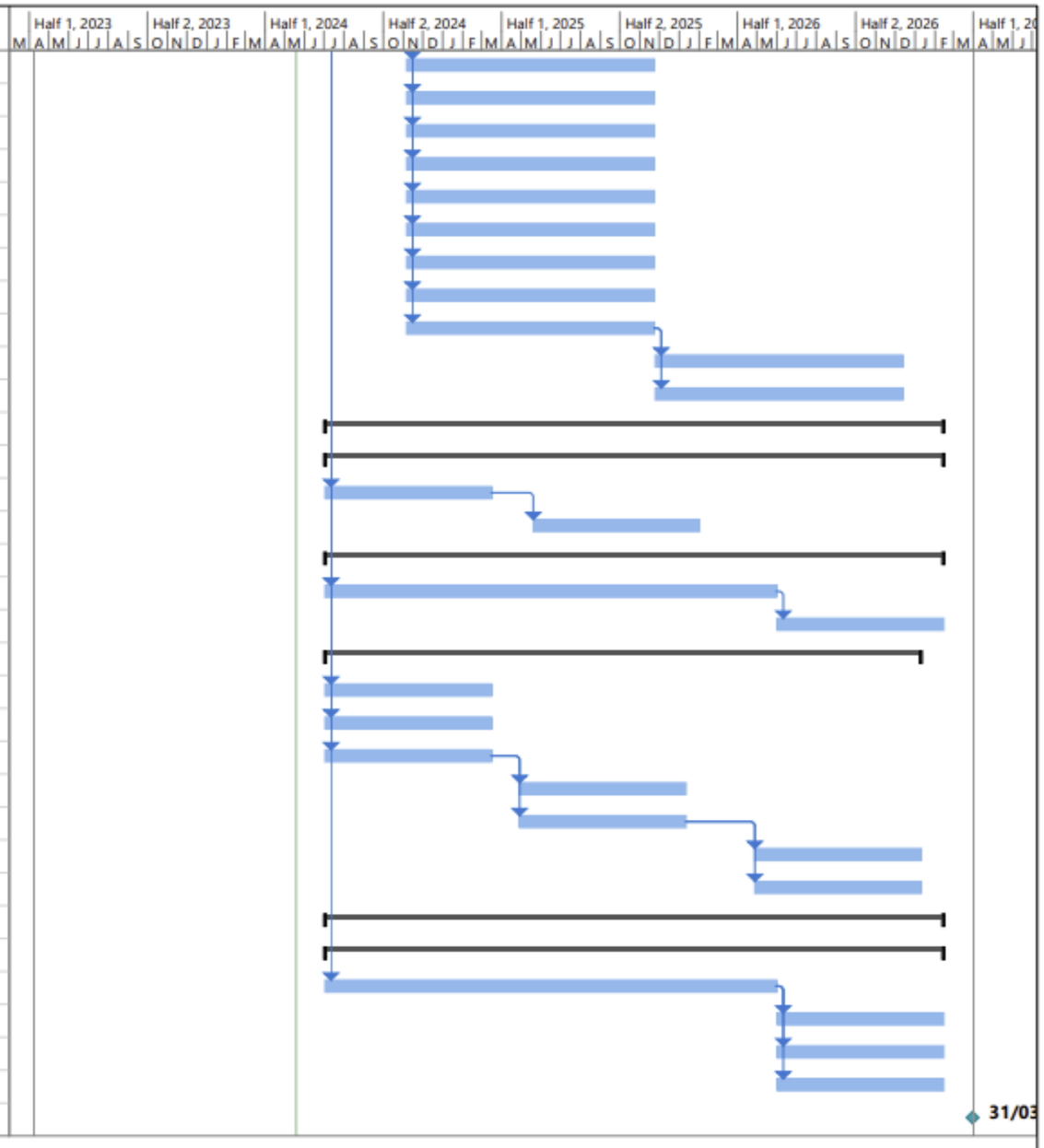


NB: Scale increased on Gantt chart

ID	Task Name	Duration	Start	Finish
98	CityLeap final Procurement	92 days	Thu 15/06/23	Fri 20/10/23
99	BCC street lighting mobilisation period	60 days	Mon 03/07/23	Fri 22/09/23
100	Charge point lead time	60 days	Mon 23/10/23	Fri 12/01/24
101	Install	50 days	Mon 15/01/24	Fri 22/03/24
102	**B&NES On-street residential sites**	**365 days**	**Mon 12/06/23**	**Fri 01/11/24**
103	Moorland Road [TRO]	**350 days**	**Mon 03/07/23**	**Fri 01/11/24**
104	Site Consultation	90 days	Mon 03/07/23	Fri 03/11/23
105	TRO, Detailed Design, Procurement, Mobilisation & Constructi	260 days	Mon 06/11/23	Fri 01/11/24
106	Snow Hill [TRO]	350 days	Mon 12/06/23	Fri 11/10/24
107	Julian Road / Circus [TRO]	350 days	Mon 03/07/23	Fri 01/11/24
108	New King Street [TRO]	350 days	Mon 12/06/23	Fri 11/10/24
109	**Community Hub Delivery**	**590 days**	**Mon 06/11/23**	**Fri 06/02/26**
110	**SGC Community Hubs**	**550 days**	**Mon 20/11/23**	**Fri 26/12/25**
111	Wickwar Village Hall	**275 days**	**Mon 20/11/23**	**Fri 06/12/24**
112	Site Consultation	90 days	Mon 20/11/23	Fri 22/03/24
113	Detailed Design, Procurement, Mobilisation & Construction	185 days	Mon 25/03/24	Fri 06/12/24
114	Charfield Memorial Hall	275 days	Mon 20/11/23	Fri 06/12/24
115	Greenhill Road	275 days	Mon 20/11/23	Fri 06/12/24
116	Severn Beach Village Hall	275 days	Mon 20/11/23	Fri 06/12/24
117	Woodlands Park	275 days	Mon 20/11/23	Fri 06/12/24
118	Frampton Cotterell District Car Park	275 days	Mon 20/11/23	Fri 06/12/24
119	Horse Street	275 days	Mon 09/12/24	Fri 26/12/25
120	Beaufort Road	275 days	Mon 09/12/24	Fri 26/12/25
121	Pucklechurch Community Centre	275 days	Mon 09/12/24	Fri 26/12/25
122	Fisher Road / Tennis Court Road	275 days	Mon 09/12/24	Fri 26/12/25
123	Warmley Community Centre	275 days	Mon 09/12/24	Fri 26/12/25
124	North Common Village Hall	275 days	Mon 09/12/24	Fri 26/12/25
125	Long Beach Road / Willsbridge Mill Car Park	275 days	Mon 09/12/24	Fri 26/12/25
126	Bitton Railway Station	275 days	Mon 09/12/24	Fri 26/12/25
127	**BCC Community Hubs**	**580 days**	**Mon 20/11/23**	**Fri 06/02/26**
128	Oldfield Place, Hotwells	275 days	Mon 20/11/23	Fri 06/12/24
129	Junction 3 Library	275 days	Mon 06/05/24	Fri 23/05/25
130	Westbury Hill	275 days	Mon 20/01/25	Fri 06/02/26
131	Little Paradise, Bedminster	275 days	Mon 20/01/25	Fri 06/02/26
132	**B&NES Community Hubs**	**550 days**	**Mon 06/11/23**	**Fri 12/12/25**



ID	Task Name	Duration	Start	Finish
133	Greenlands Car Park	275 days	Mon 06/11/23	Fri 22/11/24
134	High Street Car Park	275 days	Mon 06/11/23	Fri 22/11/24
135	Wedmore Car Park	275 days	Mon 06/11/23	Fri 22/11/24
136	High Street Car Park	275 days	Mon 06/11/23	Fri 22/11/24
137	Batheaston New Village Hall	275 days	Mon 06/11/23	Fri 22/11/24
138	High Littleton Primary School	275 days	Mon 06/11/23	Fri 22/11/24
139	Mountain Wood	275 days	Mon 06/11/23	Fri 22/11/24
140	Clutton Social Club	275 days	Mon 06/11/23	Fri 22/11/24
141	Bathampton Pharmacy	275 days	Mon 06/11/23	Fri 22/11/24
142	Farmborough Memorial Hall	275 days	Mon 25/11/24	Fri 12/12/25
143	Bishop Sutton Community Hall	275 days	Mon 25/11/24	Fri 12/12/25
144	**Destination Charger Delivery**	**685 days**	**Mon 03/07/23**	**Fri 13/02/26**
145	**SGC Destination Chargers**	**685 days**	**Mon 03/07/23**	**Fri 13/02/26**
146	Byron Place Car Park (Fishponds)	185 days	Mon 03/07/23	Fri 15/03/24
147	Flaxpits Lane (Winterbourne)	185 days	Mon 20/05/24	Fri 31/01/25
148	Newton Road (Cadbury Heath)	**685 days**	**Mon 03/07/23**	**Fri 13/02/26**
149	Wayleave agreement	500 days	Mon 03/07/23	Fri 30/05/25
150	Detailed Design, Procurement, Mobilisation & Construction	185 days	Mon 02/06/25	Fri 13/02/26
151	**BCC Destination Chargers**	**660 days**	**Mon 03/07/23**	**Fri 09/01/26**
152	Trenchard Street car park	185 days	Mon 03/07/23	Fri 15/03/24
153	Long Ashton P&R	185 days	Mon 03/07/23	Fri 15/03/24
154	Portway P&R	185 days	Mon 03/07/23	Fri 15/03/24
155	West End car park	185 days	Mon 29/04/24	Fri 10/01/25
156	Brislington P&R	185 days	Mon 29/04/24	Fri 10/01/25
157	The Grove car park	185 days	Mon 28/04/25	Fri 09/01/26
158	SS Great Britain	185 days	Mon 28/04/25	Fri 09/01/26
159	**B&NES Destination Chargers**	**685 days**	**Mon 03/07/23**	**Fri 13/02/26**
160	Twerton Village Hall / Bath City FC (backup)	**685 days**	**Mon 03/07/23**	**Fri 13/02/26**
161	Wayleave agreement	500 days	Mon 03/07/23	Fri 30/05/25
162	Detailed Design, Procurement, Mobilisation & Construction	185 days	Mon 02/06/25	Fri 13/02/26
163	Newbridge P&R	185 days	Mon 02/06/25	Fri 13/02/26
164	Larkhall Car Park	185 days	Mon 02/06/25	Fri 13/02/26
165	**Funding Deadline**	0 days	Tue 31/03/26	Tue 31/03/26



Project: EVCharging5mGRF_PP
Date: Fri 19/05/23

Task	Inactive Task	Manual Summary Rollup	External Milestone	Progress
Split	Inactive Milestone	Manual Summary	Deadline	Manual Progress
Milestone	Inactive Summary	Start-only	Baseline	Slippage
Summary	Manual Task	Finish-only	Baseline Milestone	
Project Summary	Duration-only	External Tasks	Baseline Summary	

APPENDIX 9: EQUALITY IMPACT ASSESSMENT

9.1 What is the proposal?

In March 2022 the Department for Transport (DfT) released Taking charge: the electric vehicle infrastructure strategy which set out the principles for Decarbonising Road transport. The government announced that the sale of all new petrol and diesel cars and vans would end in 2030.

As a Combined Authority we want to ensure that our citizens and visitors can travel around the region sustainably through making the option of an running an electric vehicle as accessible as possible.

The West of England Combined Authority (the CA), with the three constituent authorities (Bath and North East Somerset, Bristol City, and South Gloucestershire) aims to deliver electrical vehicle charging infrastructure across the West of England, thus supporting the transition from internal combustion engines to electric vehicles.

This will be done in partnership with the Revive Board which is managed by Bristol City Council (through the City Leap partnership) to which Bath and North East Somerset, Bristol City, and South Gloucestershire are a part of (as well as North Somerset – who are not part of the GRF scheme). There is also a part of the project to deliver on-street charging solutions recognising not everyone has the ability to charge a vehicle off-street.

To support the decarbonisation of transport and the reduction of tail pipe emissions across the region, the project will be split into three sections:

- On-street electric vehicle charging solutions
- Community charging hubs
- Destination charging

The EV Charging GRF project is based on intervening where the private sector is not investing, or least likely to invest therefore most sites are focused in areas that are in the lower percentile bands in the index of multiple depravation to close the gap to EV ownership for these communities, and to provide a fair and social equitable charging network across the region.

The impact on the wider community by the project would be to facilitate in a socially equable way the of the uptake of electric vehicles across the region through an increase in the charging infrastructure network connectivity and availability.

219 of the 256 charge points detailed in the Final Business Case (FBC) are focused on addressing this social equity issue, whereas the remaining 37 charge points are more

commercially focused, with the intent that these more commercial sites will help cross-subsidise the others.

The project will increase the number (and type) of electric vehicle chargers across the region, providing a charging network facilitating the transition from internal combustion engines to electric vehicles will ultimately improve air quality for the region. As there is an increase in uptake of electric vehicles there will be a reduction in 'direct emissions' (Type 1 & 2), including pollutants such as nitrogen oxides and greenhouse gases (GHGs), and primarily carbon dioxide (Co2), which are all harmful to public health.

9.2 What information do we have?

9.2.1 What evidence is there which tells us who is / could be affected?

As part of the long-list site selection process for looking at locations to place electric charging points, data has been used in the scoring criteria for site selection regarding:

- Journey times to existing charging point locations
- Geographical information – Ward and Settlement boundaries
- Areas that have poor air quality
- Close to existing transport proposals being undertaken by the CA
- Index of Multiple Deprivation (IMD) 2019
- Car Ownership levels by household
- Existing numbers of registered Electric Vehicles
- Data from the technical report undertaken by WSP
- Current electric demand capacity of local sub-stations

For protected characteristics, the scoring weights in favour of areas of higher disadvantaged areas, as well as specific locations which are disproportionately impacted by air quality issues, which can impact on health.

9.2.2 Who is missing? Are there any gaps in the data?

The weighting assessment is neutral in its assessment of other protected characteristics, including age, gender and disability.

9.2.3 How have we / will we involve groups that could be affected?

The creation of a long-list selection was undertaken using existing transport datasets. This data has then been used to inform each local authority in providing a further assessment of locations for installing electric charging points. As part of this process, the local authorities have been engaging with the local communities for locations are being proposed. This includes ward councillors, parish councils and local landowners where applicable.

Further engagement will take place as sites are taken forward into design and installation by each of the local authorities at implementation.

In terms of design and site location, there will be consideration that any charge point infrastructure installed will not adversely impact other road users, including pedestrians (i.e. measures will be put in place to ensure the footway is not blocked or restricted).

9.3 Who might the proposal impact?

9.3.1 Potential adverse impacts on people with protected characteristics?

The proposal is to provide a fair and equable charging infrastructure across the region, to which we have used the index of multiple deprivation (giving a higher weighting for the areas which score lower).

219 of the 256 charge points shortlisted are focused on addressing this social equity issue, whereas the remaining 37 Destination chargers are more commercially focused, with the intent that these more commercial sites will help cross-subsidize the others. The Combined Authority expects the private sector to install chargers where there is a clear commercial viability.

As defined under the equality act 2010 protected characteristics the potential impacts are as follows:

- **Age**: There could be difficulties for the elderly around plugging in the cables regarding dexterity and strength.
- **Disability**: Infrastructure installed will be designed with accessibility though there is potentially a small risk of negative impacts for those that have a visual impairment and for wheelchair users.
- **Gender reassignment**: Not defined within project
- **Marriage and civil partnership**: Not defined within project
- **Pregnancy and maternity**: Not defined within project
- **Ethnicity**: People from some Black, Asian and Minority Ethnic (BAME) backgrounds have a significantly lower likelihood of holding such a full driving licence.
- **Religion or belief**: In the shortlist of selected sites for charging points, the Unitary Authorities had identified several facilities for potential electric vehicle locations that are places of worship.
- **Sex**: Not defined within project

NB: At this stage the Combined Authority is aware that there are limitations with data on equalities groups at a local level. We know that there are gaps in our diversity data for some protected characteristics citywide, especially where this has not historically been included in census and statutory reporting e.g., sexual orientation.

9.3.2 Can these impacts be mitigated or justified? If so, how?

The mitigation of the impacts outlined in 10.3.1 are as follows:

- **Age:** To mitigate the identified impact, the Combined Authority will work with the unitary authorities to consult and engage with Age Charities where appropriate.
- **Disability**: This has been considered within the project/charge point design.
- **Gender reassignment**: It is not considered that the project is likely to have impacts in relation to gender reassignment.
- **Marriage and civil partnership**: It is not considered that the project is likely to have impacts in relation to marriage and civil partnership.
- **Pregnancy and maternity**: It is not considered that the project is likely to have impacts in relation to pregnancy and maternity.
- **Ethnicity**: In addition, we know that people from some BAME communities are significantly more likely to live in poverty and financial hardship. We recognise that the cost of purchasing an electric vehicle may mean it is more challenging for some BAME communities to utilise the electric vehicle infrastructure. As such, we plan to provide this infrastructure to ensure this is available once the cost of electric vehicles reach a more affordable price point such.
- **Religion or belief**: Following our discussion: The local authorities have selected sites based on local knowledge, some of which are places of worship that have been identified within the shortlisting process. However, it is worth noting that as part of the longlist process, an assessment of EV demand has been undertaken across the full extent of the region, assessing EV demand irrespective of the type of facility for the placement of EV charging points. This has allowed for an unbiased assessment as to locations of EV charging at the longlist stage before the shortlisting process undertaken by each of the local authorities.
- **Sex**: It is not considered that the project is likely to have impacts in relation to a person's sex.
- **Sexual orientation**: It is not considered that the project is likely to have impacts in relation to sexual orientation.

NB: As the electric vehicle charging sites have yet to fully determined due to the nature of the work (the unknown civils requirements, actual site suitability the need for agreements in for private land) the locations may change during the project. Therefore, once the sites are refined, the project team will be able to look at the ward data and acknowledge gaps that have arisen.

The Combined authority will follow previous learnings that have arisen from the Revive Network where mitigation or justification is required and appropriate.

9.3.3 Are benefits created for people with protected characteristics?

The proposal is to provide a fair and equable charging infrastructure across the region therefore this should provide a benefit for people with protected characteristics (as defined under the equality act 2010) who engage with this mode of transport will have access to an accessible charging infrastructure as a part of the Revive network and access to on street charging where applicable.

The project seeks to facilitate the transition from internal combustion engines to electric vehicles which will improve air quality for the regions. Poor air quality disproportionately affects the poorest which includes significant portion of the protected characteristics.

- **Age**: The project is designed to provide equitable charging infrastructure across the region for all ages that use an electric vehicle. As the shortlisted sites selected will be across the region to give a fair spread of charging options to all age demographics.
- **Disability**: This could provide a benefit for those with conditions that affect breathing as air quality is improved.

9.3.4 Can they be maximised? If so, how?

It is not anticipated at this time that the project outputs could be maximised to impact benefits for people with protected characteristics.

9.4 So what?

9.4.1 Has the equality impact assessment informed the proposal?

As the driver for public sector EV charge point interventions is based around social equity and equality, the evaluation of the Equality Impact Assessment has informed the site selection criteria and ratio of social equity to immediately commercially profitable chargers in the proposal.

9.4.2 What actions have been identified going forward?

To work with our Unitary Authorities to engage and consult with Age and Mobility charities or organisations as a part of this project or included with the West of England Electric Vehicle Charging Action Plan.

9.4.3 How will the impact of your proposal be measured?

The Combined Authority has identified some key activities and indicators that will be monitored. The list below is not exhaustive, however, and will be developed further with the Revive Network and UAs.

- The utilisation of the electric vehicle charging points
- Number of charge point user registrations with the Revive Network
- Costs – construction and operation
- Where possible air quality data be reviewed to see if there is an improvement
- Customer feedback and applicable complaints

APPENDIX 10: ADDENDUM NOTE 1

10.1 Introduction

During review of version 3.19 of the Final Business Case by West of England Combined Authority (the CA) Grant Assurance and by Bristol City Council's (BCC) Client Function Team (the interface with Bristol City Leap) and Chief Executive's Office, a small number of additions or clarifications were requested to the Final Business Case. These were agreed to be included as an addendum note rather than re-work of the document. As such this section notes these clarifications and sets out the requested additional economic sensitivity tests.

10.2 Clarifications

Electrical Energy Tariff: Section 1.4 The Revive Network, specifically the Financial and Commercial Status section, and also Section 4.2.2 Operational Expenditure (OPEX), specifically the Electricity section, refer to the Revive Network utilising Bristol City Leap's new advantageous energy tariff. This is incorrect: the new advantageous electricity tariff is a result of BCC's 'sleeving' arrangements as part of it's combined 'Energy Power Purchase Agreement' which incorporates BCC's electrical power generation assets.

Bristol City Leap and Bristol City Council: As of the official contract signing on January 18th 2023, Bristol City Leap – a joint venture between BCC and renewable energy management and low carbon delivery private company Ameresco Limited – has been responsible for the operation and on-going maintenance of the Revive Network, on BCC's behalf. In conjunction of this move of responsibility, the associated BCC officers responsible for the operation and on-going maintenance of the Revive Network, as well as project staff, were transferred to Bristol City Leap.

As a consequence of the Final Business Case being largely authored prior to this organisational and personnel change taking place, there are multiple references throughout to electric vehicle charge points (EVCPs) in BCC being delivered by BCC officers. It should therefore be noted that this change has occurred and Revive operational team officers now reside within Bristol City Leap.

In addition to this, there is limited reference to the role of Bristol City Leap in delivering the wider EV strategy throughout the region. This is currently in discussion and will be clarified in future as part of the Local Electric Vehicle Infrastructure (LEVI) bids to the Office of Zero Emission Vehicles (OZEV) and as part of the West of England EV Action Plan.

10.3 Additional Economic Sensitivity Tests

This document presents a revised Economic Case section to the 'West of England Electric Vehicle Charging Infrastructure Full Business Case'. An alternative approach has been taken to calculating the 'EV uplift' figure, using the electrical capacity of each type of charge point and projected sessions a day (see Figure 20). The subsequent calculations which rely on this input have been updated accordingly. A number of sensitivity tests and other amendments have also been made, as per CA Grant Assurance comments.

10.3.1 Revised EV Uplift Calculations

A primary aim of the scheme to increase the number of electric vehicles in the region. In order to calculate the scale of this increased EV uptake the following process was applied:

- Estimate the expected utilisation rate of a single chargepoint.
- Calculate the amount of power that a single chargepoint could distribute in a year
- For the entire proposed network calculate the power which could be distributed
- Calculate the number of vehicles which could be supported by the total chargers
- Of these total vehicles estimate the proportion which would be new EVs

Utilisation rate: Theoretically EV chargers could operate constantly to maximise the benefits of these assets. In practice chargers are only utilised for a fraction of the day. Using real world utilisation data from the existing Revive network estimates have been made of the utilisation that could be expected at the new chargers in year 1.

Over time the utilisation rate is expected to increase. Although there remains significant uncertainty around how this will evolve. Estimates of yearly utilisation increases were based on information received through engagement with industry. These are averages for the entire network and in practice utilisation will likely fluctuate up and down at individual sites each year.

Potential power distributed (kWh per year): A simple calculation was carried out to calculate the potential power which could be distributed by each type of charger in the scheme (lamp column, fast, rapid and ultra-rapids).

Speed (kWh) x utilisation (% of day) x 24 hours x 365 days

Vehicles supported by a single charger: The annual power requirements of an EV were calculated using assumptions around the average vehicles. The average vehicle travels 7400 miles per year (National Travel Survey) and has an efficiency of 3.5 kWh per mile (industry benchmark).

This value of 2114kWh per year, was used to calculate the number of vehicles which a single charger using this formula.

$$\frac{\textit{Annual power distributed by a charger}}{\textit{Annual power requirements of a single vehicle}}$$

Vehicles supported by the entire proposed network of chargers: The values above were scaled up, for each speed of charger, to represent the capacity of the entire proposed network of chargers.

Number of new EVs supported: The following assumptions were made around the potential 'EV uplift effect' or the number of new EVs which the schemes will support:

- The lamp column and community charging hub schemes will facilitate existing vehicles to switch to EV.
- Existing EVs already have charging provision available. Generally, they would not make use of the new residential charging provision.
- The destination charging scheme will support drivers which need top up or en-route charging. Whilst this is a valuable facility in most cases it will contribute less to enabling the switch to EVs than residential (lamp column and community) charging will.
- It is estimated based on current research that 88% of charging occurs at home, either using a private domestic charger or a public charger close to home.

Calculations were made based on these assumptions. **Table 60** shows the forecast number of vehicles which would be able to switch to EV as a result of the proposed chargers. There is a low, core and high scenario to represent the range of uncertainty.

Table 60: Forecast EV uplift as a result of the scheme

Year	Financial Year	Low Scenario	Core Scenario	High Scenario
1	2023-24	321	826	3163
2	2024-25	321	894	3328
3	2025-26	351	923	3503
4	2026-27	351	962	3668
5	2027-28	419	991	3838
6	2028-29	419	1059	4037
7	2029-30	419	1127	4240
8	2030-31	448	1156	4444
9	2031-32	448	1224	4677
10	2032-33	516	1292	4910
11	2033-34	516	1360	5152
12	2034-35	545	1419	5414
13	2035-36	575	1487	5686
14	2036-37	613	1555	5957
15	2037-38	652	1622	6229

10.4 Value for Money – reduced EV Uplift

Table 61: Value for money (VfM) summary for core scenario

Item	Core scenario
Total CAPEX	£4,092,275
Total OPEX	£3,256,784
Revenue	-£6,701,038
PVC	**£648,021**
Environmental Impacts	£9,517,509
PVB	**£9,517,509**
NPV	**£8,869,489**
BCR	**14.69**
VfM Category	**Very high**

10.5 Sensitivity Analysis – reduced EV Uplift

10.5.1 Sensitivity to Costs

The scheme's sensitivity to the cost estimate was tested by changing the level of optimism bias to 30% for the high cost scenario and 10% for the low cost scenario.

Table 62: Sensitivity testing on Optimism Bias (OB)

Item	High Cost	Low Cost
Total CAPEX	£4,433,298	£3,751,252
Total OPEX	£3,256,784	£3,256,784
Revenue	-£6,701,038	-£6,701,038
PVC	**£989,043**	**£306,998**
Environmental Impacts	£9,517,509	£9,517,509
PVB	**£9,517,509**	**£9,517,509**
NPV	**£8,528,466**	**£9,210,512**
BCR	**9.62**	**31**
VfM Category	**Very high**	**Very high**

10.5.2 Sensitivity to Utilisation

To account for sensitivity in revenues, high and low EV charge point utilisation scenarios have been tested (see Figure 20 for more detail).

As per Box 1.2 of the Value For Money Supplementary Guidance on Categories, a negative PVC (where difference between revenue exceeds project costs) and a positive PVB and NP(P)V are present then a negative BCR is in fact Very High FM.

Table 63: Sensitivity to Utilisation

Item	High Utilisation	Low Utilisation
Total CAPEX	£4,092,275	£4,092,275
Total OPEX	£5,891,942	£2,649,551
Revenue	-£14,921,469	-£4,806,765
PVC	**£4,937,252**	**£1,935,062**
Environmental Impacts	£9,517,509	£9,517,509
PVB	**£9,517,509**	**£9,517,509**
NPV	**£14,454,761**	**£7,582,448**
BCR	**-1.93**	**35.43**
VfM Category	**Very high**	**Very high**

10.5.3 Sensitivity to EV uplift

Two sensitivity tests were carried out to understand the range of uncertainty around the core scenario. This sensitivity also influences the assessment of the Environmental Impacts.

Table 64: Sensitivity testing on EV uplift

Item	High Uplift	Low Uplift
Total CAPEX	£4,092,275	£4,092,275
Total OPEX	£3,256,784	£3,256,784
Revenue	-£6,701,038	-£6,701,038
PVC	**£648,021**	**£648,021**
Environmental Impacts	£36,281,723	£3,673,207
PVB	**£36,281,723**	**£3,673,207**
NPV	**£35,633,703**	**£3,025,187**
BCR	**60**	**5.67**
VfM Category	**Very high**	**Very high**

10.5.4 Sensitivity testing with equal (net-zero) Operating Costs & Revenue

This sensitivity test measures the welfare benefit (i.e. environmental impact) against the capital investment across all scenarios. It assumes operating cost and revenue are equal.

Table 65: Sensitivity testing with equal (net-zero) Operating Costs & Revenue

Scenario	PVC	PVB	NPV	BCR	VfM
Core	£4,092,275	£9,517,509	£5,425,234	2.33	High
High costs	£4,092,275	£36,281,723	£32,189,448	8.87	Very high
Low costs	£4,092,275	£3,673,207	-£419,068	0.90	Low
High utilisation	£4,092,275	£9,517,509	£5,425,234	2.33	High
Low utilisation	£4,092,275	£9,517,509	£5,425,234	2.33	High
High uplift in EVs	£4,433,298	£9,517,509	£5,084,211	2.15	High
Low uplift in EVs	£3,751,252	£9,517,509	£5,766,257	2.54	High

10.6 Value for Money Summary – reduced EV uplift

Table 66: Value for Money (VfM) summary

Scenario	NPV	BCR	VfM
Core	£8,869,489	15	Very high
High costs	£8,528,466	10	Very high
Low costs	£9,210,512	31	Very high
High utilisation of CPs	£14,454,761	-2[12]	Very high
Low utilisation of CPs	£7,582,448	5	Very high
High uplift in EVs	£35,633,703	56	Very high
Low uplift in EVs	£3,025,187	6	Very high

The VfM is categorised as 'Very High' in all scenarios. These sensitivity tests demonstrate that the scheme will generate significant benefits which will outweigh the costs of the scheme.

[12] Where a negative PVC and a positive PVB and NP(P)V are present then a negative BCR is categorised as Very High FM, Box 1.2 of the Value For Money Supplementary Guidance on Categories.