Black Country Transport

PROJECT

Final Report

ULEV Strategy

Black Country

Lowering your emissions through innovation in transport and energy infrastructure

15 May 2020

Prepared for:

Stuart Everton
Director of Transport
Black Country Transport

Stuart.everton@blackcountrytransport.org.uk
01902 554097

Prepared by:

Chris Rimmer and the project team
Infrastructure Strategy lead

Approved by:

Chris Cox
Head of Energy Systems and Infrastructure

Company Details
Cenex
Holywell Building
Holywell Park
Ashby Road
Loughborough
Leicestershire
LE11 3UZ

Registered in England No. *5371158*

Tel: **01509 642 500**
Email: **info@cenex.co.uk**
Website: **www.cenex.co.uk**

Terms and Conditions

Cenex has exercised all reasonable skill and care in the performance of our services and we shall be liable only to the extent we are in breach of such obligation. While the information is provided in good faith, the ideas presented in the report must be subject to further investigation, and take into account other factors not presented here, before being taken forward. Cenex shall not in any circumstances be liable in contract, or otherwise for (a) any loss of investment, loss of contract, loss of production, loss of profits, loss of time or loss of use; and/or (b) any consequential or indirect loss sustained by the client or any third parties.

Document Revisions

No.	Details	Date
1	Report outline	8th Apr 2020
2	Initial content	14th Apr 2020
3	Content body added by consultants	15th Apr 2020
4	First internal review (CR)	15th Apr 2020
5	Second internal review (CCX)	16th Apr 2020
6	Draft report for issue	17th Apr 2020
7	Client comments	1st May 2020
8	Final report for issue	15th May 2020

Contents

Figures

Tables

Executive Summary

Cenex was commissioned by Black Country Transport to develop an evidenced Ultra-Low Emission Vehicle (ULEV) Strategy, Vision and Implementation Plan.

The objectives of the study were to:

- Build upon the existing Transport for West Midlands ULEV Strategy Report by Cenex;
- Baseline the current Black Country situation;
- Develop and analyse scenarios projecting the number of EVs, infrastructure, energy demand and grid capacity constraints;
- Calculate the benefits associated with these scenarios;
- Create and agree a five-year ULEV vision; and
- Outline an implementation plan to deliver the vision.

Challenges to Address:

The Black Country needs a coordinated ULEV programme to deliver its vision against the backdrop of six challenges:

- Political – commitments have been made to tackle climate change;
- Environmental – the world continues to warm, and transport is now the worst-performing sector in the Black Country for Greenhouse Gas (GHG) emissions;
- Societal – whilst mobility brings social benefits, carbon-emitting transport impacts health, life expectancy and resilience to respiratory disease;
- Technological – many EVs are being launched by manufacturers, so the Black Country needs to be prepared to take advantage of this transition, so it is not left behind;
- Legislative – the UK's net-zero 2050 target is binding, the WMCA has set a similar target for 2041 and some Black Country Authorities must be net-zero by the end of this decade; and
- Economic – the uptake of EVs can help drive economic growth through regeneration, planning, business growth, skills, tourism and inward investment – all even more important in the light of economic pressures due to covid-19.

A Vision for Change:

The Black Country will lead the West Midlands on the road to net-zero by accelerating and amplifying the EV transition in anticipation of a 2035 ban on the sale of conventional vehicles.

By 2025, this will be achieved by:

- Installing an additional 380 standard and 110 fast charging sockets;
- Coordinating with TfWM to support installation of additional rapid and ultra-rapid chargers;
- Leading by example by procuring only EVs for all new council cars and vans
- Equipping all council offices, depots, car parks and sports facilities with charge points;
- Publishing a local public transport decarbonisation action plan;
- Requiring most taxi and private hire vehicles to switch to ULEV;
- Using planning policy to deploy charge points at retail and business car parks;
- Deploying measures to slow the growth of the vehicle parc; and
- Establishing a programme to inform and encourage the public and businesses

If successful, by 2025 this vision is expected to deliver:

- A 1% reduction of transport CO_2 emissions;
- A 10% reduction of transport NOX emissions;
- A 35% reduction of transport PM emissions;
- An increase of the number of EVs to at least 4% of the vehicle parc;
- Over 90% of Black Country land area within 5 minutes' drive of a rapid charger; and
- Over 95% of urban areas within 500m of any public chargepoint.

Black Country Ultra-Low Emission Vehicle Vision

2020
- Resource the ULEV **Programme**
- Initiate **Regional** Co-ordination
- Consult on **Proposal** & Adopt **Policy**
- **Full Business** Case **Development**

Launch **Public Engagement** Programme

2021
- Secure **~£2.25m Funding**
- Deploy Measures to **Reduce Vehicle Parc**

2022
- Install First **Rapid** & **Ultra-Rapid** Charging Hubs
- All **New Council Cars / Vans** are **EVs**
- Publish Public Transport **Decarbonisation Plan**

2023
- **Refresh Planning** Policy
- All **New Taxi / PHV** Licences **EV**

2024
- Equip **Council Sites** with Chargepoints

2025
- **>90%** Black Country Land Area **Under 5 Minute** Drive from **Rapid Chargepoint**
- **380 Standard** Chargepoints Installed
- **110 Fast** Chargepoints Installed
- **Refresh** the **ULEV Vision** and **Strategy**

2028
- Wolverhampton Council **Net-Zero** Target

2030
- *Subject to scenario:*
  ~1,500 Standard Chargepoints Installed
  ~300 Fast Chargepoints Installed
- **£20m to £50m** Total Annual **Savings** from **Emission Reduction**, depending on scenario
- Walsall Council **Net-Zero** Target

The Black Country will lead the West Midlands on the road to net-zero by accelerating and amplifying the EV transition in anticipation of a 2035 ban on the sale of conventional vehicles.

Dudley Metropolitan Borough Council | Sandwell Metropolitan Borough Council | Walsall Council | City of Wolverhampton Council | Black Country LEP Building Growth with Midlands Engine HM Government

A Plan to Implement:

On top of the specific targets contained within the vision and Black Country-specific actions contained within the TfWM ULEV Report, the following actions and next steps are also recommended for the Black Country:

Policy:

- Agree the Vision as policy to ensure visibility across all council departments.
- Agree an in-depth vehicle replacement strategy so a clear pathway to net-zero council fleets can be outlined.
- Commission a wider evidence-led study to examine the ways in which journeys and the vehicle parc can be managed by local authorities.

Coordination:

- Ensure Black Country representation on the WMCA EV Steering and Working Groups.
- Take a leading role in coordinating all charging infrastructure deployments to ensure a coherent approach and avoid over- or under-supply.

Funding[1] :

- Set aside £2.25m capital investment plus Distribution Network Operator (DNO) connection costs and resourcing costs to fund this vision.
- Deploy infrastructure under an Own and Operate or External Operator model.

Site Selection:

- Coordinate with the WMCA who are working with WPD to develop processes that can provide accurate information on DNO costs.
- Feed 7 potential sites into the WMCA assessment of locations for transit and charging hubs.

Resourcing:

- Pool resource from across Black Country authorities to achieve efficiencies.
- Appoint one FTE management-level officer to manage the programme, especially procurement and operation of charging infrastructure.
- Ensure support of this lead with resource from transport planning, procurement, parking, highways, PR/communications, transport planning management and Place Directorate Leadership (or equivalent departments).
- Cost up this resource plan so it can be included in the next round of budgets.

See Section 6 (page 69) for more details

Key Insights from Projections:

The Vision is based on analysis of three scenarios constructed from current and expected UK Government policy ('Mid', '2035 Ban' and '2032 Ban'), which conclude:

EV Uptake:

- Up to 2025, all scenarios track closely due to a low baseline starting position.
- After 2025, the 'Ban' scenarios diverge from the Mid scenario.
- By 2025, between 14,000 (Mid scenario) and 32,000 (2032 Ban) EVs are projected, rising to 44,000 – 154,000 in 2030.

Infrastructure:

- By 2025, 369 (Mid) to 830 (2032 Ban) charging sockets are projected, rising t o 870 – 3,027 in 2030.
- By 2030, the number of 7 kW chargers in the 2032 Ban is over triple those in the Mid.

- Just 16 rapid/ultra-rapid charging sockets are needed by 2030 in the Mid scenario, but 135 in the 2032 Ban scenario.
- The exact locations should be evaluated to ensure good coverage in-line with the objective to be within five minutes of a rapid charger.

Energy Demand:

- Residential charging increases the 2025 peak demand by 86 - 195, up to 249 – 865 MW by 2030, depending on scenario.
- The 2035 Ban scenario projects an additional 140 MW by 2025 and 563 MW by 2030.
- In all scenarios, electrical demand is likely to be higher in suburban areas.
- In all scenarios, the potential future deficit between demand and supply of electricity for EV charging is also likely to be highest in suburban areas.

Gap Analysis:

- Current provision of public 50 kW infrastructure is sufficient for projected 2025 rapid and ultra-rapid demand in the 2035 Ban scenario, especially in Wolverhampton.
- This scenario requires an additional 381 public standard and 113 fast sockets by 2025.
- Up to 2025, EV infrastructure procurement should focus on standard and fast chargepoints at long and short-stay parking locations, respectively.
- Additional sockets projected in 2030 are 1,500 standard, 300 fast, 50 rapid and 20 ultra-rapid respectively.

See Section 3 (page 39) for more details.

Key Insights from Benefits:

The benefits of the Vision are justified by the following analysis of the benefits of the scenarios:

Emissions Reduction:

- If the 2035 Ban scenario is followed, 1.3% CO2, 10% NOX and 25% PM road transport emissions reductions are projected by 2025.
- Only the Ban scenarios show significant changes in CO2 due to the aggressive phasing-out of petrol, diesel and hybrid vehicles, producing 50-60% reductions by 2040.
- PM reduction is good throughout due to recent standards changes which will remove NOX and PM emissions, even in the Mid scenario.
- None of the scenarios produce a net-zero car and LGV parc by 2040, meaning the road transport component of 2041 net-zero target for the West Midlands is difficult to achieve.
- However, maintaining (or slightly reducing) the vehicle parc has a significant effect on the total CO2 produced by vehicles and the 2041 target becomes within reach for road transport.
- The impact of the covid-19 lockdown clearly demonstrates the large step change needed in road transport in order to achieve meaningful and large scale emissions reductions.

Mitigated Damage Costs:

- Total annual savings of between £20m and £55m are available from emissions reduction by 2030, depending on scenario. For the 2035 Ban scenario, annual savings for the three main emissions are: £12.8 million for CO2, £13.5 million for NOx, and £11.7 million for PM.
- In the 2035 Ban scenario, this equates 1/3 of 1% of the Black Country's GDP.

Noise Reduction:

- The noise from the engines of petrol or diesel vehicles is louder than EVs at speeds below 20 mph, especially if higher gears are selected.

- However, the UNECE technical standard that forces EVs to have sound generators below 12mph reduces this benefit so that any noise benefits from transitioning to EVs are likely to be confined to roads with average speeds of 12 – 20 mph.
- The maximum mitigated damage cost benefit from noise reduction is approximately one quarter of the benefits from individual CO2, NOX or PM reductions.
- Improved tyre technology or Connected and Autonomous Vehicles may add additional improvements, but these technologies are not yet prevalent.

Economic Benefits:

- The economic benefit from installation or operation of EV charging infrastructure is felt regionally and locally in regeneration, planning, business growth, skills/employment, tourism/trade and inward investment.
- The skills and employment benefits are already well-developed and accessible.
- Black Country authorities should seek to engage local training providers to ensure the local labour market is ready to install and maintain chargepoints.

See Section 4 (page 51) for more details.

Key Baselining Observations and Insights:

The implementation plan is justified because of the need to act to change the current status to achieve the vision:

Vehicles – The Black Country has a significant challenge to deliver emissions reductions both from the vehicle parc in general and specifically in the council fleets.

Vehicle Parc:

- Cars are the most popular vehicles in the area, with more petrol than diesel.
- The Black Country vehicle parc composition is broadly representative of the UK.
- The Euro 6/VI standard are only the third most common vehicle type with dominance by Euro 5/V and 4/IV, which have higher emissions, particularly NOX.
- There is a high % Euro VI HGVs and buses, which have better emission standards.
- The number of pre-Euro 4/IV vehicles is a concern, representing 36% of the total parc.

Current EV Penetration:

- Black Country councils are the worst-performing West Midlands councils for EV uptake.
- However, all four authorities sit on or above the mean wage/EV uptake trend.

Vehicle Parc Emissions:

- Cars represent 60% of all transport CO2; Diesel cars emit 33% and 46% of the area's NOX and PM.
- LGVs emit 21% of the area's NOX and PM because of high dominance for Euro 3 vehicles.
- HGVs have no CO2 standards and emit 12% of the area's GHG emissions, despite being just 2% of the total vehicle parc. 22% of NOX and 15% of PM come from HGVs.
- Car and LGV emissions are expected to reduce more easily than freight or bus emissions.

Council Fleets:

- LGVs dominate the vehicle fleet, although there are several HGVs and buses too.
- Dudley's fleet will be difficult to decarbonise due to the high proportion of HGVs.
- 89% of the Sandwell fleet are cars and LGVs, positioning it well to move to net-zero.
- Only 4 EVs and 12 Hybrids are operational throughout all four fleets.
- Where aggressive internal council decarbonisation targets exist, transition to cleaner powertrains will need to happen rapidly.

Taxi & Private Hire (TPH):

- Nearly 13,000 TPH vehicles are currently licensed in the Black Country. Around 9,185 of these are private hire vehicles registered by City of Wolverhampton Council, which are known to operate and originate from outside of the Black Country.
- 533 are Wheelchair Accessible Vehicles, which will be more difficult to transition to EV.
- It is expected that the Birmingham Clean Air Zone will promote a switch to EV.

Chargepoints – the Black Country currently lags the West Midlands in the maturity and diversity of its infrastructure.

- Current infrastructure is mostly rapid chargers or legacy standard chargers, with few fast.
- Provision is currently 20 plug-in vehicles (PiVs) per chargepoint, compared to 10 per PiV for the West Midlands.
- Around 80% of the area is further than one km from the nearest public chargepoint.
- 99% of the area is within ten minutes' drive of a rapid chargepoint.
- Sandwell lags in the Black Country's rapid chargepoint coverage.

Customers and constraints – EV and infrastructure uptake is expected to vary significantly across the Black Country

- Mapping early adopters predicts a diversity of EV uptake across the Black Country.
- The more likely locations for residential charging demand have been identified for further work, along with areas which will be more or less constrained by grid connections.
- DNO upgrades can take six months or more, so early engagement with WPD is crucial.
- Black Country should engage actively with WMCA's efforts to simplify site selection.

See Section 2 (page 17) for more details.

1 Introduction

1.1 Introduction to Cenex

Cenex was established in 2005 as the UK's first Centre of Excellence for Low Carbon and Fuel Cell technologies.

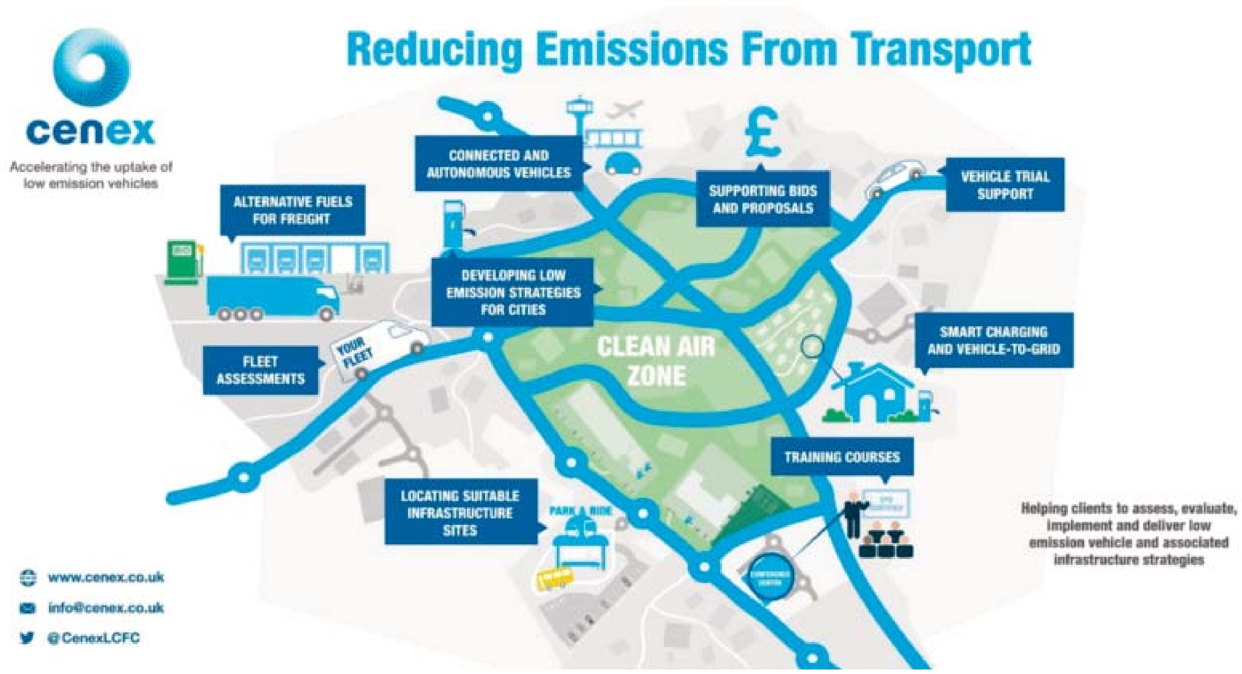
Today, Cenex operates as an independent, not-for-profit consultancy specialising in the delivery of projects, supporting innovation and market development, focused on low carbon vehicles and associated energy infrastructure.

We highly value our independence as it allows us to provide impartial advice and helps us build trust with our customers.

Being a not-for-profit, Cenex isn't driven by doing the work which pays the most or builds our order book, but by what is right for our customers and for the industry. This is reflected in everything we do, from the work we do and the advice we give, even to the prices we charge.

Finally, as consultants our aim is to be trusted advisors with expert knowledge – the go-to source of help and support for public and private sector organisations. We want to be people you can trust to help where and when it is most needed as our customers progress along their journey to a zero-carbon future.

To find out more about us and the work that we do, visit our website: **www.cenex.co.uk**



1.2 Introduction to the Project

1.2.1 Black Country cooperation

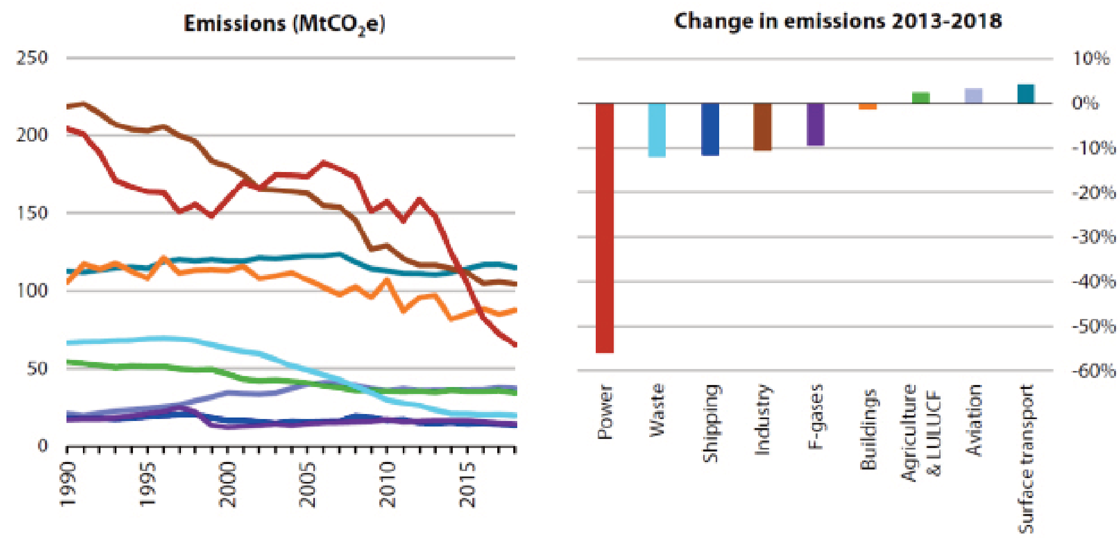
In response to environmental and public health concerns, Wolverhampton, Dudley, Sandwell and Walsall Councils have collaborated to develop and deliver a Black Country-wide Ultra Low Emission Vehicle (ULEV) programme. This aims to accelerate the uptake of ULEVs across the local area, facilitate the installation of chargepoints, upgrade energy infrastructure and promote ULEVs.

1.2.2 Challenges to address

The need for the Black Country to have a ULEV programme is driven by six main challenges.

1 - Political. The need to fulfil multiple public commitments to reduce carbon emissions. Mayor Andy Street highlighted the region's "moral responsibility to tackle climate change" when the West Midlands Combined Authority (WMCA) declared a climate emergency. The four authorities comprising the Black Country have also joined over 400 local authorities across the UK who have made similar declarations.

2 - Environment and Climate Change. The UK's ten warmest years all occurred since 2002[2], reflecting a global heating which is considered "extremely likely" to have been caused by the increasing levels of carbon dioxide (CO2) being emitted into the atmosphere[3]. Although UK GHG emissions have dropped 43% in total since 1990 – driven particularly by the decarbonisation of power generation – the latest Committee on Climate Change report shows that transportation is now the worst-performing sector in the country and emissions have risen in recent years[4]. In the West Midlands, transport is responsible for 37% of all CO2 emissions[5]. The recently-released Decarbonising Transport puts it starkly: "there is no plausible path to net-zero without major transport emissions reductions… that need to start being delivered soon"[6].



3 - Society and Public Health. Everyday life is impacted by the widespread use of petrol and diesel engines into every aspect of life, commuting, business and leisure for good and ill. Yet because of the economic and social benefits of transport, poor air quality is now the largest environmental risk to UK public health[7] and airborne pollution may soon be listed as an official cause of death for those in polluted areas[8]. A recent study highlighted that a child living within 50m of a major road in Birmingham could have their lung growth stunted by up to 8% due to air pollution[9]. All four Black Country authorities have declared Air Quality Management Areas in response to consistent breaches of nitrous oxide (NOX) pollution thresholds. More recently, the unprecedented covid-19 crisis and the ensuing lockdown has highlighted wider, more worrying links between urban air quality and public health resilience as evidence emerges that populations exposed to poorer air quality have lower resilience to the disease[10].

2 *https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2019/state-of-the-uk-climate-2018, accessed 8th April 2020.*

3 *https://www.ipcc.ch/site/assets/uploads/2018/02/ar5_syr_headlines_en.pdf, accessed 8th April 2020.*

4 *https://www.theccc.org.uk/publication/reducing-uk-emissions-2019-progress-report-to-parliament/, accessed 8th April 2020.*

5 *Sectoral split of 2016 CO2 emissions for WMCA area from BEIS Statistics. Quoted in internal WMCA document 'Climate Emergency Workshop v9'.*

6 *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/878642/decarbonising-transport-setting-the-challenge.pdf, paragraph 5.1, accessed 8th April 2020.*

7 *https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution, accessed 8th April 2020.*

8 *https://www.bbc.co.uk/news/uk-england-london-48132490, accessed 8th April 2020.*

9 *https://www.kcl.ac.uk/news/living-near-a-busy-road-can-stunt-childrens-lung-growthAccessed 9th December 2019*

4 - Technological. Prior to the current crisis, most vehicle Original Equipment Manufacturers (OEMs) were preparing for an order of magnitude increase in the sales of ULEVs, and especially Electric Vehicles (EVs). Whereas ten years ago, there were around ten models available, now customers can choose between nearly 100 models of electric car with announcements of multiple vans and Light Goods Vehicles (LGVs) on the horizon. Whether the coronavirus disruption continues short- or medium-term, a coherent ULEV strategy, vision and implementation plan will be needed to ensure the Black Country is well-placed to take advantage of promised innovations and not be left behind by more wealthy or advanced areas as the economy rebuilds.

5 - Legislative. Whilst there are many good 'soft' reasons for a ULEV programme, it is important to recognise that there are also official 'hard' targets to be met. The UK Government committed the country in June 2019 to a legally binding goal of reducing Greenhouse Gas (GHG) emissions to a net-zero position by the middle of this century. Closer to home, the Black Country's regional authority, the WMCA has the ambition to achieve this milestone nine years earlier than the UK, by 2041. Walsall and Wolverhampton Councils have set internal net-zero targets at 2030 and 2028 respectively. Furthermore, petrol and diesel cars are to be banned from sale beyond 2040, with a consultation underway to bring this forward to 2035 or earlier, potentially including hybrids.

6 - Economic. At the time of writing, economic growth is under pressure with the real threat of a covid-19-induced recession. Yet, even before many workers were furloughed earlier this year, economic growth was a critical piece of the ULEV puzzle. 43% of the UK's automotive Gross Value Add (GVA) is produced in the West Midlands, presenting both a threat (if ULEV uptake is delivered by others) and an opportunity (to expand existing businesses). The uptake of EVs can benefit local economies through regeneration, business growth, upskilling local labour, trade and even inward investment[11]. With the anticipated "new normal" as the area recovers from the covid-19 pandemic, infrastructure provision may be needed to ensure that Black Country residents are able to remain mobile and economically productive. Additionally, the design, manufacture and utilisation of EVs is a part of the UK's national Industrial Strategy. Addressing these challenges will therefore be required for the Black Country to keep or set the pace in a national context.

1.2.3 Responses to the challenges

In response to these challenges, National Government and Regional Authorities have started to respond with a variety of interlocking and overlapping policies and strategies. The Road to Zero[12] is widely acknowledged as a key cornerstone in the UK's industrial strategy in this area. Closer to home, the WMCA Movement for Growth envisions a modern, effective, efficient and reliable transport system that drives economic growth within the context of cleaner air and improved health. "The West Midlands will play its full part in reducing carbon emissions in line with the national target" it declares .

Recently, Cenex delivered analysis and recommendations as part of a ULEV Strategy for Transport for West Midlands (TfWM), which covers the Black Country footprint (referred to as 'the TfWM ULEV Report'). In this, there was acknowledgement that the implementation of a regional strategy has some hurdles to overcome. For instance, the lack of capacity and capability in the public sector bodies in the region has been highlighted already by TfWM. A sparsity of funding was noted, which is encouraging growth of a fragmented and uncoordinated vehicle and infrastructure market. The lack of chargepoint inter-operability is concerning and the best sites for enabling infrastructure are being cherry-picked by private investors who tie-up prime locations without fulfilling the wider aspirations of the programme.

Notwithstanding these barriers, this report for the Black Country follows the same approach and uses many of the same assumptions as the TfWM work to create a strategy which is coherent with its regional and national equivalents and seeks to deliver the area's contribution to the wider effort.

This report presents a five-year vision and implementation plan to start to outline details of how existing political commitments will be fulfilled.

If delivered, it has the potential to set the Black Country on course to deliver necessary improvements to the global and local environment and also to benefit the quality of life of tens of thousands of households, with significant knock-on benefits to the health service. Taking advantage of the rapid pace of technological innovation in the transport sector, it proposes an ambitious vision to ensure legislative targets are met without compromising economic growth or leaving the Black Country lagging behind.

1.3 Scope of Work

To allow this specific piece of work to play its role within the wider tapestry of activities being carried out in the Black Country and beyond, the work was scoped as following:

Vehicle Category: It is well established that the definition of an Ultra-Low Emission Vehicle (ULEV) encompasses a wide range of technologies and fuels. However, the bulk of this work is focused on Electric Vehicles, which present the most pressing challenge in the timeframe particularly considered by this report.

Mode of Transport: The analysis presented within this report focuses predominantly on cars, vans, taxi/private hire, car clubs, council fleet and powered two-wheelers. However, larger vehicle categories such as freight, logistics and public transport are included in the vision.

Segment: Private, self-employed, SME, corporate and charitable customer segments are considered throughout this analysis.

Out of Scope: Whilst the vision touches on these areas, specific analysis of modal shift, active travel, economic development and/or skills provision have been excluded from this report[14].

1.4 Deliverables

The core output of this work is a high-level summary which presents the vision, accompanied by commentary summarising the current landscape, outlining a set of targets and proposing an implementation plan. This is found in the Executive Summary.

The assumptions, results and conclusions from each part of the analysis which Cenex has completed can be found in the subsequent report chapters.

Where applicable, a more detailed methodology for the analysis can be found in the appendices for reference.

Mapping, interview notes, poll results and the outputs of supporting modelling files are included in the supporting documentation accompanying this report.

14 More information on some of these wider context topics which are relevant for this piece of work can be found in Work Package 2 of the Transport for West Midlands (TfWM) ULEV Strategy, delivered by Cenex to the West Midlands Combined Authority (WMCA) in January 2020.

1.5 Work Packages

The project was broken down into 6 work packages, each contributing part of the evidence required to build a coherent strategy, vision and implementation plan. The work package definitions and their relationships are shown, below.

Table 1: *Work package definitions*

WP	Title	Purpose
1	Baselining	Establish the current status of each Black Country local authority area.
2	Forecasting, projections and gap analysis	Develop a suite of scenarios to project the number of ULEVs and the implications for required charging infrastructure, energy demand and grid constraints. Evaluate the differences between the scenarios.
3	Benefits	Calculate the wider benefits for each scenario.
4	Vision	Supplement existing strategies and local plans with a high-level vision for the region (emissions, vehicles, infrastructure, policy and innovation).
5	Implementation Plan	Deliver the next level of planning in detail to execute the vision over the coming five years.
6	Project Management	Ensure that the overall programme of work delivers on-time, on-cost and to the quality required by the Black Country authorities.

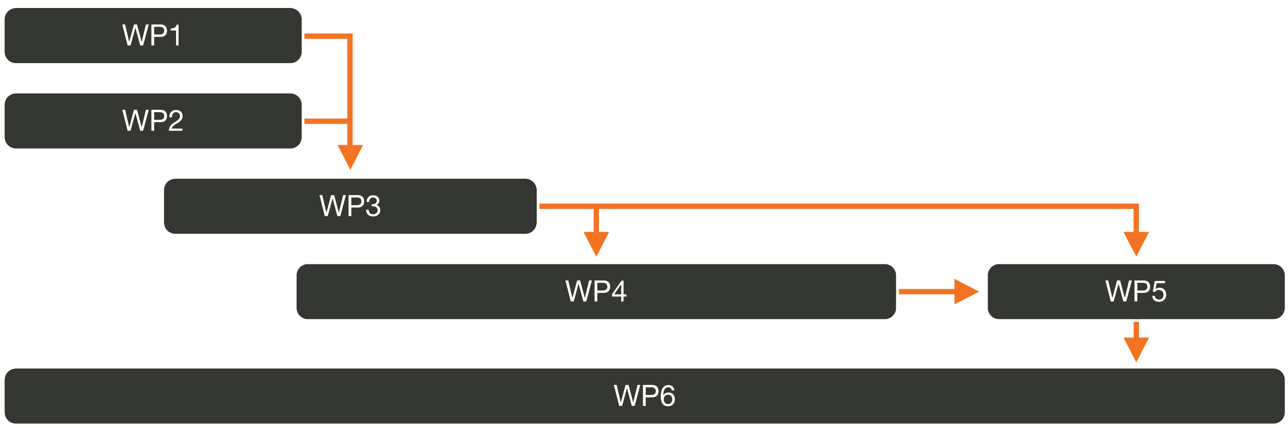


Figure 1: *Relationships and sequencing of the work packages*

Each chapter of this report sets out the methods and outputs of the work package, along with appropriate commentary and recommendations to support the executive summary.

1.6 Navigation

Key conclusions, recommendations or takeaways are highlighted like this.

! Important notes are highlighted like this.

Possible further pieces of work that could be undertaken are highlighted like this.

Abbreviations are expanded in Section 7 (page 87).

2 Baselining (WP1)

This section outlines and establishes the current status of each Black Country local authority area for vehicles, chargepoints, constraints and customers.

2.1 Vehicles

2.1.1 Methodology

Registrations

The same methodology as applied to the TfWM ULEV Report has been used in order to create a baseline for the vehicle parc within the Black Country.

- Overall UK vehicle parc registration data were gathered with number of vehicles and date of registration used as a proxy for Euro Standards[15]; and
- Regional registrations were then collected for the Black Country breaking down into cars, diesel cars, motorbikes, LGVs, diesel LGVs, HGVs, buses and registered ULEVs[16, 17].

For each vehicle category, a full breakdown of the vehicle type was gathered on a UK basis then extrapolated to the Black Country region (Cars[18], Motorbikes[19], Light Goods Vehicles (LGVs)[20], Heavy Goods Vehicles (HGVs)[21, 22, 23], Buses[24]). These are broken down further into Euro standards using the data previously acquired.

Emissions

Since the publication of the TfWM ULEV Report, Cenex has enhanced its emissions calculation methodology.

> ! An addendum to that report has been supplied to TfWM to ensure that this report fits with its regional counterpart.

In order to calculate emissions, duty cycles of all vehicle types are calculated along with mean annual mileages and average speeds.

- Annual Mileages (Cars[25], Motorbikes[26], LGVs and Buses[27], HGVs[28]);
- Average Speeds (Cars, Motorbikes, LGVs and Buses[29], HGVs[30]); and
- Duty cycle data[31].

Carbon Dioxide (CO2), Nitrous Oxides (NOx) and Particulate Matter (PM) values were calculated using the above data along with DEFRA figures to evaluate the emissions for any given vehicle type. Using the vehicle registration statistics along with the emissions data, a total emissions figure was calculated for each vehicle type in the Black Country as well as an overall figure.

15 - 24 VEH0126 Gov UK
25 National Travel Survey: Table NTS0901
26 National Travel Survey: Motorcycle use in England
27 Road Traffic Estimates: Great Britain 2017
28 Road Freight Statistics: Table RFS01112
29 National Travel Survey: Table NTS0303
30 Estimated based on Cenex fleet data
31 Road Traffic Estimates: Great Britain 2017
32 DEFRA figures 2018

2.1.2 Vehicle Parc Composition

Figure 2 illustrates the current fleet composition by vehicle type across the Black Country. The chart illustrates that cars are by far the most common vehicle type in the region followed by LGVs.

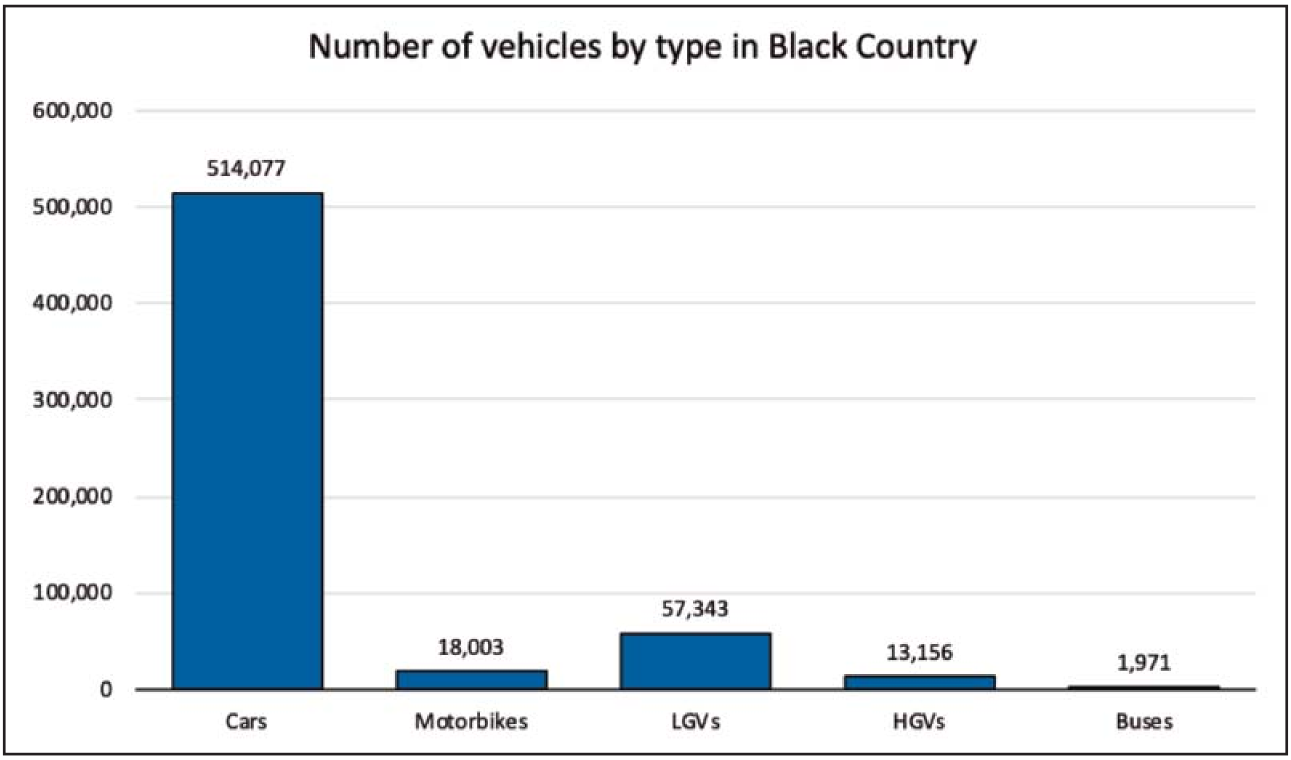


Figure 2: *Vehicle parc in the Black Country*

Figure 3 shows a further breakdown of the fleet down by vehicle and fuel type, revealing that there are slightly more petrol passenger cars than diesel on the roads.

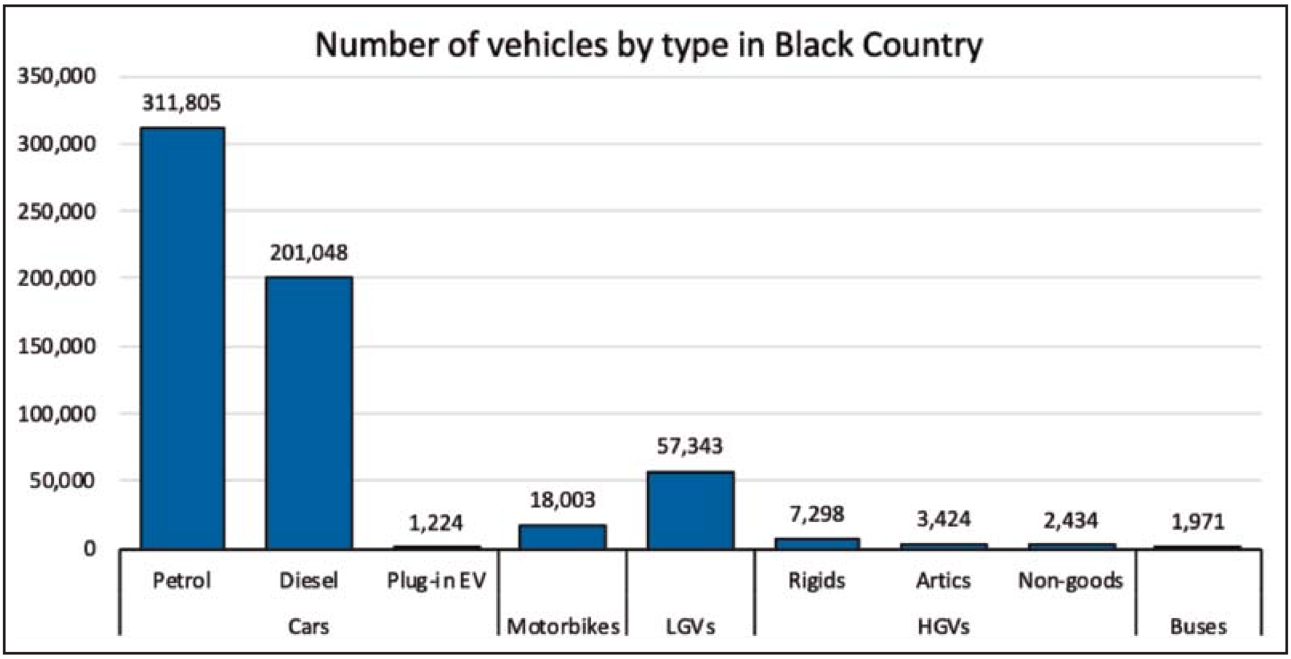


Figure 3: *Vehicle parc in the Black Country*

Figure 4 shows the vehicle parc composition of Black Country in comparison to both the wider TfWM area (excluding Black Country) and the UK. There is a higher proportion of petrol cars within the area and fewer diesel cars compared to the wider TfWM study footprint, although the Black Country is broadly representative of the UK vehicle parc. The difference with the TfWM region is likely because the West Midlands includes more rural areas than the Black Country, which increases diesel ownership due to longer mileages required to travel to amenities and the cheaper running costs of diesels.

Similarly, the proportion of LGVs present in the Black Country is considerably lower compared to the other TfWM local authorities, though the Black Country's proportion is similar to the UK as a whole.

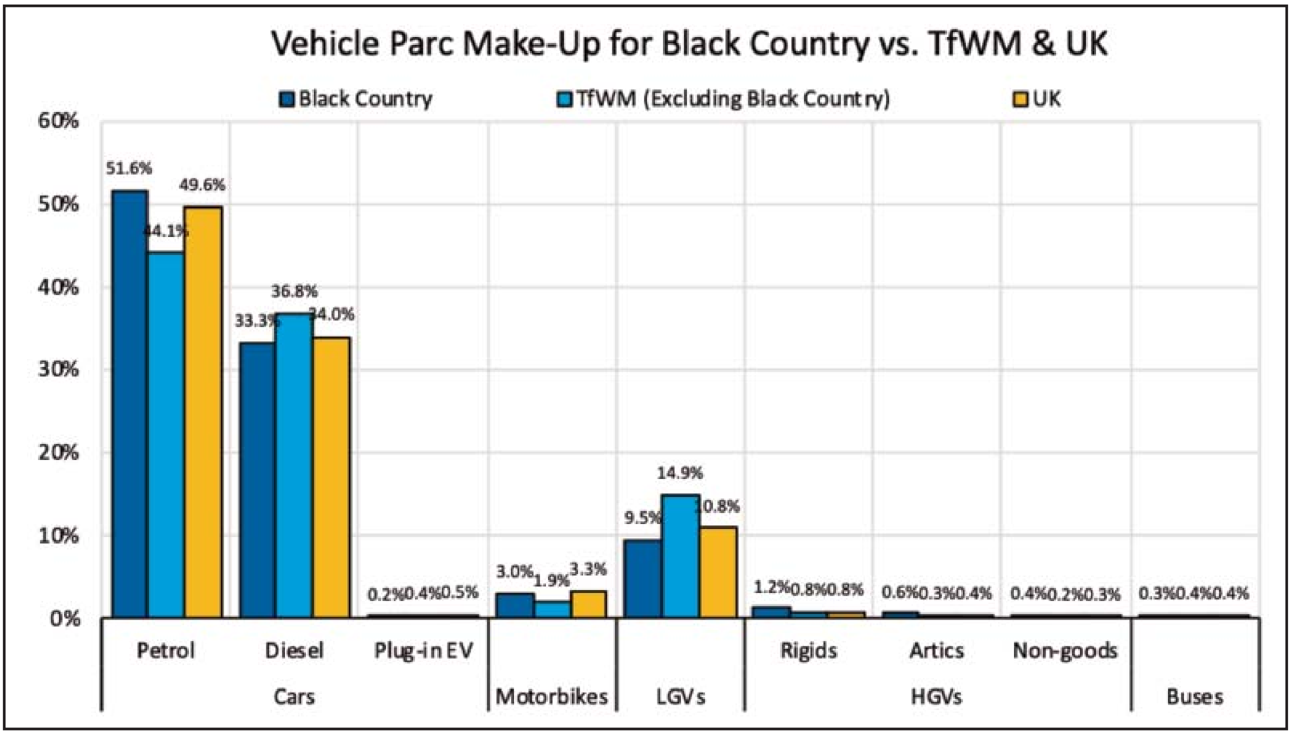


Figure 4: *Comparison of Black Country, TfWM & UK vehicle parc*

Figure 5 breaks down the vehicle parc by Euro emissions standards. The cleanest vehicles – those which meet the Euro 6/VI standard – are only the third most common type of vehicle in the region. The fleet is dominated by Euro 5/V and 4/IV vehicles, which have significantly higher emissions, particularly NOx.

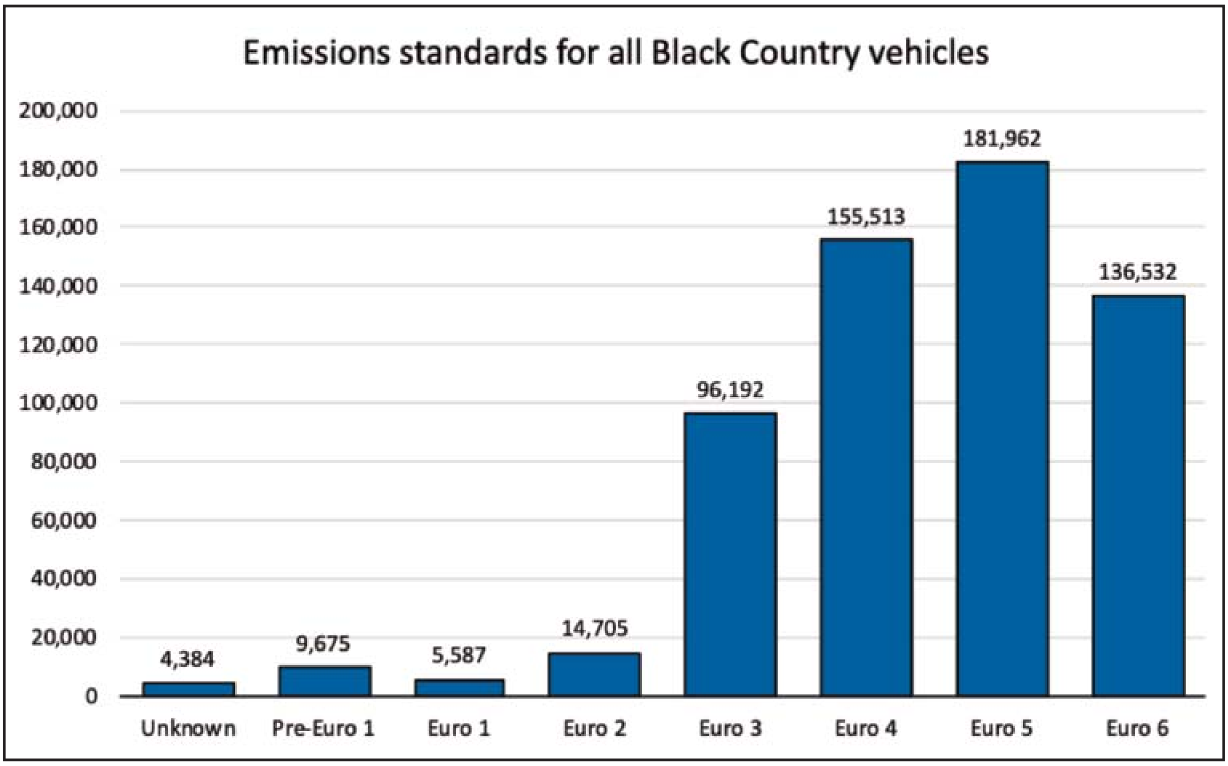


Figure 5: *Vehicle parc emission standards in the Black Country*

Figure 6 drills down further into the data, splitting the parc into vehicle type and emissions standard. This shows that there are a relatively high proportion of Euro VI HGVs and buses in the Black Country. Conversely, for cars and LGVs, there is a more even distribution of Euro 4, 5 and 6 vehicles.

A key concern is the number of pre-Euro 4/IV vehicles, which represent 36% of the total vehicle parc.

Pre-Euro 4/IV vehicles have substantially higher PM and NOX emissions than newer vehicles and, unless very well maintained, will have even higher emissions than official data would suggest. These vehicles will naturally reduce in number over time as they come towards the end of their life. Accelerating the rate at which these older vehicles are removed from the vehicle parc should be considered, although it is acknowledged that it is a UK-wide challenge, not limited to the Black Country (see Section 4.2.2 on page 54 for more details).

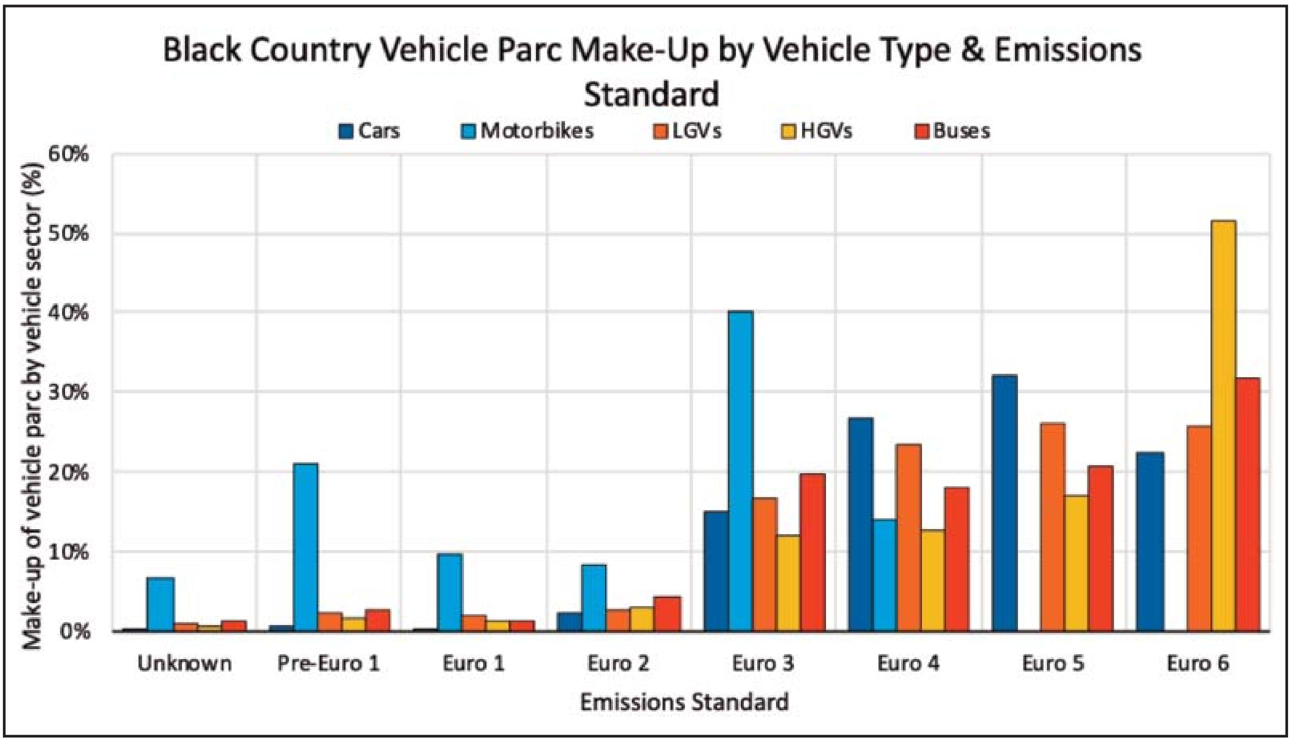


Figure 6: *Vehicle parc emission standards in the Black Country*

2.1.3 EV Penetration

Table 2 shows the penetration of all EVs in each of the local authority areas in the West Midlands and the whole of the UK for comparison.

Lex Autolease's headquarters are in Birmingham and as such all vehicles they own are registered here whether they are operating in the region or not. The number of EVs owned by Lex Autolease is 13,635, which has been removed from the table. Note that if Lex Autolease EVs were included, EV penetration in Birmingham would be 2.05%.

As a whole, the West Midlands is behind the UK in terms of EV adoption (0.35% compared to 0.47%). Furthermore, the Black Country authorities (highlighted in green) are four of the five worst-performing councils in the region.

Table 2: *Breakdown of EVs by local authority in the West Midlands*

	Total Vehicles	EVs	EV %
Warwickshire			
North Warwickshire	56,221	135	0.24%
Nuneaton and Bedworth	79,980	138	0.17%
Rugby	69,236	261	0.38%
Stratford-on-Avon	102,232	713	0.70%
Warwick	96,289	408	0.42%
West Midlands (Met County)			
Birmingham	796,070	2,652	0.33%
Coventry	160,143	376	0.23%
Dudley	181,552	417	0.23%
Sandwell	157,601	314	0.20%
Solihull	214,567	1,795	0.84%
Walsall	142,451	275	0.19%
Wolverhampton	127,078	218	0.17%
Total West Midlands	**2,183,420**	**7,702**	**0.35%**
UK	**39,364,569**	**186,386**	**0.47%**

One of the well-publicised barriers to EV adoption is the higher capital cost of these vehicles compared to conventional petrol and diesel cars. Figure 7 shows the EV uptake rate in relation to mean wages in the Black Country and West Midlands, as well as the 10 UK Local Authorities with the lowest wages and the UK average, for context.

Relative to wage, all four Black Country authorities sit on or above the trend, indicating higher uptake than might be expected on this measure.

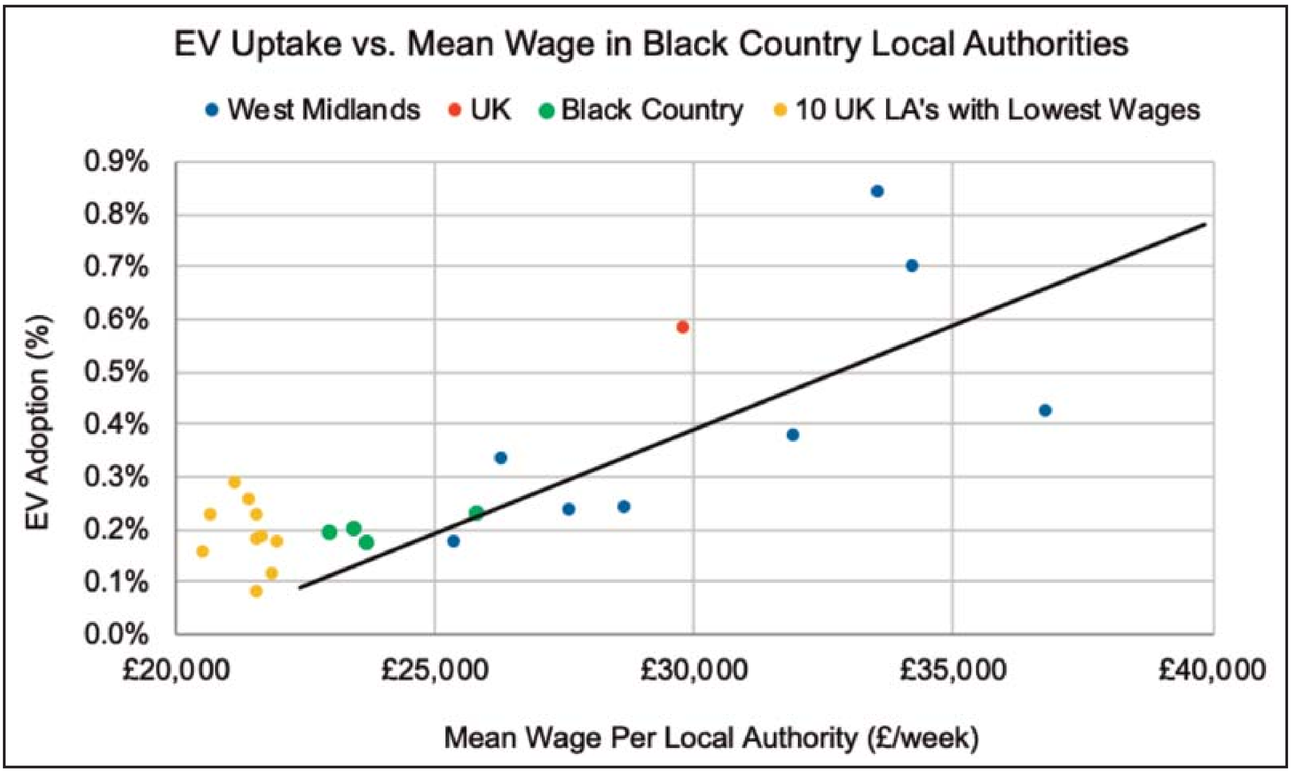


Figure 7: *EV uptake vs mean wage*

For example, Blackpool has an average mean wage of £21,181, the third lowest wage in the UK. However, it has managed to buck the trend of a low EV adoption rate with 0.29% of all vehicles being plug-in. One of the ways it appears to have managed to encourage this is through infrastructure provision. In Blackpool, there is one public charge point for every 4 plug-in vehicles, compared to the Black Country where this figure is one public charge point for every 20 plug-in vehicles.

2.1.4 Current Emissions

Figure 8 shows the emissions produced by road transport in the Black Country in 2019, broken down by the three areas of interest: CO2, NOx and PM. The CO2 are calculated using both Tank-to-Wheel (TTW) and Well-to-Wheel (WTW) considerations.

TTW CO2 refers to the emissions that come out of the vehicle directly, which are zero for EVs. WTW CO2 also includes all the CO2 emitted in fuel production as well as use. For petrol fuelled vehicles this includes drilling, refining, and transporting the fuel as well as the direct exhaust emissions (as expressed in the TTW data). For EVs, WTW measures include any CO2 produced to generate the electricity. WTW CO2 figures are important on a global scale as they account for the whole system and not just localised emissions, whereas TTW emissions are more within the control of the Black Country authorities.

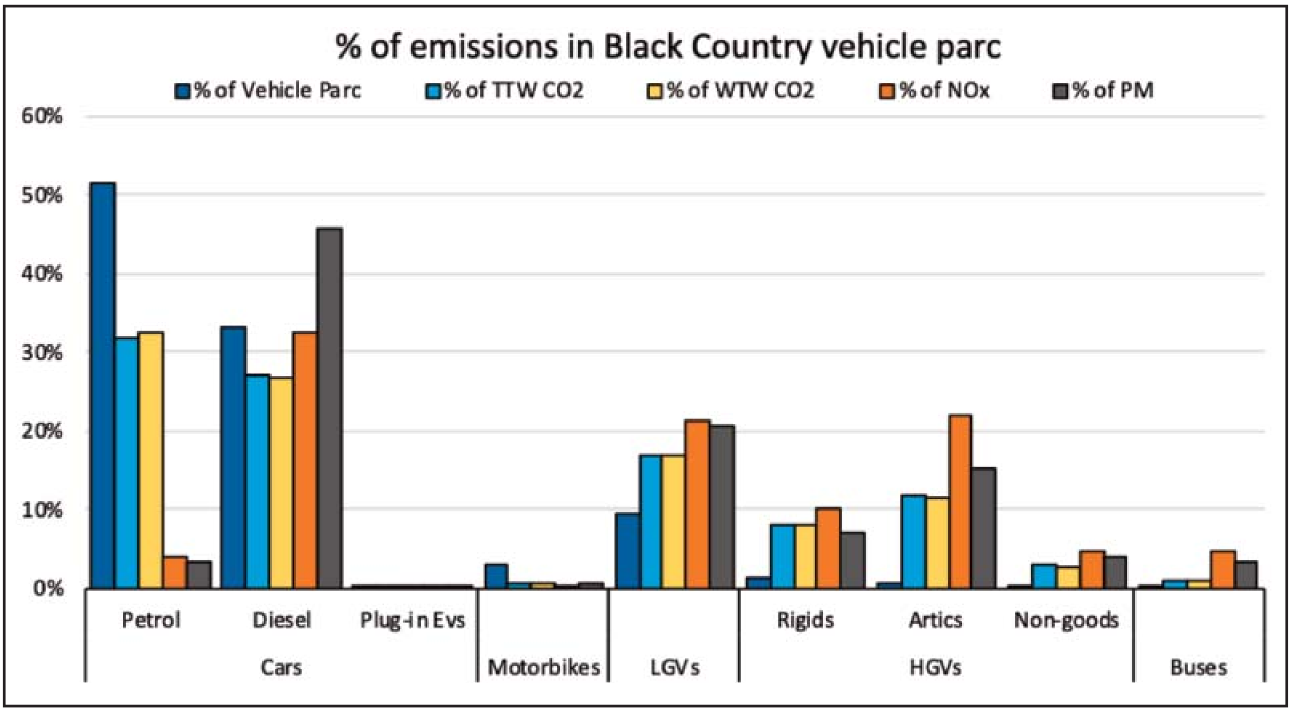


Figure 8: *Vehicle types and associated emission contributions in the Black Country*

Cars are the predominant source of all three emissions when considered across the whole parc, even though they have much lower per-vehicle emissions than vehicle types (especially CO2).

LGVs, buses and HGVs have disproportionately high levels of emissions in comparison to the number of vehicles on the road, due to the high emissions from individual vehicles in these categories, the fact that there are more Euro 3 LGVs than Euro 6 and the lack of CO2 emissions standards for HGVs.

Given the relatively clear technology and policy pathways for cars to shift to plug-in alternatives, it is expected that car emissions will reduce relatively quickly over the next two decades (see Section 4, page 51).

However, cutting emissions from freight and buses will be more challenging because of uncertainty over technology pathways, lack of clear policy guidance and the slow rate of churn of these vehicles.

2.1.5 Local Authority Fleet

Dudley, Sandwell, Walsall and Wolverhampton local authorities provided fleet data for their fleets, which are presented in Figure 9, Figure 10 and Figure 11.

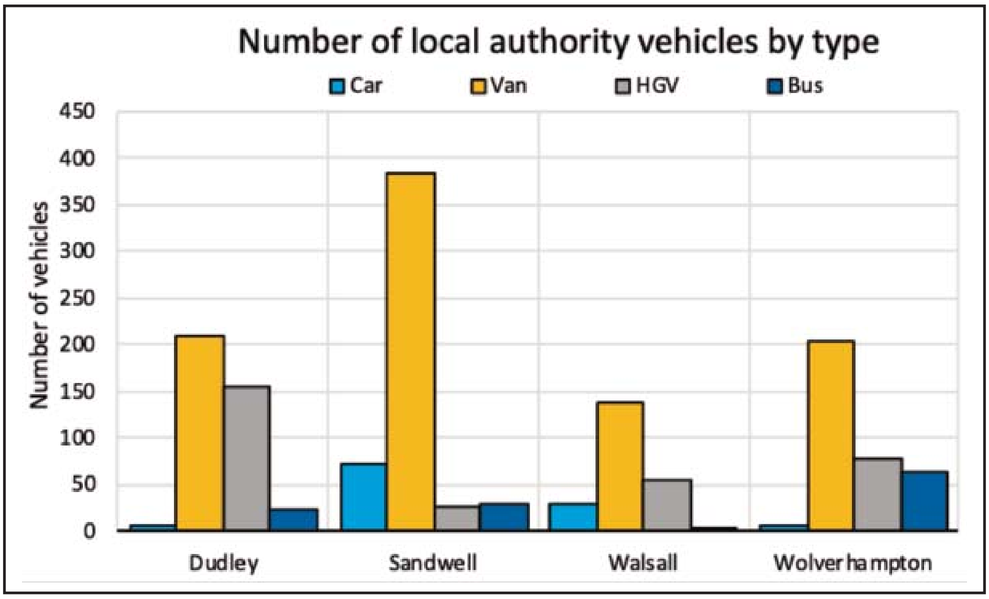


Figure 9: *Local authority fleet by vehicle type*

Figure 9 shows that while vans dominate the vehicle fleet, there are still a significant number of HGVs and buses under the control of the local authorities. The Dudley vehicle fleet especially will be challenging to decarbonise with a high proportion of HGVs, Sandwell however is in a prime position to move most of its fleet over to zero emission EVs with vans and cars representing 89% of its current fleet.

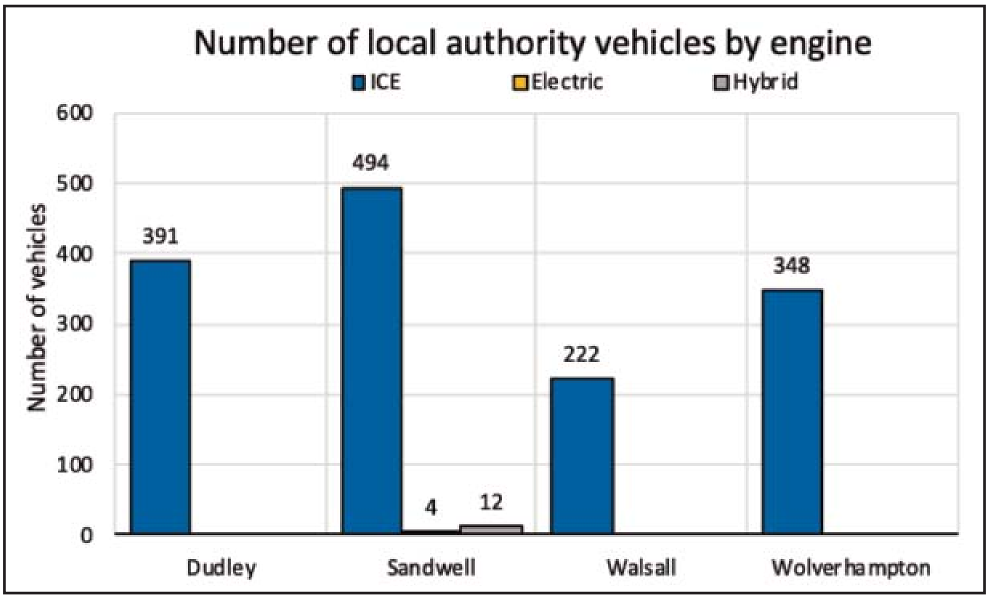


Figure 10: *Local authority fleet by engine type*

Figure 10 clearly highlights the magnitude of the task at hand for all local authorities.

Only 4 EVs and 12 hybrid vehicles are present throughout all four local authorities' fleets.

An in-depth vehicle replacement strategy should be made as soon as possible to ensure that the various net-zero targets are met and can be financed within the available budgets.

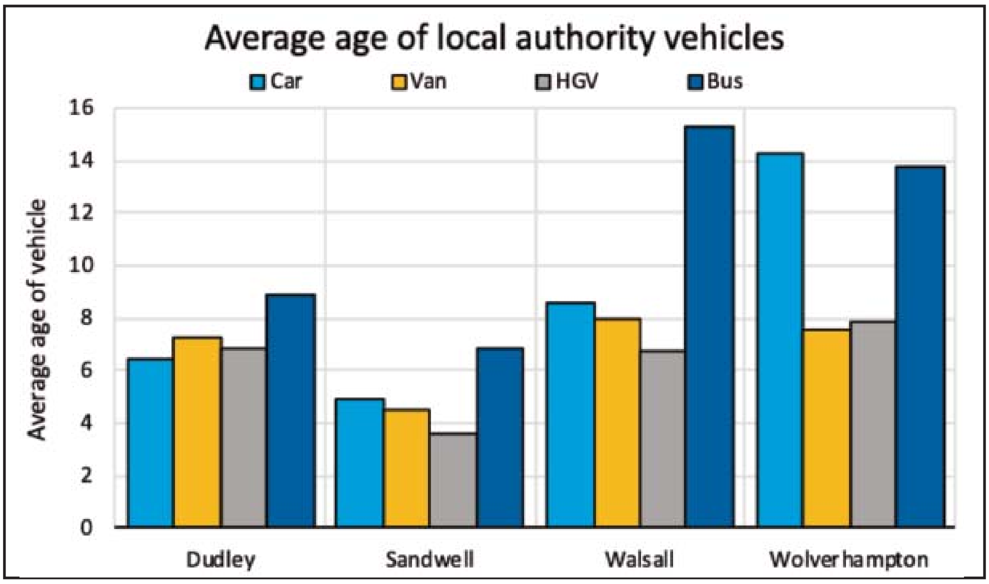


***Figure 11**: Average age of local authority fleet*

Figure 11 displays the average age of each vehicle type for each local authority. It is important to note that the older a vehicle is, the less stringent emissions regulations it adheres to. There are a large proportion of vehicles within the local authority fleets that are over 8 years old meaning that any new vehicle purchases are likely to still be present within the fleet at the latter end of this decade.

In order to reach net-zero by the WMCA's target of 2041, all fleet vehicles will be required to move over to either electric, biofuel or hydrogen powered engines.

Where more ambitious internal targets exist (i.e. for Walsall and Wolverhampton councils), transition to cleaner powertrains will need to happen aggressively in the next few years.

Thought must be given to all purchasing decisions with the various net-zero targets in mind and as such an in-depth vehicle replacement strategy should be developed.

For cars and vans, economically viable solutions exist now in the form of EVs. Similarly, there are a multitude of economically viable options for buses in the form of EVs, hydrogen and biomethane with over 4,000 low emission buses already deployed throughout the whole of the UK. HGVs however, present more of a challenge with limited options currently available, though some councils throughout the UK have already begun to invest in electric Refuse Collection Vehicles (RCVs). HGVs will be the most challenging sector to decarbonise for the local authority fleets and these could well be the last vehicles to move over to clean, low and zero emission alternatives.

By having a combined Black Country fleet replacement strategy by vehicle type, the following benefits can be realised:

- Best practice fleet purchasing processes can easily be shared;
- Capital and resources are saved by having a combined strategy rather than four separate strategies; and
- No local authority will be "left behind", which will likely bring forward all local authority fleet decarbonisation plans.

Due to the size of the combined Black Country fleet, there is unlikely to be a direct cost benefit from the joint purchasing power of all four local authorities. However, this is still worth discussing with OEMs. Once a combined strategy has been created, this can then be adjusted by local authority dependant on budget constraints or make-up of their individual fleet.

It is recommended that any replacement strategy should be created by vehicle type rather than by local authority.

! More information on the technology and policy pathways available to the Black Country councils can be found in Section 2 of the TfWM ULEV Report.

Cenex has considerable experience developing vehicle replacement strategies for both private and public sector bodies if further support is required to develop a complete strategy.

2.1.6 Taxi and Private Hire

Currently there are 12,922 licensed Taxi and Private Hire (TPH) vehicles in the Black Country, of which 2,163 are taxis. 533 of these are also Wheelchair Accessible Vehicles (WAVs). They are predominantly found in Wolverhampton, as shown in Figure 12. Currently, there are no licence caps, although Walsall and Wolverhampton impose vehicle age limits.

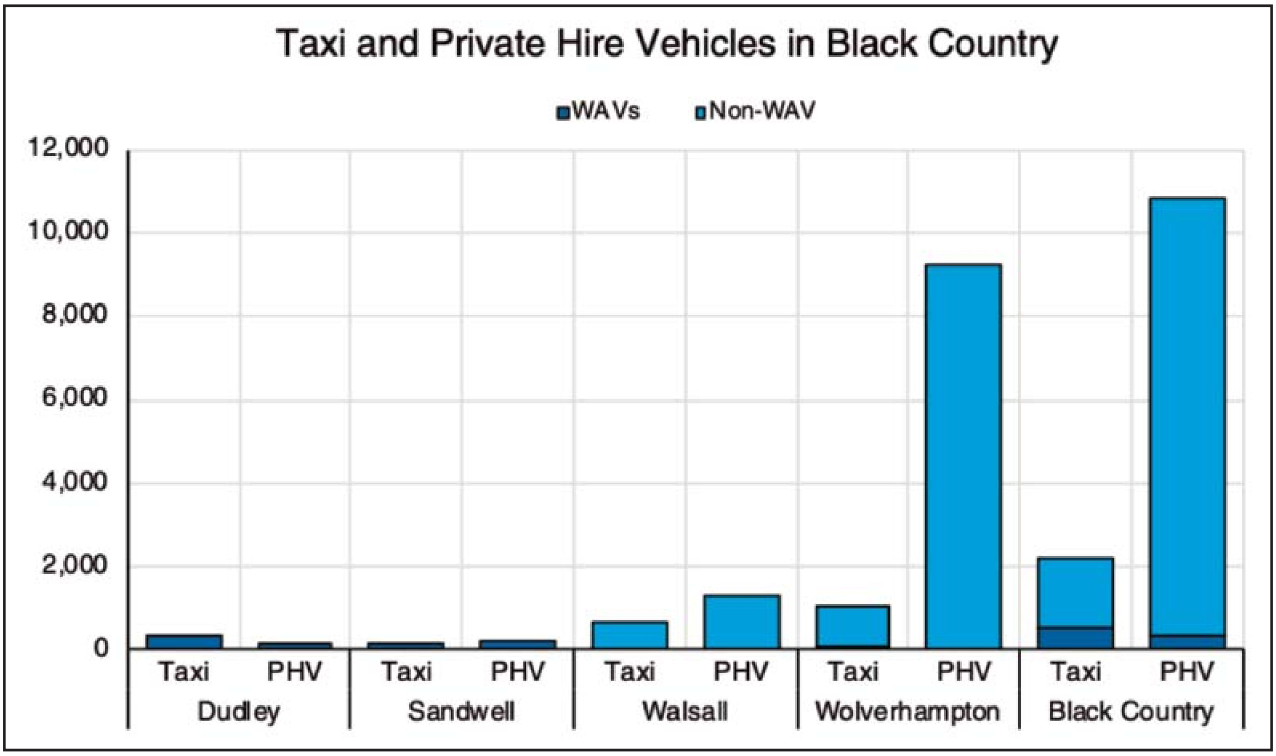


***Figure 12:** Taxi and Private Hire Vehicles*

***Legend:** PHV: Private Hire Vehicle; WAV: Wheelchair Accessible Vehicle.*

It should be noted that the majority of TPH vehicles in the Black Country are private hire vehicles licensed by City of Wolverhampton Council, of which there are 9,185. Some of these vehicles are known to operate outside of the Black Country region[33] and therefore have limited environmental impact on the Black Country.

Non-WAVs are more likely to be able to transition to EV due to the range of EVs currently available but it is expected that the Clean Air Zone proposed for Birmingham will mean that a number of these vehicles will soon switch to ULEV or EVs.

2.2 Chargepoints

An important component of delivering an effective regional EV chargepoint network is maximising geographical coverage to ensure that home location does not impact the feasibility of owning an EV. This approach is supported by the UK Secretary of State for Transport who, in 2019, expressed that "postcode should play no part in how easy it is to use an electric car"[34]. In order to baseline the current status of chargepoints in the Black Country, two spatial analyses have been conducted to

33 *BBC News, Why is my taxi from another city?, 18th July 2018*

34 *New 'league table' reveals electric car charging availability across UK as Transport Secretary calls on local authorities to do more. 2nd November 2019.*

illustrate the geographical coverage of the Black Country's existing charging infrastructure: distance to nearest public chargepoint and driving time to the nearest rapid chargepoint.

2.2.1 Current Chargepoint Coverage

The TfWM ULEV Report analyses the whole region and compares this to the overall population. The same data from Zap-map and the National Chargepoint Registry identifies the total EV charging infrastructure provision for the Black Country in detail.

There is currently no easily accessible data record of non-public chargepoints installed at businesses[35], so these are not included in the analysis, below.

Figure 13 (below) shows that the Black Country's public charging infrastructure is mostly rapid chargers from projects (i.e. in Wolverhampton) or legacy standard chargers. There are very few fast options available. Currently, the infrastructure provision is approximately 20 plug-in vehicles (PiV) per public chargepoint, compared to around 10 per PiV for the West Midlands.

35 Unpublished data is collected by OLEV in order to track the number of individuals and businesses accessing the EV Homecharge Scheme and Workplace Charging Scheme, respectively.

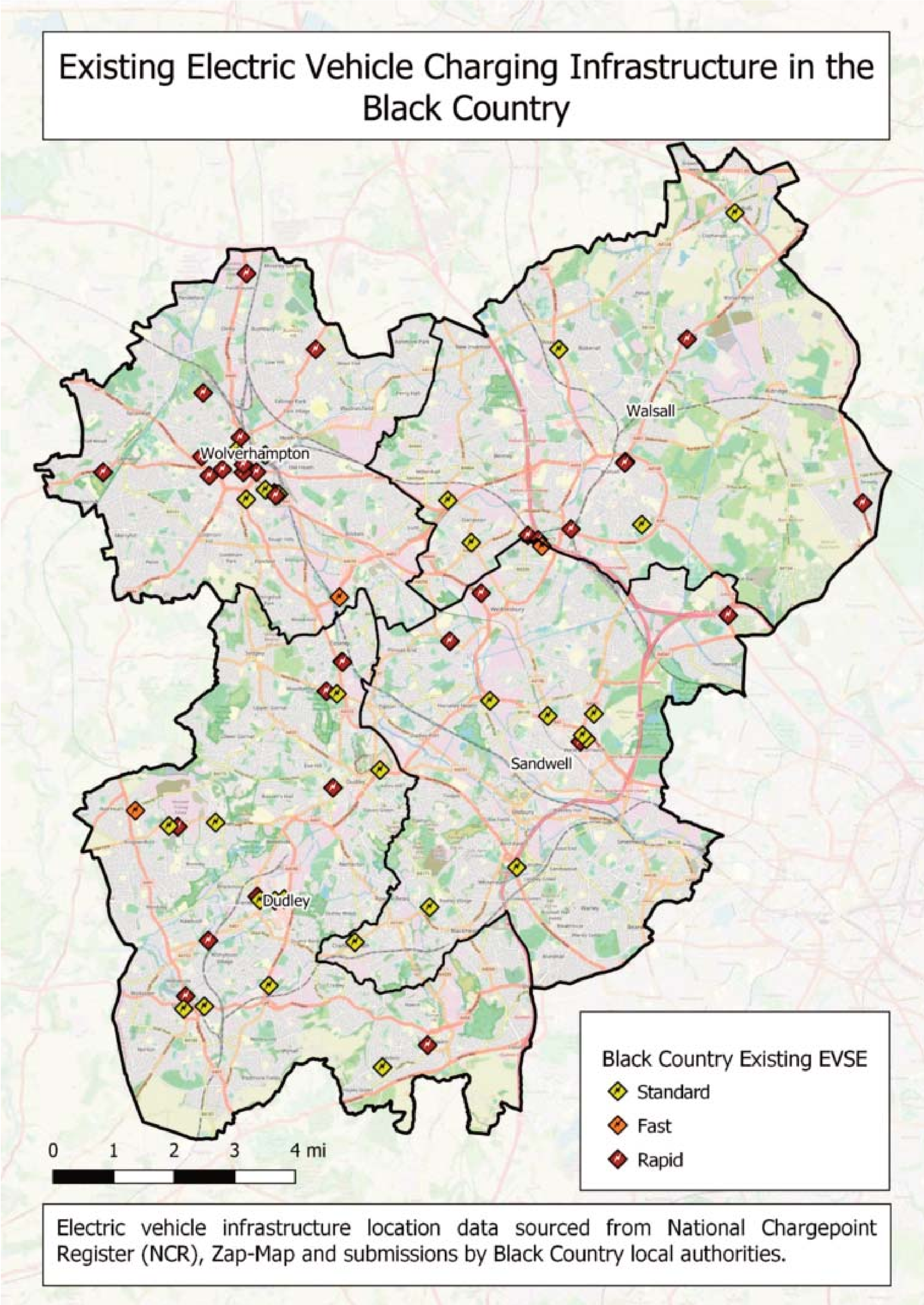


Figure 13: *Existing EV Charging Infrastructure*

Legend: *Chargepoint power types are categorised standard (7 kW AC), fast (22 kW AC) and rapid (43 kW AC, 50 kW DC)*

The Black Country currently lags behind the West Midlands in the maturity and diversity of its chargepoints.

2.2.2 Distance to Nearest Public Chargepoint

Those who do not have off-street parking must rely on public charging infrastructure to recharge an EV. The distance between their home and the nearest public chargepoint therefore has a significant impact on the convenience of owning an EV. It is important to consider that certain individuals may be disinclined to leave their vehicle overnight at a location that is a significant distance from their home. Doing so can impact insurance premiums and would introduce an inconvenience that does not exist with ICE vehicles. Therefore, ensuring that all residents live within a reasonable walking distance of a public EV chargepoint is likely to be an important prerequisite to the mass adoption of EVs.

Examination of the land area and proportion of area that is not within one kilometre of the nearest public chargepoint gives an indication of the current maturity of infrastructure provision for the population.

! This analysis considers geographical area.

Additional work could be considered to explore what proportion of the population live within one kilometre of a public chargepoint and to factor-in walking times to account for the varying topography of the Black Country.

Table 3 reveals that around 79% of the land area of the Black Country is not within one kilometre of a public chargepoint.

Table 3: *Black Country area and proportion of area not within one kilometre of the nearest public chargepoint.*

	Area not within 1 km of any chargepoint	% of total area not within 1 km of any chargepoint
Dudley	71 km^2	72.5%
Sandwell	69 km^2	80.6%
Walsall	88 km^2	84.7%
Wolverhampton	55 km^2	79.2%
Total	**283 km^2**	**79.3%**

Figure 14 illustrates geographical locations within the Black Country that fall within 250, 500 and 1,000 metres walking distance of the nearest public chargepoint. This map shows that some urban centres are well covered by the existing network, including Wolverhampton and West Bromwich.

Around 80% of the Black Country area is currently further than one kilometre from the nearest public EV chargepoint.

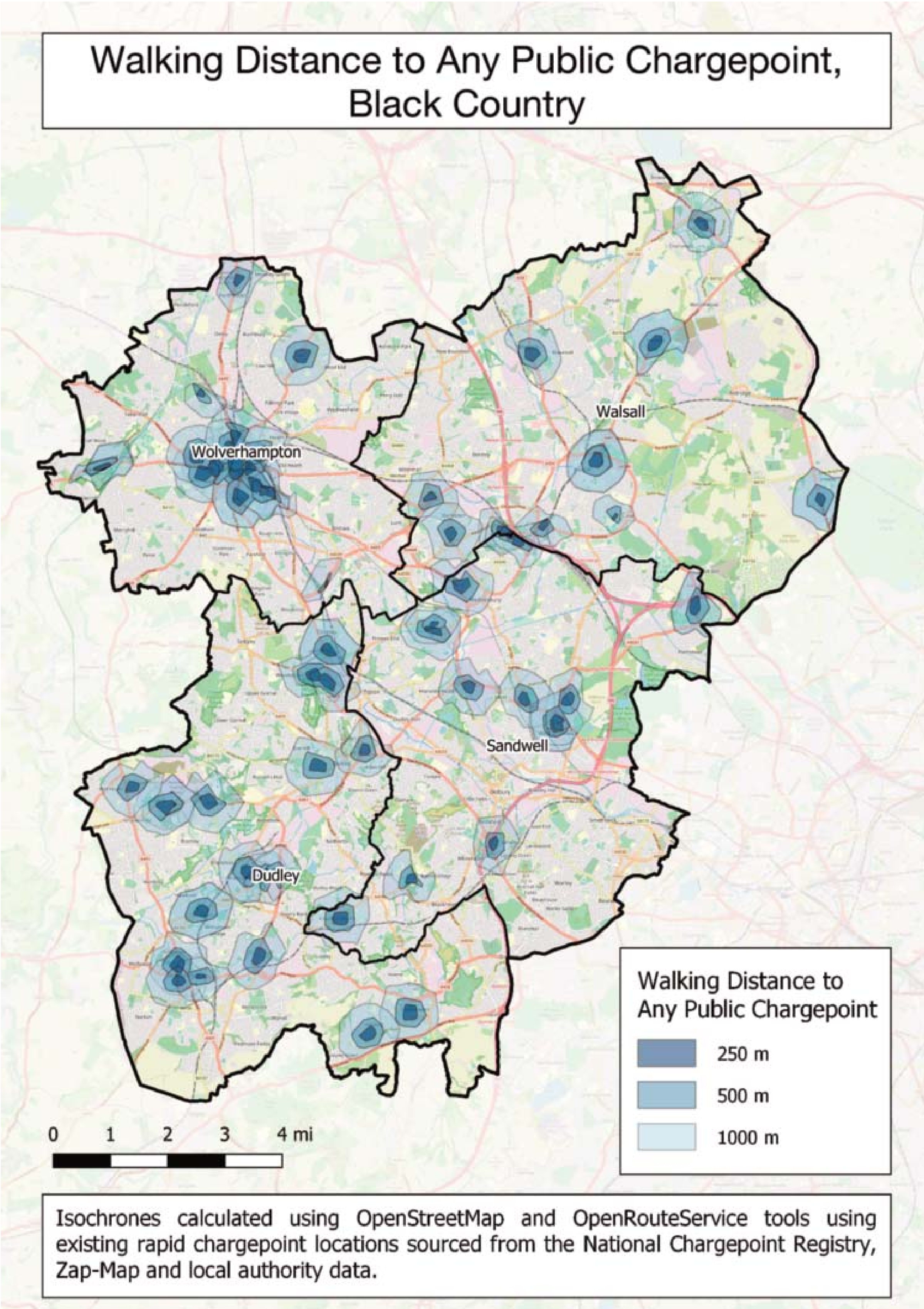


Figure 14: *Walking distances to the nearest public chargepoint.*

2.2.3 Drive Time to Nearest Rapid Chargepoint

The time it takes to drive to the nearest public rapid chargepoint is another important factor that may influence the uptake of EVs. For those who are unable to charge at home and who potentially live in areas that are unsuitable for public residential charging infrastructure (e.g. because there is insufficient local electrical grid capacity), rapid charging is essential to ensuring that EVs are a feasible option. For residents, it is important that rapid charging is within a convenient distance of home locations in order to reduce any disruption to existing routines that could be caused should significant detours be required.

An additional benefit of maximising the coverage of rapid charging infrastructure is that residents will be given the confidence that, should they need to recharge their vehicle in transit, they will always be within range of a rapid charger. This reduces the risk that EV users run out of charge and require assistance to continue their journey, which is important because "range anxiety" is commonly regarded as a key factor discouraging individuals and businesses from owning EVs.

! Providing a dense network of rapid chargepoints is an important step to removing range anxiety and encouraging EV adoption. However, this is also dependent on effective publicity to ensure that residents and local businesses are aware of the network.

Table 4 shows that almost all of the Black Country area is within a ten-minute drive of a rapid chargepoint. The only areas not covered in this category are found in the south-eastern extent of Sandwell and the north-western extent of Walsall.

Table 4: *Land area and proportion of area that is not within ten-minutes' drive of the nearest public rapid chargepoint. Drive times are calculated assuming free-flowing traffic.*

	Area not within a 10-minute drive of a rapid chargepoint	% of total area not within a 10-minute drive of a rapid chargepoint
Dudley	0 km^2	0%
Sandwell	2.3 km^2	2.7%
Walsall	0.6 km^2	0.6%
Wolverhampton	0 km^2	0%
Total	**2.9 km^2**	**0.8%**

99% of the Black Country is within ten minutes' drive of a rapid chargepoint.

However, if the threshold is increased to two- or five-minutes, a considerably larger area does not have coverage, with Sandwell especially poorly served (see Figure 15).

Sandwell Metropolitan Borough lags behind other Black Country local authorities in its rapid chargepoint network coverage.

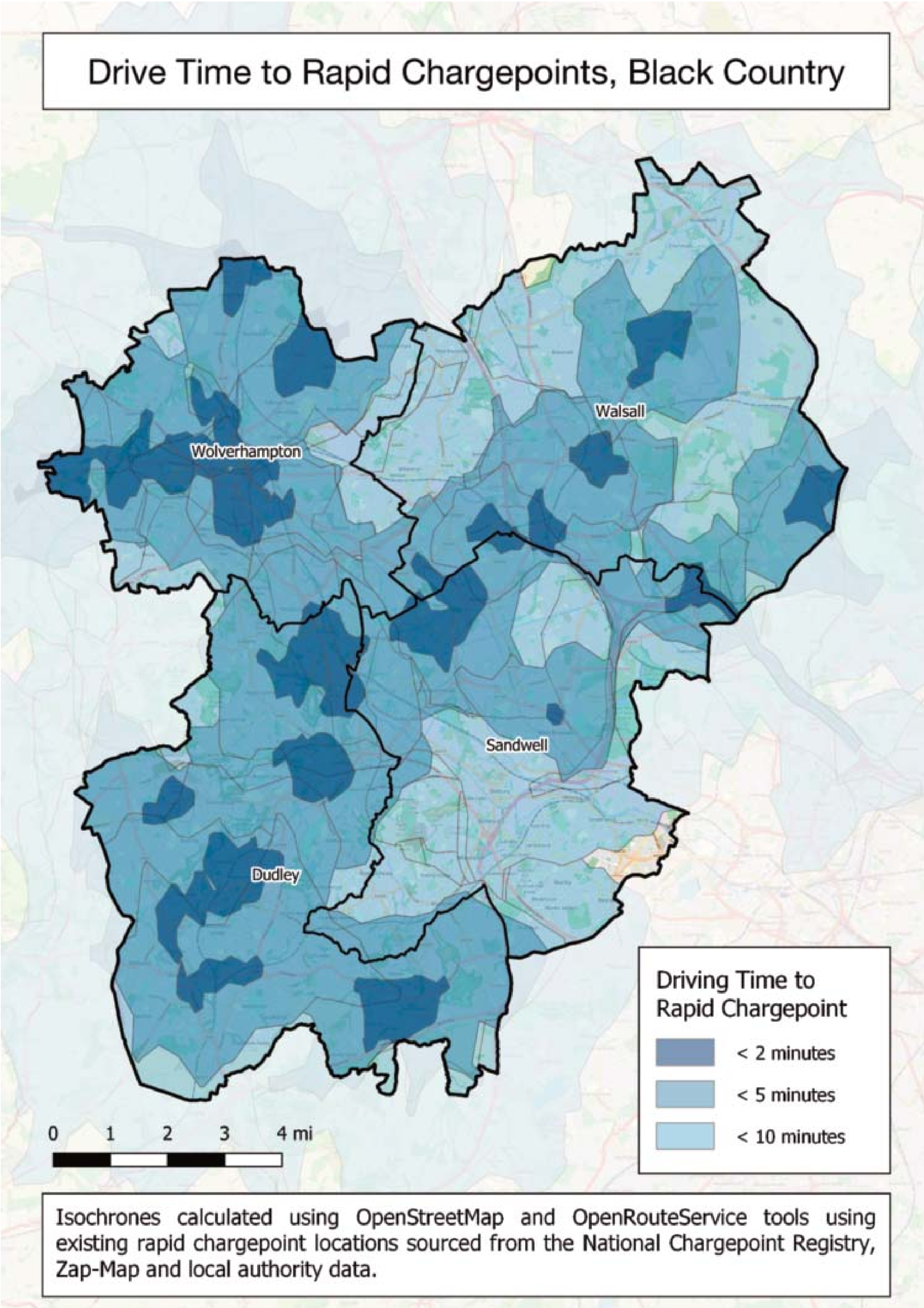


Figure 15: *Driving times to the nearest public rapid (50 kW) chargepoint, based on free-flowing traffic conditions.*

Note: *This analysis is site by site, so a site with a single rapid charger will not be able to serve mass adoption in a region.*

2.2.4 Existing chargepoint usage and energy demand

Data was requested from the Black Country to analyse the utilisation of the existing chargepoints and the energy demand for the current EVs. This would have helped understand the current benefit which the Black Country gets from its existing chargepoint population and feed-into the infrastructure projection assumptions in Section 3.3 by allowing the assumptions in Appendix 2 (page 92) to be adjusted to better represent the Black Country.

Unfortunately, only a monthly summary of the total chargepoint energy demand and charging events was received, which is not of sufficient granularity for the required analysis.

Therefore, Cenex's standard assumptions were used for the infrastructure projections and no conclusions could be drawn about existing chargepoint usage or current energy demand.

2.3 Impacts of EV Adoption

2.3.1 Likely early adopters

As noted in the TfWM ULEV Report, there is a known strong demographic trend in terms of EV users across the UK. Research from OLEV concludes that the majority are currently male, aged 40-69, tertiary-educated, affluent and have access to two cars or more. The research indicates that this trend is unlikely to change significantly in the near future[36].

This is supported by more recent information collected by Zap-Map, who conducted a survey of 1,617 EV and PHEV owners in 2019. Over half of the 1,261 respondents who disclosed their annual household income declared earnings of over £50,000 per year, with roughly a quarter of those earning over £80,000 per year. An earlier survey of 908 UK adults, conducted by the UK Office for National Statistics in 2016[37], indicated that those with degrees were more likely to consider buying an EV than those without, those with an annual income of more than £26,000 were 33% more likely to consider buying an EV than those earning less than £26,000 per year, and men were more likely to consider buying an EV than women.

Likely early adopters have been mapped using the same demographic and census data as the TfWM ULEV Report to create an adoption index. Areas with residents more likely to be early adopters are assumed to have higher proportions of households with:

- High-value occupations;
- No deprivation on any dimensions;
- Ownership of multiple vehicles;
- Higher annual mileages; and
- Detached or semi-detached properties.

Geospatial data is freely available that can be used to map these demographics so areas that include a relatively higher proportion of early EV adopters can be identified (see Figure 16 on page 33).

It is worth noting that the location of demand is particularly important in the short-term where infrastructure provision should outpace demand to address range anxiety and concerns over the reliability of chargepoints. Therefore, a good knowledge of the likely demand is needed to best-position initial installations as part of the Black Country ULEV programme.

2.3.2 Likely Locations for Residential Public Charging

Further analysis has been completed to systematically identify parts of the Black Country that are relatively more likely to require the installation of public residential EV charging infrastructure. The outputs can be used to guide early identification of potential locations for infrastructure.

36 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/464763/uptake-of-ulev-uk.pdf, accessed 14th April 2020.

37 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/551446/electric-vehicles-survey-2016.pdf, accessed 14th April 2020.

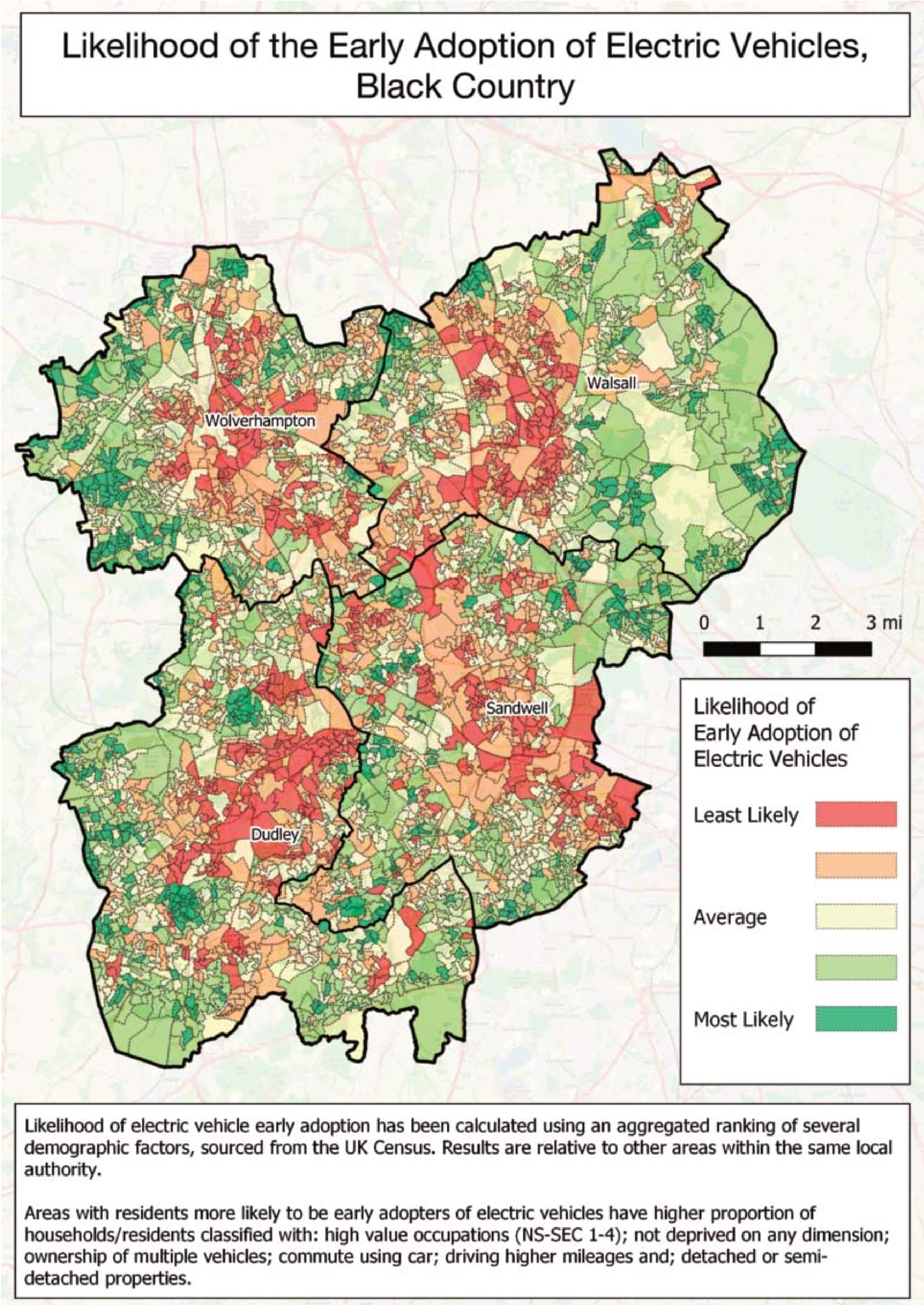


Figure 16: *EV early adoption index*

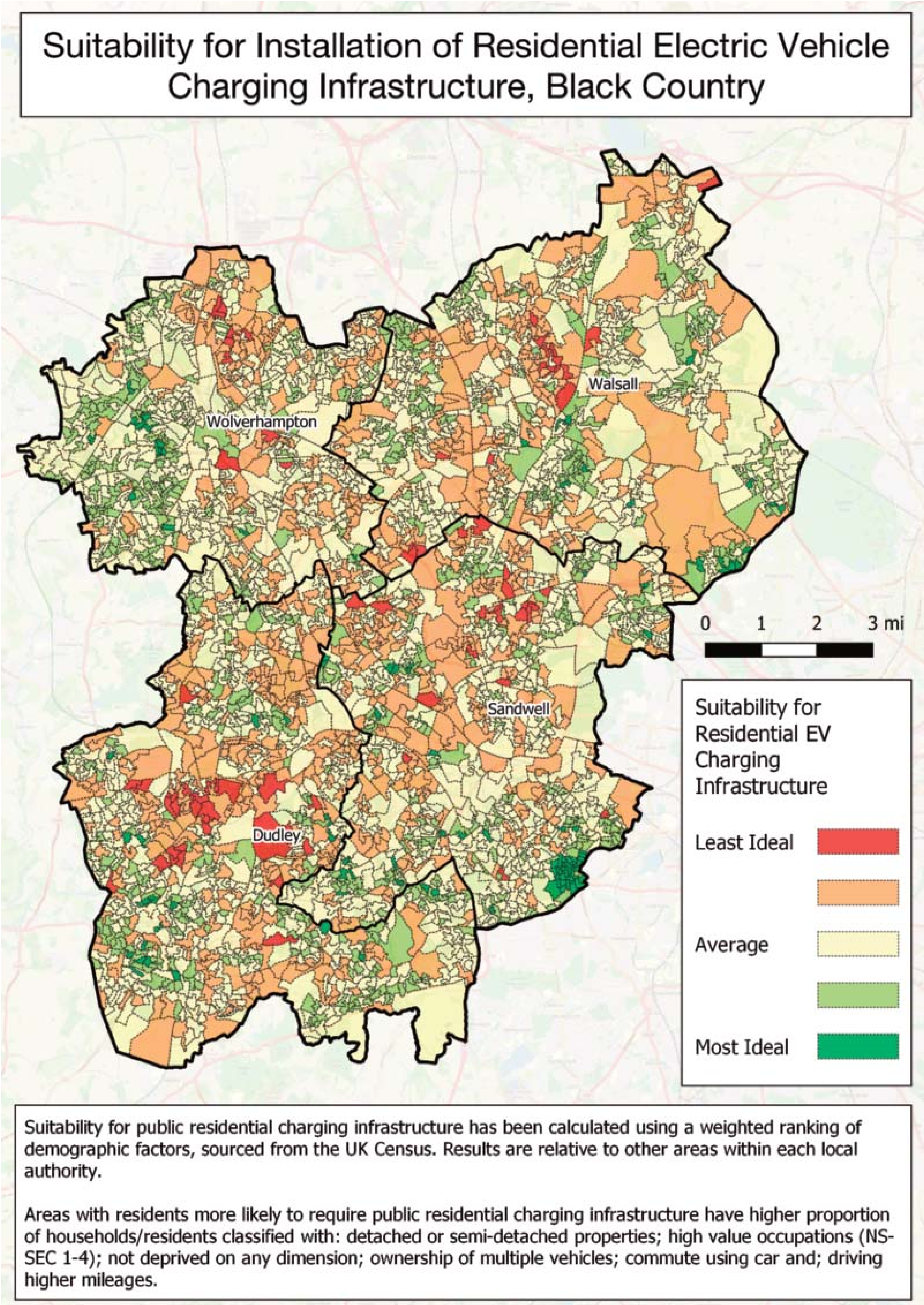


Figure 17: *Map showing the Residential Charging Index for the Black Country*

! Note that the indices only show relative values (likelihood of EV adoption, need for residential charging), so cannot be taken as an absolute index.

Taken in isolation, the demographics favourable to EV adoption presented in Figure 16, above, do not necessarily reflect the locations where public residential charging infrastructure is likely to be required. EV users with access to off-street parking can install domestic charging equipment, enabling them to charge at home and reducing their need for public infrastructure. To understand where public residential charging infrastructure is most likely to be required, a further step to include the proportion of off-street parking availability also needs to be added. The full methodology for how this is achieved is documented in Appendix 1 (page 87) and the result shown in Figure 17, above.

2.3.3 Existing distribution network constraints

Aside from EV demand, the supply of energy is the other key factor in chargepoint installation and can be the main source of variability in the installation cost. To avoid unexpected costs, it is good practice for site surveys to be undertaken by the host or the chargepoint installer/tendering organisation before an EV infrastructure supplier is appointed. For the Black Country area, the Distribution Network Operation (DNO) Western Power Distribution (WPD) will be required to carry out an analysis to check whether there is sufficient electrical supply to support the proposed number and rate of chargepoints, as well as providing a quote for any upgrades required.

WPD have made available two online maps that can be helpful when identifying potential locations where installation of EV charging infrastructure may not require significant distribution network reinforcement. These maps include:

- Grid capacity heatmap, showing location and headroom of distribution network assets down to the primary substation level[38]; and
- Electric Vehicle Capacity Map, providing a red-amber-green rating for all substations relating to their suitability for EV charging infrastructure connection.

The data used to create these online maps has been adapted to produce a map of relative available capacity for EV charging infrastructure installation, shown in Figure 18.

Distribution Network Operator Works

DNOs are responsible for ensuring that the local electricity network has the capacity and reliability to meet demand. Increases in demand by a customer can require the DNO to carry out network upgrades. Costs are passed directly to the end customer making the request and vary significantly depending on the characteristics of the network and the additional demand required (Table 5).

Upgrades can take six months or more and can be very costly, so it is vital to engage with the DNO as early as possible to agree a timescale and secure funding.

Table 5: *Illustrative example of DNO costs and timescales*

Small (up to 70kVA)	Medium (200kVA – 1,000kVA)	Large (above 1,000kVA)
	Number of charge points	
1-3 Fast or 1 Rapid	10-50 Fast, 4-20 Rapid or 1-6 Ultra-Rapid	50+ Fast, 20+ Rapid or 6+ Ultra-Rapid
	Approximate Connection Time	
8-12 Weeks	8-12 Weeks	6 Months +
	Approximate Connection Cost	
£1,000 - £3,000	£4,500 - £75,000	£60,000 - £2 million
	Other Consideration Affecting Cost	
• Street work costs	• Street work costs • Legal costs for easement and wayleaves	• Street work costs • Legal costs for easement and wayleaves • Planning Permission • Space for a Substation

38 https://www.westernpower.co.uk/smarter-networks/electric-vehicles/ev-capacity-map

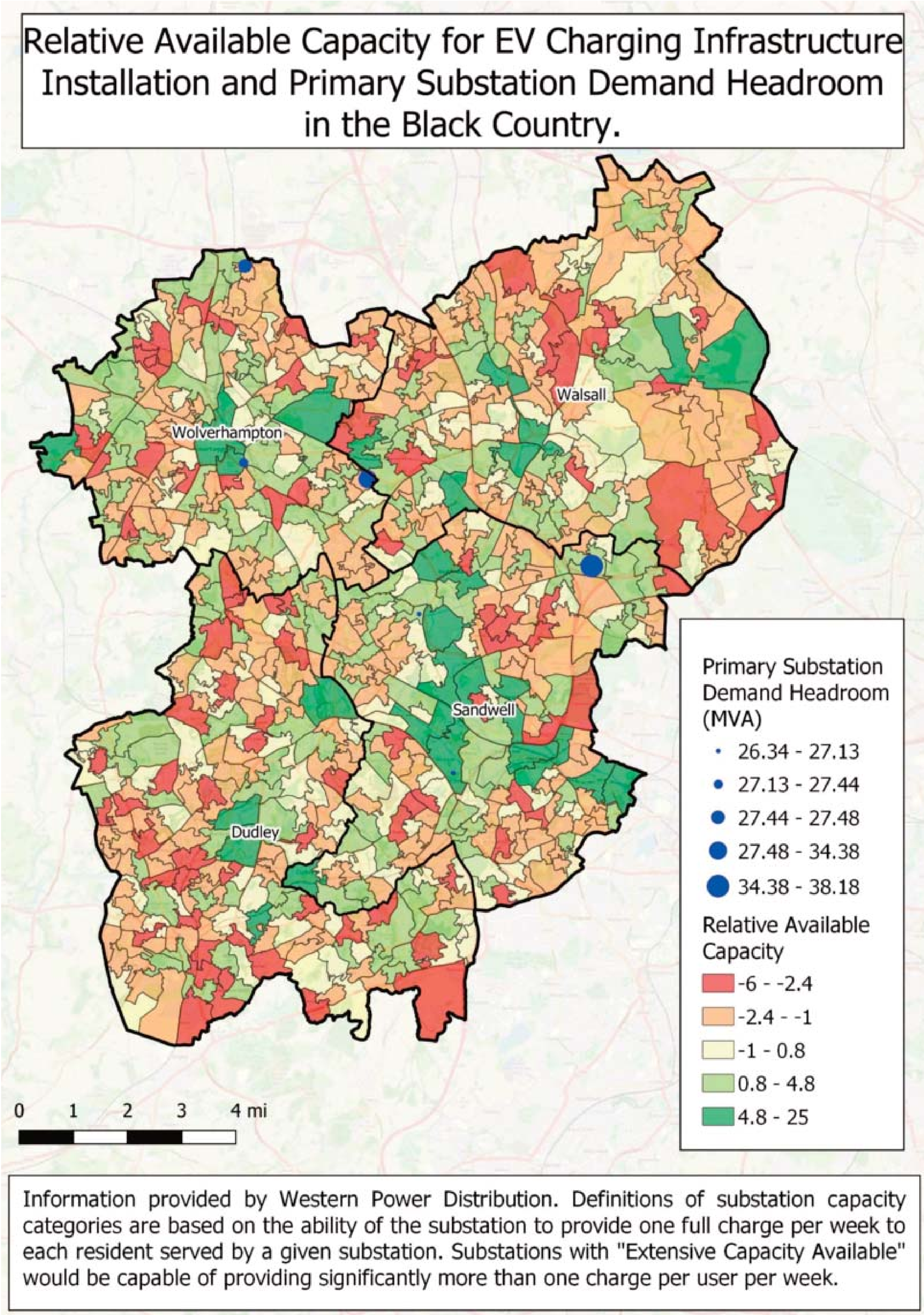


Figure 18: *Primary substation demand headroom and relative available capacity*

Reducing the likelihood and impact of DNO works

Steps can be taken to reduce costs associated with DNO works:

- Investigate 'timed-profile connections', which have set times when demand must be below a certain level but permit higher demand at other times. This would minimise the DNO upgrade work required to meet demand. It should be noted that this service is not currently available from all DNOs and the terminology can vary from DNO to DNO;
- A large site may be supplied by more than one substation, so the DNO may be able to provide the capacity at a cheaper cost elsewhere on the estate;
- Consult local organisations who may also need extra capacity, with a view to spreading costs;
- Consider smart charging or vehicle-to-grid (V2G) services;
- Use load management devices which can manage the power provided to individual compatible chargepoints to ensure supply limit is not breached when multiple chargepoints are in use. This can be preferable to upgrading the DNO connection and can enable the installation of larger quantities of chargepoints. Such devices are already commercially available and can be included in the specification of a procurement framework or discussed with equipment suppliers; and
- In areas where network constraints are significant, consider installing a system with on-site generation (such as solar PV) and battery storage. This can be used to reduce the peak demand of the installation but equally may make the grid connection request more complicated.

Installing a new power supply may considerably increase the time needed to complete a project. In fact, several UK DNOs state that 12 weeks is required from initial enquiry to completion of installation of the new cut out. DNOs do not install feeder pillars, distribution boards or energy meters. DNOs will only start connection works when the appropriate infrastructure (the feeder pillar) has been installed prior to their arrival.

WPD should be contacted as soon as sites are identified (ideally before tendering for a chargepoint supplier) to obtain low voltage grid maps and provide information on where and what is intended to be installed. This is usually done via a new connections or project form downloadable from the DNO's website. Where many sites within a geographic region are being considered, DNOs offer a 'feasibility' service where they will review the available capacity and upgrade costs for proposed infrastructure at each site. This typically cost around £10,000 but depends on the number of sites being considered.

For rapid chargers, the DNO may ask for grid harmonic disturbance information to be supplied on a standard form. This information should be available from a chargepoint supplier and the supplier should fill in the form on the owner's behalf.

At a minimum, the required capacity in current and kilovolt amps (kVA) for the charger should be identified. This will allow the DNO to check the available capacity locally before a tender is released. This checking service may incur a survey cost of about £200-£500 per site. The harmonic distortion information may not be needed at this point (depending on the DNO and primary contact) but will need to be provided after a tender appointment has been decided and before any installations can take place.

Integrating energy and transport

Finding new ways of working to better integrate the energy and transport considerations and data into the site identification will be increasingly important. For instance, deploying better substation monitoring more widely would ensure capacity data is up-to-date, accurate and available to inform early decisions. This would eliminate the normal time-consuming and costly trial-and-approach to site selection. This approach has worked well in London where the Mayor's EV Infrastructure Taskforce includes UK Power Networks, alongside industry leaders and policymakers to ensure alignment between key charging infrastructure stakeholders. Following the recommendations in the TfWM ULEV Report, the WMCA Energy Capital team is known to be working with WPD to make this process smoother to enable potential costs or hurdles to be identified earlier.

The Black Country authorities should engage actively with WMCA's efforts to simplify budgeting and planning for new or upgraded connections.

2.4 Conclusions

Examining the baselining analysis, the following conclusions can be drawn:

Vehicles – the Black Country has a significant challenge to deliver emissions reductions both from the vehicle parc in general and specifically in the council fleets.

Vehicle Parc:

- Cars are the most popular vehicles in the area, with more petrol than diesel.
- The Black Country vehicle parc composition is broadly representative of the UK.
- The Euro 5/VI standard are only the third most common vehicle type with dominance by Euro 5/V and 4/IV, which have higher emissions, particularly NOX.
- There is a high % Euro VI HGVs and buses, which have better emission standards.
- The number of pre-Euro 4/IV vehicles is a concern, representing 36% of the total parc.

Current EV Penetration:

- Black Country councils are the worst-performing West Midlands councils for EV uptake.
- However, all four authorities sit on or above the mean wage/EV uptake trend.

Vehicle Parc Emissions:

- Cars 60% of all transport CO2; Diesel cars emit 33% and 46% of the area's NOX and PM.
- LGVs emit 21% of the area's NOX and PM because of high dominance for Euro 3 vehicles.
- HGVs have no CO2 standards and emit 12% of the area's GHG emissions, despite being just 2% of the total vehicle parc. 22% of NOX and 15% of PM come from HGVs.
- Car and LGV emissions are expected to reduce more easily than freight or bus emissions.

Council Fleets:

- LGVs dominate the vehicle fleet, although there are several HGVs and buses too.
- Dudley's fleet will be difficult to decarbonise due to the high proportion of HGVs.
- 89% of the Sandwell fleet are cars and LGVs, positioning it well to move to net-zero.
- Only 4 EVs and 12 Hybrids are operational throughout all four fleets.
- Where aggressive internal council decarbonisation targets exist, transition to cleaner powertrains will need to happen rapidly.

Taxi & Private Hire (TPH):

- Nearly 13,000 TPH vehicles are currently licensed in the Black Country.
- 533 are Wheelchair Accessible Vehicles, which will be more difficult to transition to EV.
- It is expected that the Birmingham Clean Air Zone will promote a switch to EV.

Chargepoints – the Black Country currently lags the West Midlands in the maturity and diversity of its infrastructure.

- Current infrastructure is mostly rapid chargers or legacy standard chargers.
- There are very few fast chargers.
- Provision is currently 20 plug-in vehicles (PiVs) per chargepoint, compared to 10 per PiV for the West Midlands.
- Around 80% of the area is further than one km from the nearest public chargepoint.
- 99% of the area is within ten minutes' drive of a rapid chargepoint.
- Sandwell lags in the Black Country's rapid chargepoint coverage.

Customers and constraints - EV and infrastructure uptake is expected to vary significantly across the Black Country

- Mapping early adopters predicts a diversity of EV uptake across the Black Country.
- The more likely locations for residential charging demand have been identified for further work, along with areas which will be more or less constrained by grid connections.
- DNO upgrades can take six months or more, so early engagement with WPD is crucial.
- Black Country should engage actively with WMCA's efforts to simplify site selection.

3 Projections and Gap Analysis (WP2)

This section develops a suite of scenarios which project the possible number of ULEVs, required charging infrastructure, additional energy demand and grid capacity constraints. A gap analysis is completed to establish the differences between the scenarios to highlight the implications of more or less aggressive ULEV uptake and to support effective decision-making.

3.1 Introduction to scenarios

3.1.1 Scenario development

EV uptake projections can take significant time and effort, especially if built from the ground-up. The Black Country has agreed that a top-down approach makes most sense for the study area in question, not least because this matches the approach in the TfWM ULEV Report.

This is primarily because it is important to consider EV uptake scenarios within the context of different scales, both geographically and politically. The scenarios developed in this study attempt to marry the practicalities and ambitions of Black Country local authorities with the targets set out in the UK Government's industrial strategy and the WMCA's aim to support low carbon transport across the region. The intention of this approach is that the scenarios used in this study are compatible at all scales and best utilise the role of different stakeholder groups (e.g. local engagement managed locally, regional networks managed regionally, etc.).

The UK Government's 2018 Industrial Strategy set out in the Road to Zero represents the country's stated policy objectives and the basis for the standard uptake projections[39]. However, the use of national targets for local projections does bring with it some potential pitfalls and risks, which are noted in the following paragraphs along with how they are addressed.

Firstly, the reasons behind national targets are inherently outside local authorities' immediate spheres of influence, making it potentially problematic to hold local representatives to account for it. For this reason, this section presents projections to give context to decision-making rather than predictions which drive policy targets.

Secondly, national policy does not explicitly take account of local policies, procedures or positions. This ultimately has the effect of smoothing the projections to cancel-out particularly aggressive or advanced policy positions, or level-out those areas which lag. In this case, however, it is felt that local policy will tend to be subject to national policy, so it is reasonable to assume that the overall direction of travel of all policy and planning is aligned, given that the Road to Zero is the UK's Industrial Strategy and the most applicable roadmap available.

Lastly, national targets become increasingly irrelevant at the most local scales as they fail to take account of local nuances. However, to address this, the projections presented below are based upon observed historic trends for each of the local authorities.

3.1.2 Scenarios

Cenex created a range of projections in response to the brief received from the Black Country. The first three scenarios are based on the Road to Zero, published in 2018 and match the TfWM ULEV Report:

- **Low:** 30% of new vehicle registrations are plug-in vehicles by 2030;
- **Mid:** 50% of new vehicle registrations are plug-in vehicles by 2030; and
- **High:** 70 of new vehicle registrations are plug-in vehicles by 2030.

> ! These scenarios scale the national targets according to the historic trends observed in the Black Country and therefore the modelling that follows is sensitive to the current status in the study area.

39 *https://www.gov.uk/government/publications/reducing-emissions-from-road-transport-road-to-zero-strategy, accessed 14th April 2020.*

The projected status as of 2030 is described in Table 6:

Table 6: *Road to Zero EV uptake projections*

Scenario	Plug-in vehicle uptake by 2030	
	% of new registrations	% of all Black Country vehicles registered
Low	30%	4.65%
Mid	50%	7.20%
High	70%	9.74%

Since delivery of the TfWM ULEV Report, the UK Government has announced it is to consult on bringing-forward the potential ban on petrol and diesel vehicles from 2040 to 2035[40] and include hybrid vehicles. It was later announced that, subject to the results of a public consultation, a ban on ICE vehicles could be brought forward to 2032[41] and other groups have called for the ban to be brought forward to 2030[42]. Therefore, in agreement with the Black Country authorities, three further scenarios were added:

- **2035 Ban:** sale of new petrol, diesel and conventional hybrid cars banned by 2035;
- **2032 Ban:** sale of new petrol, diesel and conventional hybrid cars banned by 2032; and
- **2030 Ban:** sale of new petrol, diesel and conventional hybrid cars banned by 2030.

! These scenarios assume that the Black Country adheres to a sales ban, thus forcing the pace of change.

The projected status as of 2030 is described in Table 7:

Table 7: *Accelerated EV uptake projections*

Scenario	Plug-in vehicle uptake by 2030	
	% of new registrations	% of all Black Country vehicles registered
2035 Ban	62%	16.25%
2032 Ban	83%	24.98%
2030 Ban	100%	34.23%

3.1.3 Scenario selection

To avoid presenting six variants of every analysis, the mid-project workshop was used to establish the levels of ambition of the Black Country. Representatives from the four local authorities and WMCA were asked which scenarios they would like to target. The most popular scenarios were the Mid, 2035 Ban and 2032 Ban so these three scenarios are the ones presented, below.

! he analysis on all scenarios is included in the supporting documentation.

3.2 EV projections

Using the scenarios outlined above, the uptake of EVs as a proportion of the overall vehicle parc is projected and presented in Figure 19:

40 https://www.gov.uk/government/consultations/consulting-on-ending-the-sale-of-new-petrol-diesel-and-hybrid-cars-and-vans, accessed 14th April 2020.

41 https://www.bbc.co.uk/news/business-51474769, accessed 6th May 2020

42 https://www.theguardian.com/environment/2018/mar/18/uk-should-bring-2040-petrol-and-diesel-car-ban-forward-2030-green-alliance, accessed 6th May 2020

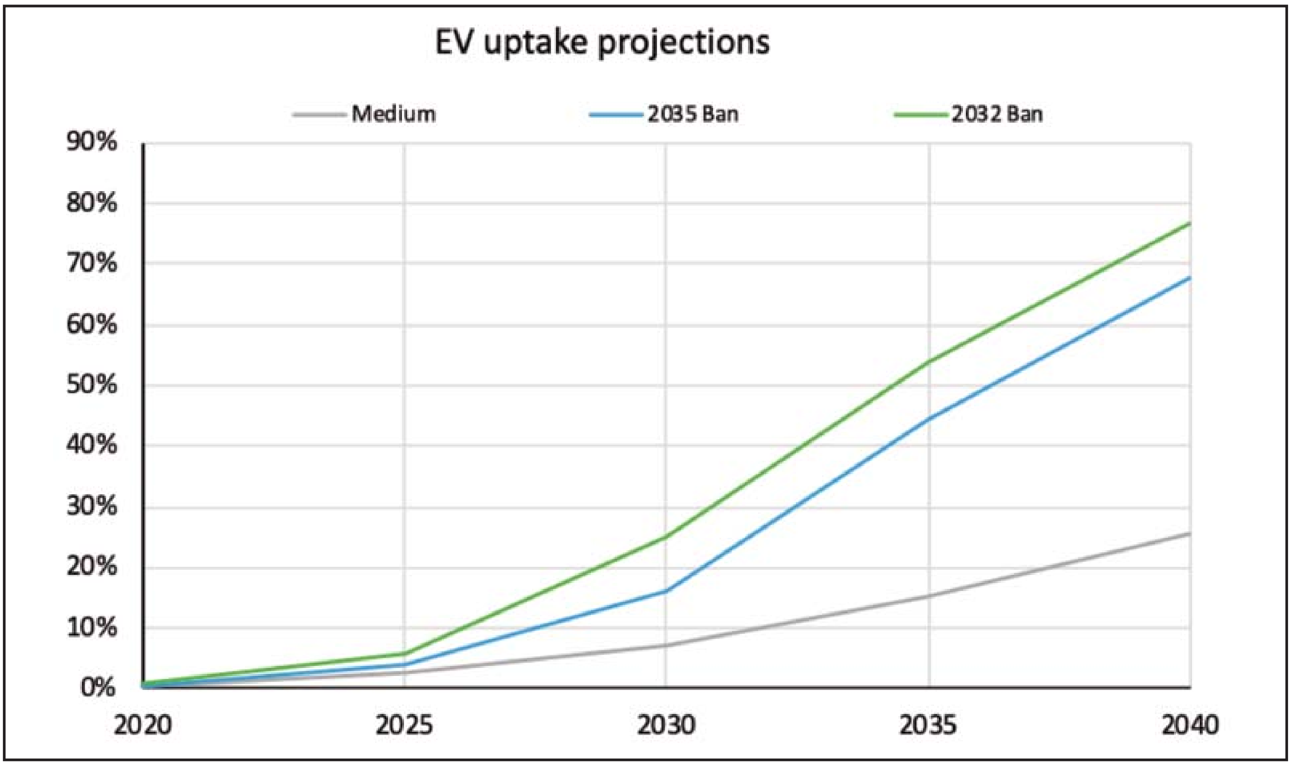


Figure 19: *EV uptake as a proportion of the vehicle parc*

In absolute terms, these scenarios imply that by 2025 between 14,000 and 32,000 EVs are projected for the area, increasing to 44,000 to 154,000 in 2030 (see Figure 20).

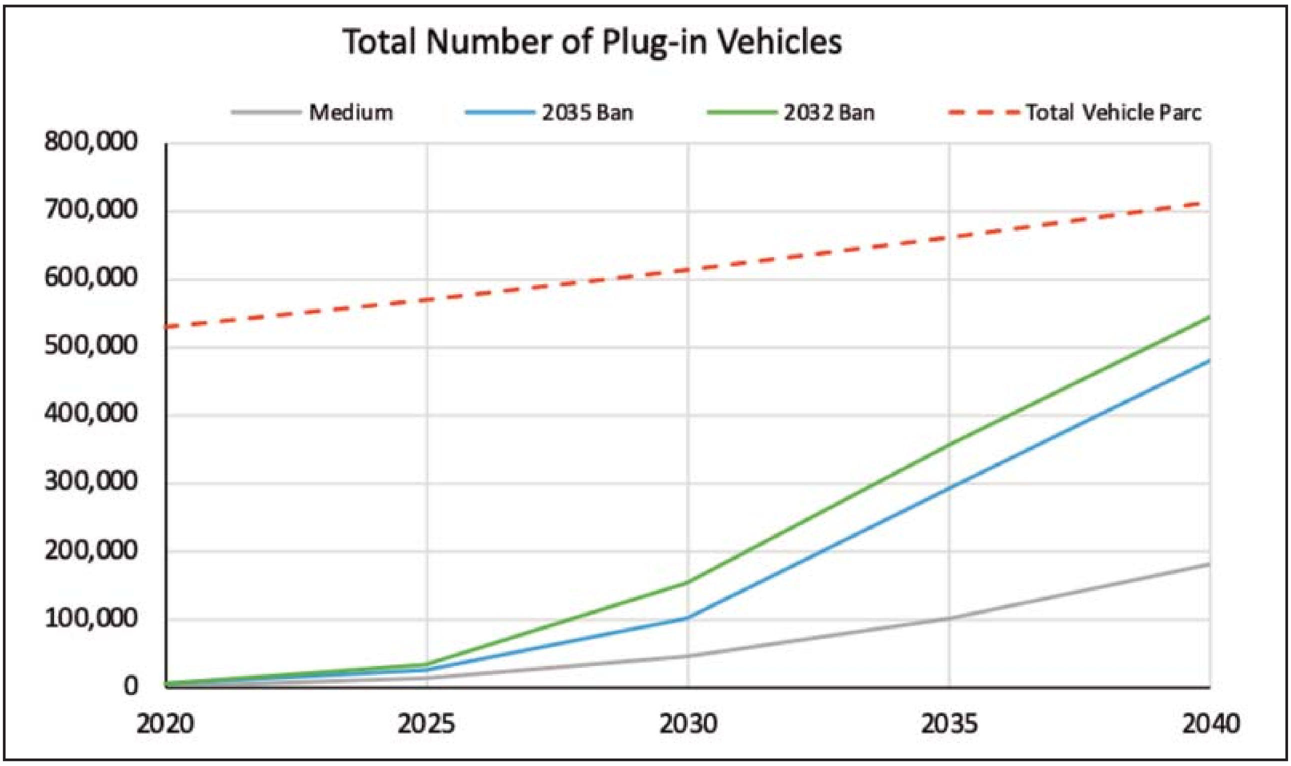


Figure 20: *Projected number of EVs in the vehicle parc*

Due to the relative immaturity of the current EV market in the Black Country (see Section 2.1.3 on page 20 for more details), all scenarios track relatively closely up to 2025 because they start from a low baseline. However, the implementation of a ban in 2035 or 2032 causes a significantly more aggressive uptake curve, especially as the ban date is approached and passed.

3.3 Charging infrastructure projections

3.3.1 Methodology and Assumptions

The EV uptake projections in Figure 19 and Figure 20 are translated to infrastructure demand by modelling based on assumptions about:

- Mean annual mileage;
- Current and future EV battery sizes;
- Likely number of vehicles of different specifications; and
- Typical charging speeds (slow, standard, fast and rapid).

These allow the likely charging output by charger and charging sessions per day to be calculated, from which the volumes and type of infrastructure required to meet this demand can be evaluated.

! A fuller explanation of the methodology and assumptions can be found in Appendix 2 (page 87).

Figure 21 shows the projected total number and types of charging sockets required to service the EV demand.

! All infrastructure scenarios are calculated by number of sockets. Freestanding 7 kW chargers are typically fitted with two sockets, meaning that a requirement for 4,500 sockets potentially only necessitates 2,250 installations.

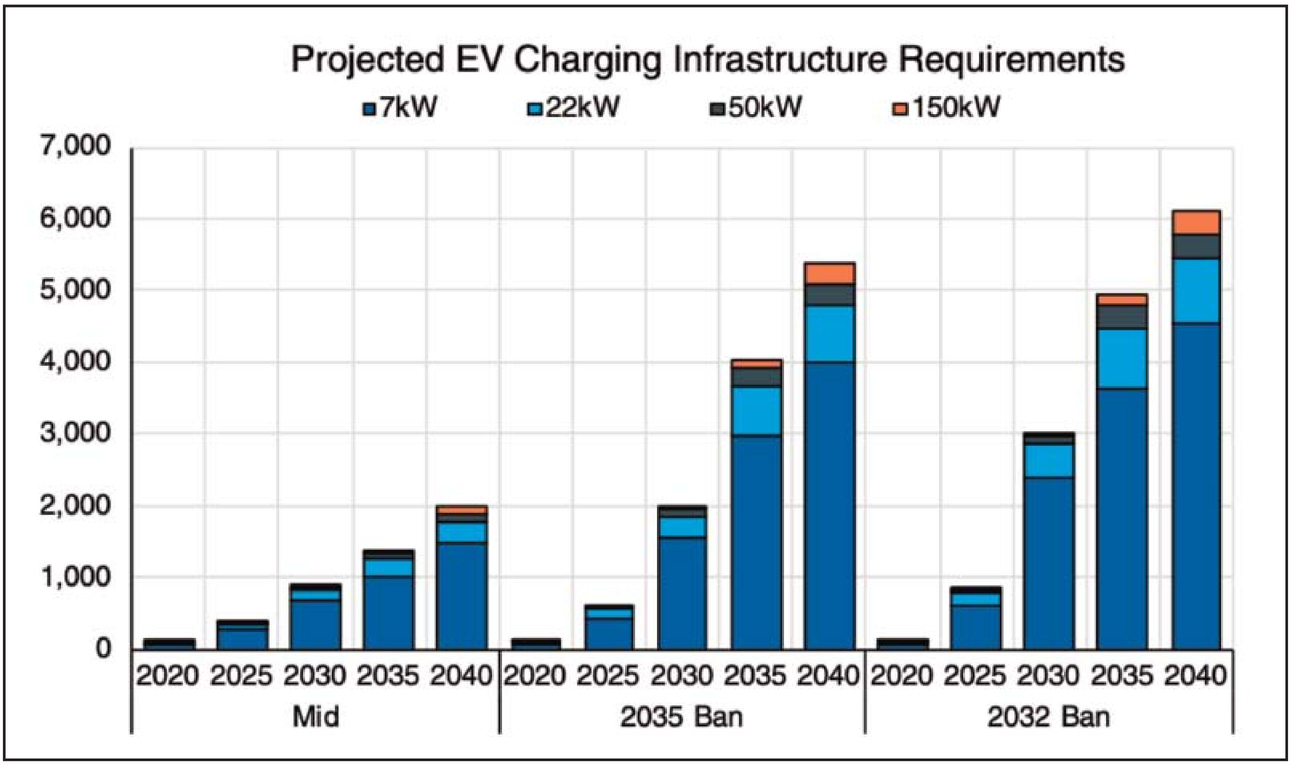


Figure 21: *Projected infrastructure demand by scenario*

The 2032 Ban scenario projects around triple the number of 7 kW sockets than in the Mid scenario (2,400 compared to 700 at 2030, 4,500 compared to 1,480 at 2040)

By contrast, 135 rapid or ultra-rapid chargers are projected for 2030 in the 2032 Ban scenario.

For the Mid scenario, the projections suggest that just 16 rapid or ultra-rapid chargers are needed by 2030, which has already been achieved by the current infrastructure deployment.

3.3.2 Slower or Faster Charging?

There are four key reasons for the significant difference between standard and the fast/rapid/ultra-rapid needs in the projections.

Slower charging implies more chargepoints

Firstly, one of the core assumptions is that there will remain a need and steady demand for slower charging options in long-stay parking locations, residential on-street zones or at businesses (see Appendix 1 on page 87 for more details of the key assumptions in this analysis). Secondly, the slower the chargepoint, the fewer vehicles can be charged over a given time. The maximum assumed utilisation is around 50% for a 7 kW charger, representing a maximum of two plug-in events in every 24-hour period. Therefore, a greater number of chargepoints is needed to meet demand. Thirdly, slower chargepoints that are in locations like residential streets are less likely to be in constant use. Most residential charging is likely to be in the evenings. This means that in most cases each 7 kW chargepoint will only be able to recharge one vehicle per day. Again, this equates to a higher number of chargepoints.

An alternative strategy would be to provide fewer on-street 7 kW units, with charging for those without off-street parking primarily provided via rapid or ultra-rapid charging hubs. There are advantages and disadvantages to both approaches but the larger number of slower chargers if preferable for several reasons.

Standard charging is likely to be cheaper for users

Slower rates of charging, such as residential or business-provided charging, are almost always cheaper for the end-user than fast or rapid public charging. In addition, visibility of conveniently located charging infrastructure is essential to build end-user confidence to ensure that EV uptake matches the projections, especially since rapid charging technologies are still developing. Provision of 7 kW charging in residential areas especially can mitigate the creation of inequality between residents with off-street parking and those without.

It is acknowledged that the practicalities of providing thousands of 7 kW sockets to meet growing demand is a challenging target. However, as the EV charging infrastructure industry develops, equipment and installation costs are likely to reduce with scale, making this target increasingly more attainable. Additionally, there are already examples of innovative technologies on the market that are quick to install, such as lamp post chargepoints that can often be fitted in a small number of hours without causing any disruption to the highway.

Standard charging makes it easier to manage the grid impacts and customer experience

Additionally, 7 kW overnight charging is easier to manage from a grid perspective, especially if load management is possible. The additional burden on the grid is considerably lower than 50 to 150 kW charging solutions. Utilising smart charging technologies in 7 kW overnight charging scenarios can maximise the number of vehicles that can accept a charge over a long period of time, within the constraints of the local distribution network. This also means that customers can ‘plug-and-forget’, rather than having to come back to prevent them blocking the chargepoint.

A worked example demonstrates the practicalities and grid challenges best.

A hypothetical residential street might have 30 EVs which need to receive a charge of 25 kWh by 7am each morning. The same energy needs to be delivered regardless of charging power. If every vehicle receives a dedicated standard-power socket, the charging can be completed overnight (a 12-hour period is assumed for convenience although such uniformity is unlikely in reality).

The connection size for the street will be a maximum of 210 kW (30 EVs x 7 kW) but with the most optimum load management system, this could be managed down to 60 kW (25 kWh x 30 EVs /12 hours). The reality will be somewhere in between to allow some slack in the system for EVs not always being plugged in for the whole 12 hours. Either way, the drivers simply plug-in and their vehicle is charged by 7am.

By contrast, if the street is equipped with six rapid sockets, the charging must be done in shifts to ensure that everyone receives a charge (assumed to be four charges before 10pm and then one overnight). The connection size for the street will be a maximum of 300 kW (6 EVs x 50 kW) but with some load management, this might be able to be managed down, perhaps to 150 kW (depending on how the four evening charges are managed). However, the street must organise itself through a rota or simply remembering to go back and unplug so the next driver can charge.

In this greatly-simplified scenario, the standard chargers give better scope for grid management and the customer experience is much more convenient. Reality is, of course, much more complicated, which enhances the case for standard chargers although where there is little or no spare distribution network capacity, grid reinforcement will need to be undertaken anyway to support a significant number of 7 kW chargepoint installations.

For these reasons, it is felt that the high proportion of 7 kW sockets is justified and the most-efficient route to support the electrification of cars and LGVs.

3.3.3 Important Considerations

Nonetheless, regardless of infrastructure strategy, it is important to highlight several critical factors which should not be ignored in formulating an effective, efficient and feasible plan for implementation.

For instance, simply identifying appropriate sites can be a major challenge, taking significant time, money and effort to overcome. Whilst the location of demand can be modelled area-by-area, when street-by-street cases are considered, a wide range of practical, compliance or electrical barriers may prevent installation. Furthermore, existing street furniture may preclude parking or prevent chargepoints from being installed, underground services may obstruct cable trenching, grid connections may be constrained in locations without these issues and a lack of energy data may mean that last-minute problems are discovered and force a re-think.

3.4 Anticipated energy demand

The mass transition to EVs and associated infrastructure projected above will result in additional demand being placed upon the UK's electricity network. At the local level, the electrical distribution network will need to ensure that supply meets demand as it grows with the burden of EV adoption. This will involve action on both the supply-side and demand-side. The former typically involves upgrading the distribution network to meet increased demand, whereas the latter involves managing demand to reduce or remove the need to make costly upgrades to the network.

In order to plan what measures should be taken to ensure that the Black Country's distribution network is equipped to meet the challenge of recharging EVs en masse, the future electrical demand originating from EV charging has been projected. These estimates are overlaid with information on the current distribution network (see Section 2.3.3) to identify locations where the distribution network is most likely to require reinforcement.

3.4.1 Future Electrical Demand

Based on the EV uptake projections in Section 3.2, the maximum potential electrical demand from residential charging has been estimated across the scenarios. Table 8 shows the estimated maximum demand from residential EV charging at 2025 and 2030, according to the 2035 Ban scenario, with upper and lower bounds of ambition based on the 2032 Ban and Mid scenarios respectively.

These figures have been estimated using Output Area vehicle ownership statistics collected through the 2011 Census, combined with EV ownership percentages projected in Section 2.1.3. These findings look at theoretical maximum power demand required in order to simultaneously supply a 7 kW charge to every EV in each area. This analysis is provided for the purpose of geographical comparison. The absolute values are not reflective of likely peak demand as it is implausible that all EVs across an output area would be plugged-in simultaneously and technological solutions exist that can manage demand to avoid these situations.

! Electrical demand estimates only consider residential demand. The nature of residential charging is more predictable and generally less diverse (i.e. more likely to occur at the same time) than rapid charging. In many cases, residential charging is therefore likely to pose a greater challenge to distribution network operators.

Table 8: *Estimated theoretical maximum electrical demand resulting from residential EV charging by 2025 & 2030.*

Maximum Demand (MW)	2025			2030		
	<	-	>	<	-	>
Dudley	27.58	44.95	62.83	80.25	181.16	278.47
Sandwell	20.14	32.82	45.88	58.60	132.29	203.34
Walsall	20.43	33.30	46.55	59.45	134.22	206.31
Wolverhampton	17.55	28.61	39.99	51.07	115.30	177.23
Total	*85.71*	**139.69**	*195.25*	*249.37*	**562.97**	*865.35*

This analysis shows that by 2025 residential charging could increase the peak demand by a maximum of 140 MW across the Black Country. By 2030, maximum demand could increase by over 550 MW, although this is highly dependent on the number of EVs owned by Black Country residents. The margin from Mid to 2035 Ban and 2035 Ban to 2032 Ban amounts to roughly ±40%, depending on the scenario. Figure 22 illustrates the margin of uncertainty in this analysis, depending on the pace of EV adoption.

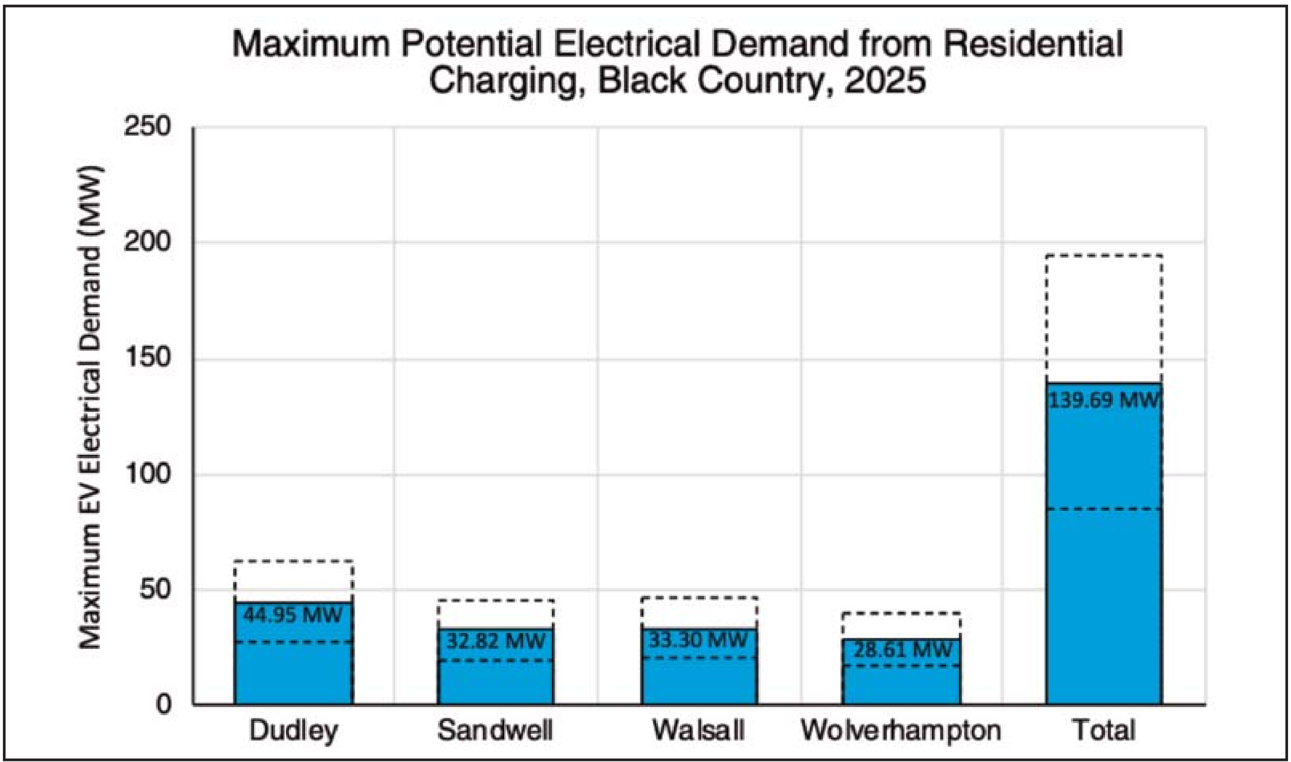


Figure 22: *Estimated maximum electrical demand from residential charging of EVs across the Black Country under the 2035 Ban scenario*

Legend: *Numbers are for the 2035 Ban scenario. Dashed lines represent uncertainty margin between Mid and 2032 Ban Scenarios*

Under the 2035 Ban scenario, EVs being charged at home could add up to 140 MW of demand onto the electrical distribution network.

3.4.2 Mapping Electrical Supply and Demand

Figure 23 and Figure 24 (below) map where the greatest electrical demand is likely to occur, based on the assumption that all vehicles in the Black Country are EVs and simultaneously recharge at 7 kW.

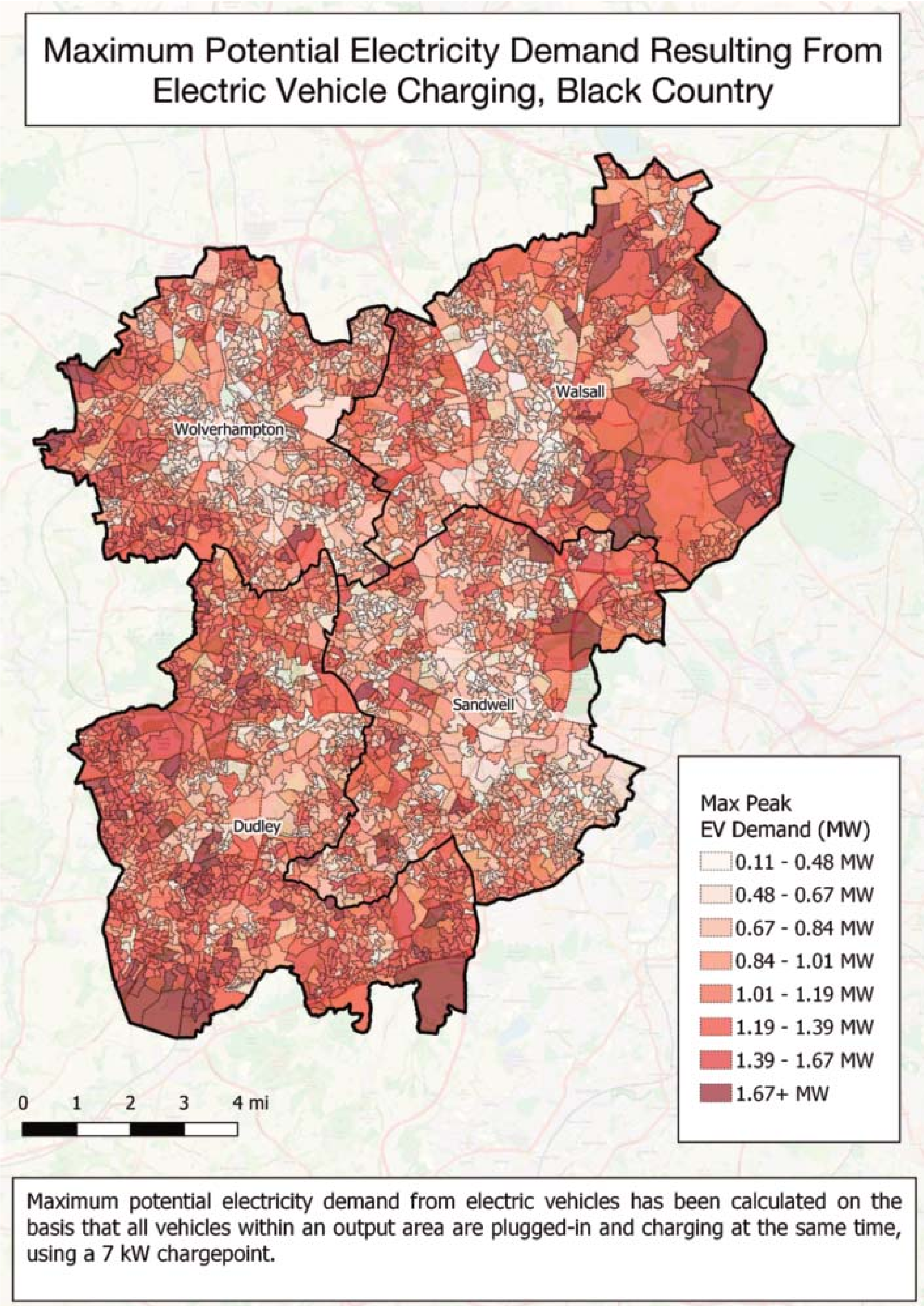


Figure 23: *Distribution of maximum potential electrical demand from residential EV charging, assuming all vehicles are EV and simultaneously recharging at 7 kW.*

In all scenarios, electrical demand from EV charging is likely to be higher in suburban areas.

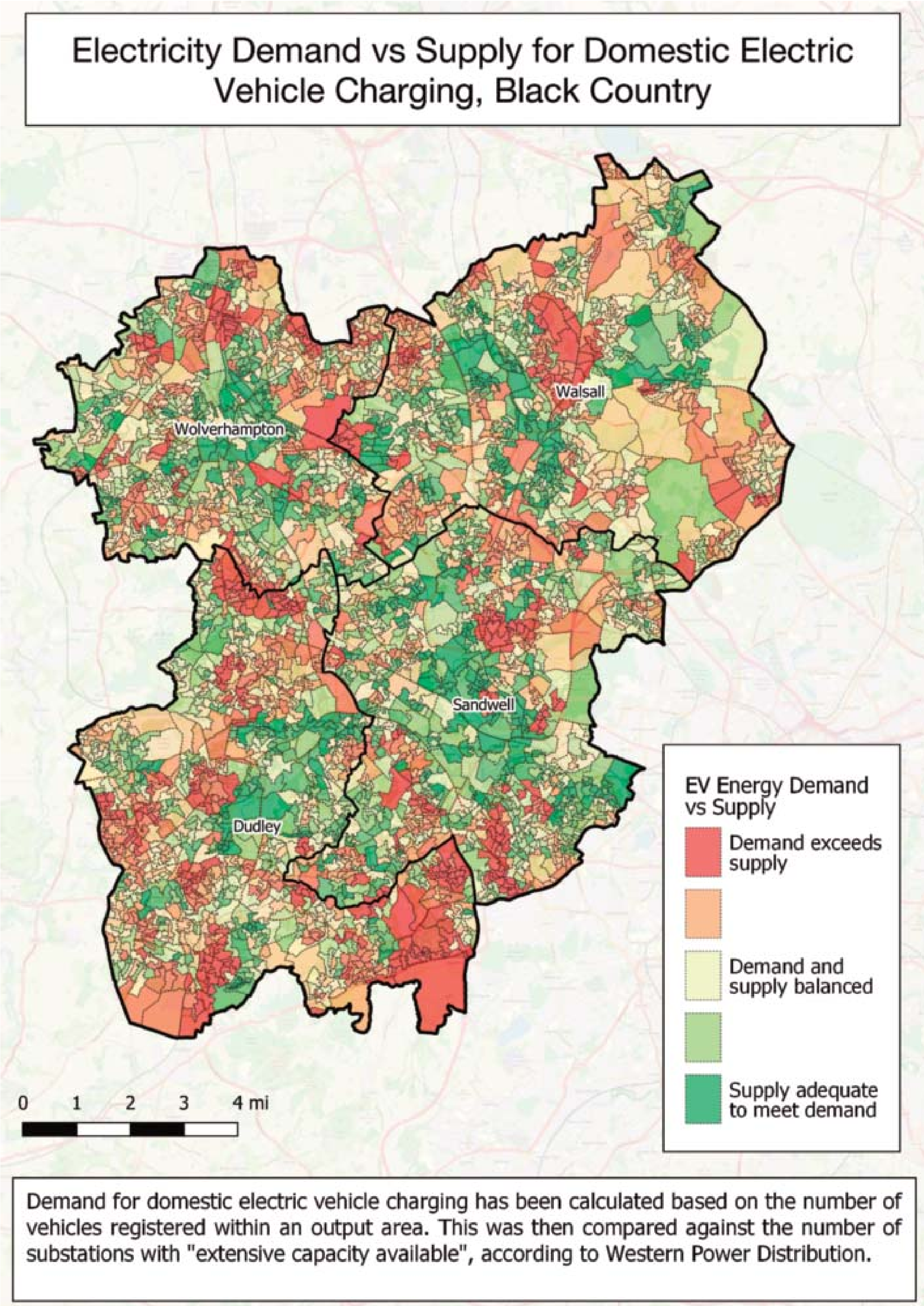


Figure 24: *Electricity demand and supply for domestic EV charging.*

The greatest potential future deficit between demand and supply of electricity for EV charging is likely to exist in suburban areas in all scenarios.

Whilst the precise distribution of electrical demand has little impact in the short-term as EVs are becoming established, it illustrates where greater demand is likely to occur at any time scale.

Analysis suggests that the greatest demand is likely to occur in suburban areas, with demand generally decreasing in more densely populated urban areas. This is primarily caused because the suburban locations typically have higher vehicle ownership rates as they are generally more affluent and have greater need for private transportation than the urban population.

Although beyond the scope of this report, further analysis could be completed to indicate how this demand is likely to vary over time, depending on scenario.

The demand analysis was further extended to understand how adequate the current distribution network is to meet local demand for EV charging. Figure 24 (above) illustrates the relationship between theoretical maximum future distribution network demand from EV charging and current distribution network supply. This map illustrates that the greatest deficit between supply and future demand is also likely to exist in suburban areas, caused by a combination of higher demand for EV charging in these areas, as well as less headroom on the distribution network.

Although beyond the scope of this report, further analysis could be completed to indicate how constraints are likely to vary over time and space, depending on scenario.

3.5 Gap analysis

With the ULEV projections, infrastructure implications, energy demand and impact on the grid completed, a gap analysis was undertaken to identify the extent to which additional charging infrastructure will be required to meet projected future demand.

The number of additional public chargepoints required was calculated by subtracting existing provision (see Section 2.2) from projected future demand (see Section 3.3). Table 9 shows the existing provision, expressed in number of sockets available for members of the public to use to recharge an EV. Data has been gathered from Zap-Map, the National Chargepoint Registry and submissions by local authorities.

! The number of sockets has been calculated on the assumption that all existing 7 kW and 22 kW public chargepoints have two sockets that can be used simultaneously, which is typically the case for free-standing infrastructure operating at this power level.

Table 9: *Current public EV charging socket provision, by Black Country local authority.*

	Current Provision			
	7kw	22kw	50kw	150kw
Dudley	24	2	9	0
Sandwell	16	2	6	0
Walsall	12	0	7	0
Wolverhampton	10	2	15	0
Total	**62**	**6**	**37**	**0**

The results of the gap analysis show that an additional 381 public 7 kW charging sockets will be required by 2025 under the 2035 Ban scenario. Additionally, 113 public 22 kW charging sockets and four 150 kW charging sockets will be required. Gap analysis results for 2025 are summarised in Table 10 (note that negative numbers indicate that existing provision is already adequate).

Table 10: *Gap analysis for additional public EV sockets required to meet 2025 demand under the 2035 Ban scenario.*

	Current Provision			
	7kw	22kw	50kw	150kw
Dudley	108	33	0	1
Sandwell	87	26	1	1
Walsall	82	25	-1	1
Wolverhampton	104	29	-7	1
Total	**381**	**113**	**1**[43]	**4**

! As 7 kW and 22 kW charging infrastructure is typically supplied with two sockets that can be used simultaneously, the number of 7 kW and 22 kW charging infrastructure units required could be as little as half the number of sockets required, as described in this section.

Current provision of public 50 kW rapid charging infrastructure across the Black Country is already sufficient for projected 2025 demand in the 2035 Ban scenario.

However, the rapid charger figures are strongly biased towards Wolverhampton, owing to their existing provision of 15 public 50 kW chargepoints. By comparison, the current supply of public 50 kW chargepoints in Dudley, Sandwell and Walsall more closely matches requirements by 2025.

Up to 2025, procurement of EV charging infrastructure across the Black Country should be focussed on 7 kW and 22 kW charging infrastructure at long and short-stay parking locations, respectively.

It should be considered that, whilst Wolverhampton has a current provision of 15 public 50 kW chargepoints, the majority of these units were installed using funding provided through the OLEV Taxi Scheme and therefore there may be a medium-term expectation that these chargepoints will not remain available for use by the general public. Should this become the case, additional public 50 kW charging infrastructure may be required to meet demand from the public.

Looking further ahead, the gap between existing provision and demand is projected to widen considerably as the uptake of EVs accelerates into 2030. Table 11 shows the number of additional public EV charging sockets projected to be required across the Black Country by 2030, under the 2035 Ban scenario. This table also shows the range of uncertainty between different EV uptake projection scenarios, highlighting the importance of re-evaluating strategic ambitions as the market for EVs and EV charging infrastructure develops.

43 *Although the sum of the column is actually -7, there is no proposal to remove chargers from Wolverhampton. Instead, one additional rapid charger is proposed (to meet the projected 2025 need in Sandwell).*

Table 11: *Gap analysis for additional public EV sockets required to meet 2030 demand under the Mid, 2035 Ban and 2032 Ban scenarios.*

	2030: Mid (<), 2035 Ban (-), 2032 Ban (>) Scenarios											
	7kW			22kW			50kW			150kW		
	<	-	>	<	-	>	<	-	>	<	-	>
Dudley	192	420	648	40	84	128	4	17	30	3	6	9
Sandwell	146	342	533	30	67	104	4	15	26	3	5	8
Walsal	130	321	502	28	64	99	2	12	23	2	5	7
Wolverhampton	153	410	648	30	79	125	-5	9	23	3	6	9
Total	621	1,493	2,331	128	294	456	10[44]	53	102	11	22	33

44 As with Table 10, although the column sum is actually 5, there is no proposal to remove chargers from Wolverhampton. Instead, ten additional rapid chargers are proposed to meet the 2030 demand in the Mid scenario.

3.6 Conclusions

Examining the projections and gap analysis, the following conclusions can be drawn from analysis of the Mid, 2035 Ban and 2032 Ban scenarios for cars and vans:

EV Uptake:

- Up to 2025, all scenarios track closely due to a low baseline starting position.
- After 2025, the 'Ban' scenarios diverge from the Mid scenario.
- By 2025, 14,000 – 32,000 EVs are projected, rising to 44,000 – 154,000 in 2030.

Infrastructure:

- By 2025, 369 – 830 charging sockets are projected, rising to 870 – 3,027 in 2030.
- The number of 7 kW chargers in the 2032 Ban is over triple those in the Mid by 2030.
- Just 16 rapid/ultra-rapid charging sockets are needed by 2030 in the Mid scenario, but 135 in the 2032 Ban scenario.

Energy Demand:

- Residential charging increases the 2025 peak demand by 86 - 195, up to 249 – 865 MW by 2030, depending on scenario.
- The 2035 Ban scenario projects an additional 140 MW by 2025 and 563 MW by 2030.
- In all scenarios, electrical demand is likely to be higher in suburban areas.
- In all scenarios, the potential future deficit between demand and supply of electricity for EV charging is also likely to be highest in suburban areas.

Gap Analysis:

- Current provision of public 50 kW infrastructure is sufficient for projected 2025 rapid and ultra-rapid demand in the 2035 Ban scenario, especially in Wolverhampton.
- This scenario requires an additional 381 public standard and 113 fast sockets by 2025.
- Up to 2025, EV infrastructure procurement should focus on standard and fast chargepoints at long and short-stay parking locations, respectively.
- Additional sockets projected in 2030 are 1,500 standard, 300 fast, 50 rapid and 20 ultra-rapid respectively.

4 Benefits (WP3)

This section calculates the wider environmental, air quality and social benefits of the scenarios. Given the current impact of covid-19 on the economy, a section has been added on the economic benefits of EV charging infrastructure.

4.1 Emissions Calculations

As outlined in the introduction, one of the main reasons for promoting EV uptake and use through the efficient deployment of effective infrastructure is to improve air quality and reduce Greenhouse Gas (GHG) emissions. These environmental and social advantages of switch to EVs will benefit the Black Country's residents and businesses.

Therefore, each of the three main scenarios (Mid, 2035 Ban and 2032 Ban) have been evaluated to quantify the CO2, NOX and PM emissions savings expected in each case. An analysis of the potential noise benefits has also been included.

These results should feed into the overall strategy development to set the right level of ambition for EV uptake and be used in the evaluation of the success of the eventual ULEV programme.

! To avoid unnecessary complexity, each scenario is appraised by consolidating emissions for cars and LGVs together.

4.1.1 Methodology

The results presented below are calculated by combining vehicle journey data with emissions information and vehicle registration statistics, as follows.

- Duty cycles[45] of cars and LGVs, mean annual mileages (Cars[46], LGVs[47]) and average speeds[48] were sourced to calculate vehicle journey performance statistics.
- Annual Carbon Dioxide (CO2), Nitrous Oxides (NOx) and Particulate Matter (PM) emissions for each vehicle type were obtained from DEFRA figures[49].
- Vehicle registration statistics detail the number of vehicles within each emissions standard with the emissions data.

This step created a 2019 baseline emissions figure for cars and LGVs in the Black Country, as used also in Section 2.1.4 on page 22.

A projection of the number of vehicles per category was calculated from:

- Annual scrappage rates and replacement schedules from SMMT and RAC data to give the age profile and quantity of vehicles removed annually from the vehicle parc;
- The projected total vehicle parc size for each year (calculated in Section 3);
- The number of new EVs (also calculated in Section 3); and
- The most up-to-date sales records showing the split between petrol and diesel vehicles.

The first two of these values allows the number of new vehicle registrations to be calculated, whilst the latter two values allow the split between EV, petrol and diesel powertrains to be projected. The same emissions figures for each vehicle type used in the 2019 baseline were applied to create a total emissions value for the vehicle parc. This is subtracted from the 2019 baseline at appropriate points in time to calculate the emissions reductions.

45 *Road Traffic Estimates: Great Britain 2017*
46 *National Travel Survey: Table NTS0901*
47 *Road Traffic Estimates: Great Britain 2017*
48 *National Travel Survey: Table NTS0303*
49 *DEFRA figures 2018*

The annual emissions savings were multiplied by known damage costs for each emissions type (£/kg), taking into account estimated inflation levels to calculate the overall mitigated damage costs due to emissions (CO_2 , NOx , PM).

! All values are for road transport only.

4.2 CO2, NOX and PM emissions reductions

Table 12: *TTW CO2 reduction vs 2019 figures*

		2025	2030	2035	2040
TTW CO2	Medium	0.2%	0.6%	2.9%	8.4%
	2035 Ban	1.3%	8.0%	29.5%	52.3%
	2032 Ban	2.5%	15.1%	38.4%	61.6%

Table 13: *NOx reduction vs 2019 figures*

		2025	2030	2035	2040
NOx	Medium	8.2%	16.6%	25.4%	35.3%
	2035 Ban	9.7%	24.6%	50.2%	71.3%
	2032 Ban	11.1%	32.2%	58.6%	79.0%

Table 13: *NOx reduction vs 2019 figures*

		2025	2030	2035	2040
PM	Medium	33.6%	47.3%	55.5%	63.1%
	2035 Ban	34.6%	52.2%	70.0%	83.2%
	2032 Ban	35.6%	56.9%	74.9%	87.5%

The forecast emissions reductions for each scenario are evaluated against the 2019 baseline. From this, it can be seen that EV uptake significantly reduces local pollutant and GHG emissions.

In the 2035 Ban scenario, by 2025 a 1.3% reduction in CO2, nearly 10% reduction in NOX and 25% reduction in PM is projected.

At 2025, as older vehicles on the road are replaced with new cleaner vehicles the NOX and PM emissions reduce in all three scenarios. However, only the 2035 and 2032 Ban scenarios show significant changes in CO2 emissions because of the aggressive phasing-out of petrol, diesel and hybrid vehicles. This is partly because the vehicle parc is expected to continue to grow, which mitigates the impact of the increase in sales of EVs in the Mid scenario (see Figure 28 on page 55 for more details on managing the vehicle parc).

Looking further ahead to 2030, there is little difference between the three scenarios with regards the effect on local air quality (NOX and PM). However, between the period of 2030 and 2040, the 2035 and 2032 Ban scenarios accelerate away from the Mid scenario.

The 2035 Ban and 2032 Ban scenarios are particularly effective with regards reducing CO2 emissions from 2030 onwards with significant strides towards decarbonising the vehicle parc by 2040 with a reduction in CO2 of over 50% in the 2035 Ban scenario and over 60% in the 2032 Ban scenario.

The absolute projected CO2, NOX and PM figures are displayed in Figure 25, Figure 26 and Figure 27 through to 2040.

50 £0.105 per kg in 2030, DfT WebTag table A3.4 – Non-traded values of CO2e

51 £18.20 per kg in 2030, DfT WebTag table A3.2 – Damage cost values by pollutant

52 £232.73 per kg in 2030, DfT WebTag table A3.2 – Damage cost values by pollutant

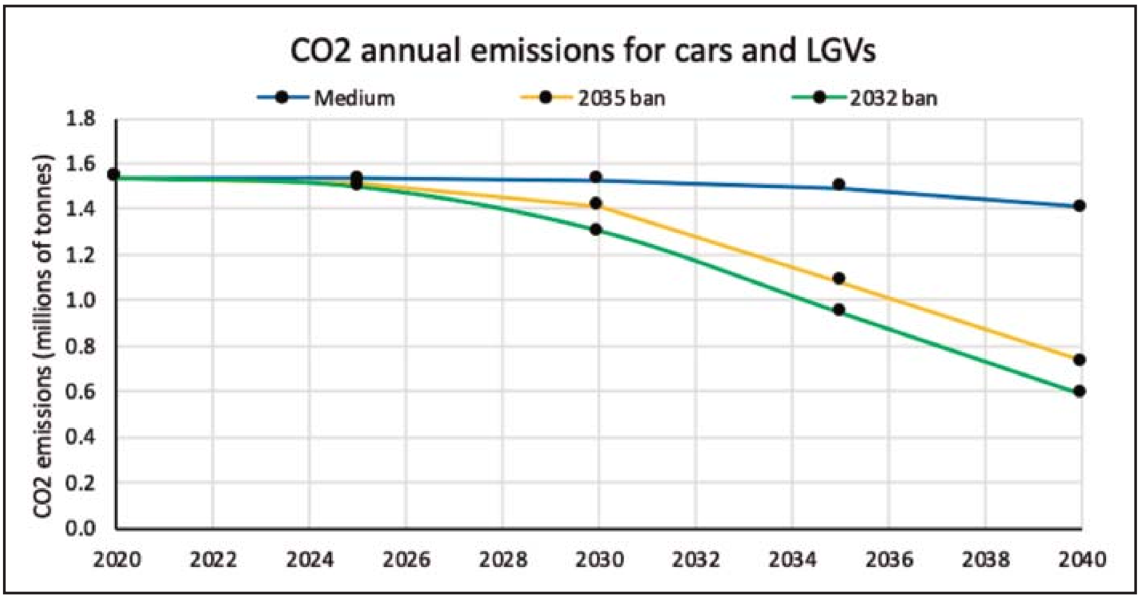


Figure 25: *Projected annual CO2 emissions for cars and LGVs*

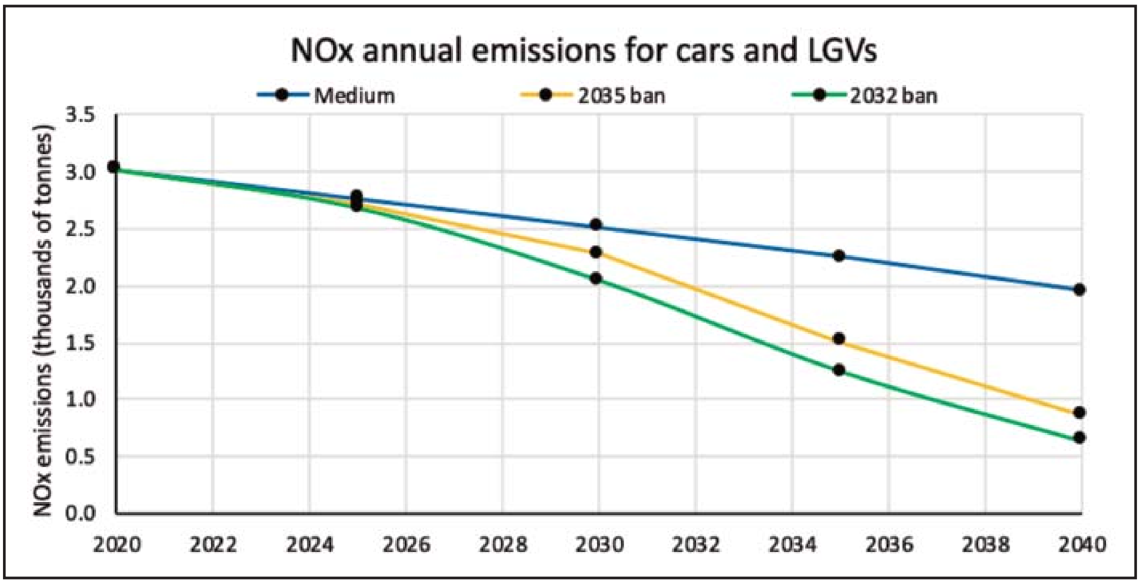


Figure 26: *Projected annual NOX emissions for cars and LGVs*

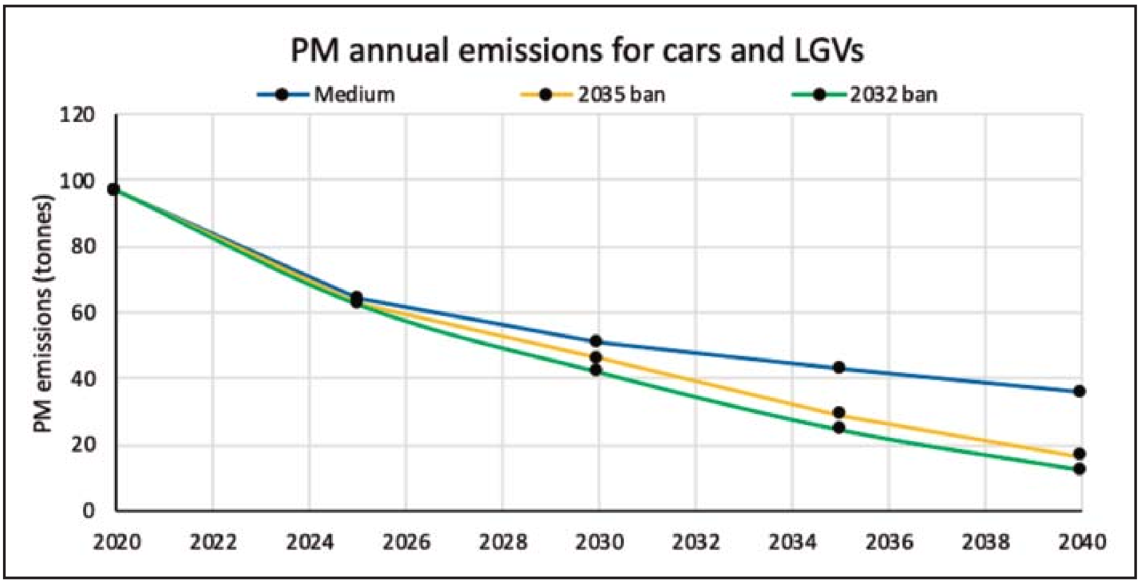


Figure 27: *Projected annual PM emissions for cars and LGVs*

As with Table 12, Table 13 and Table 14, PM reduction is greatest followed by NOX and CO2. This is primarily because the Euro 4/IV and Euro 5/V vehicles that currently dominate the parc have significantly greater NOX and PM emissions than the more modern Euro 6/VI vehicles, so reductions are captured as they are retired. However, CO2 emissions remain similar between these standards, so the reductions are more modest unless the more aggressive Ban scenarios are taken.

None of the scenarios produce a net-zero car and LGV parc by 2040, leaving the road transport aspects of the 2041 net-zero target for the West Midlands difficult to achieve, even under the 2032 Ban scenario.

4.2.1 Tyre and Road Wear

Vehicle-related PM emissions can arise from non-exhaust mechanisms, such as brake wear, tyre wear and road pavement abrasion, which may be emitted directly or indirectly through resuspension of settled road dust. As the vehicle parc moves towards EVs, the proportion of PM attributable to vehicle traffic is expected to come increasingly from non-exhaust sources.

Currently, very little empirical data is available to characterise Tyre and Road Wear Particles (TRWP) in the PM10 and PM2.5 fraction. However, it is estimated that as a percentage of total PM, the contribution of TRWP to ambient PM10 and PM2.5 is 2.2-2.5% and 0.1-0.5% respectively[53]. PM emissions from exhaust mechanisms are thought to contribute around 25% of total ambient PM[54].

Major contributing factors to TRWP include vehicle weight and speed. As EVs are currently heavier than conventional ICE vehicles, it is expected that there will be a small increase in TRWP. However, this is considered negligible when compared to the PM produced from the exhaust mechanisms of ICE vehicles. If PM becomes a concern, it should be noted that reducing road speeds will reduce PM production through TRWP.

It is worth noting that a recent announcement from Emissions Analytics concluded that TRWP emissions were much higher than previously thought and contributed 1,000 times more PM than exhaust mechanisms, contrary to the study referenced above[55]. The report concluded that TRWP emissions were equal to 5.8 g per km (1.45 g per km per tyre). If this is indeed the case, given a typical tyre weighs 7.5 kg[56] of which 35% (2.62 kg) is tread, this would imply the tread on standard passenger car tyres would be entirely worn down after less than 2,000 miles of driving. Given the annual mileage covered on an average tyre in the UK is 30,000 miles, Cenex does not believe the figures from Emissions Analytics should be relied on. With the exception of this report, the consensus within the industry remains that PM from exhaust mechanisms is far higher than TRWP.

4.2.2 Impact of vehicle parc assumptions

Further analysis was completed to establish the impact of managing the vehicle parc growth on emissions reduction. The vehicle parc is defined as the total number of vehicles registered in the region.

As mentioned earlier in this section, the emissions calculations are based on a vehicle parc growth trend similar to the past 10 years. By 2040, this is equivalent to more than a 30% increase in the number of vehicles registered in the Black Country. Figure 28 shows the impact of keeping the vehicle parc static or achieving just a 10% reduction in the number of registered vehicles compared to today's figures.

53 Panko, J. et al., Evaluation of Tire Wear Contribution to PM2.5 in Urban Environments, 8th Jan 2019

53 Karagulian, F. et al., Contributions to cities' ambient particulate matter (PM): A systematic review of local source contributions at global level. Atmos. Environ. 2015, 120, 475–483

53 https://www.emissionsanalytics.com/news/pollution-tyre-wear-worse-exhaust-emissions

53 R17 tyre (average passenger car size)

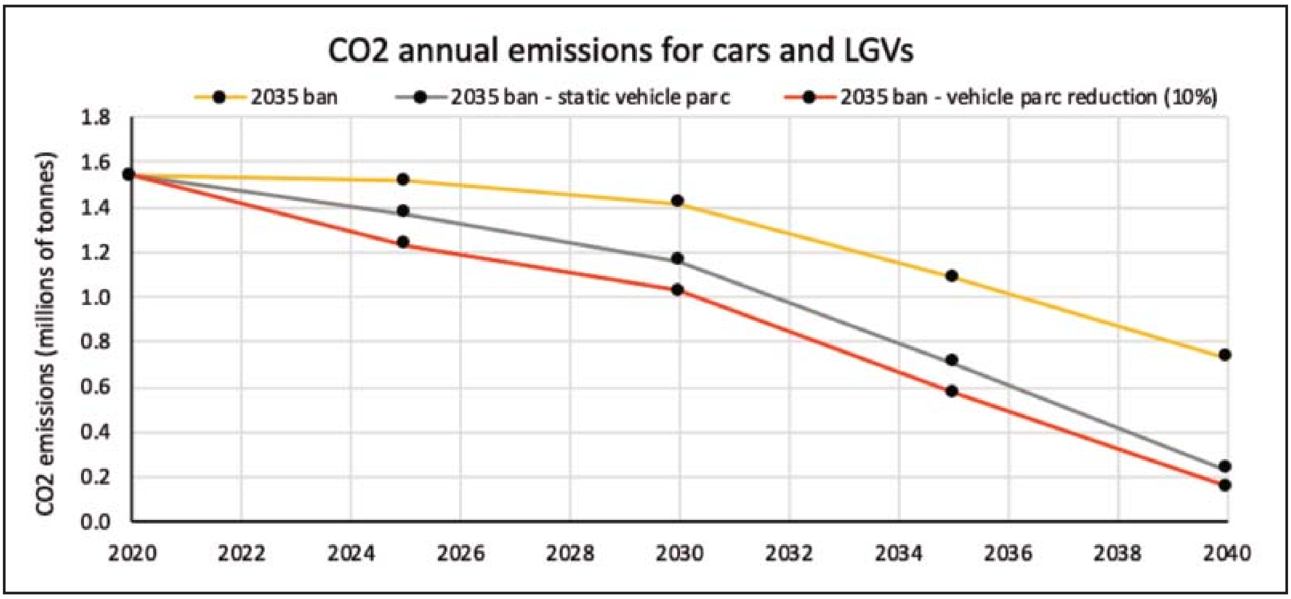


Figure 28: *Projected annual CO2 emissions for 2035 Ban scenario with varying vehicle parc size*

Maintaining the vehicle parc size through to 2040 has a significant effect on the total CO2 produced by vehicles in the area and the important 2041 legislative target is within reach.

There are clear benefits to slowing the growth of the vehicle parc in terms of both emission reduction as well as traffic. However, given a likely rise in population, achieving a static or even reducing vehicle parc growth would mean decreasing the proportion of adults who own a vehicle and/or decreasing the number of households with more than one vehicle. If this is to be the case, investment needs to be made into replacement transport services such as public transport (buses and trains), active travel (walking and cycling), and shared mobility (car clubs can reduce the growth of the vehicle parc, with one carsharing vehicle able to replace 7 to 13 private vehicles)[57].

4.2.3 The Effects of Covid-19 on Road Transport and Emissions

The Covid-19 crisis has seen pollution levels drop in many UK cities, resulting from the lockdown that restricted movement and encouraged working from home. From a transport and air quality perspective, this unprecedented period has had some positive impacts including cleaner air, lower CO2 emissions and lower road noise. News outlets have reported anecdotal evidence that riders feel that going out on a bike is now a pleasure due to less congestion and less traffic[58].

There are around 40,000 premature deaths in the UK each year due to air quality. Not all would have been prevented by this lockdown but awareness is growing in the general public of the impacts of cleaner air, particularly in our cities where vehicle emissions are the main cause. This appears to be reflected in recent announcements by the UK Government intending to promote an increase in active travel after the lockdown[59].

As noted in the Introduction (page 12), it is believed that there are a higher number of Covid-19 cases in areas of poor air quality, but it may well be because these areas have a higher population density as well as populations with more respiratory disease.

Figure 29 shows the effects of the Covid-19 outbreak on daily road traffic travel compared to the equivalent date in 2019. Although traffic from all forms of motor vehicles has dropped by around 60-70%, public transport has been hit hardest, especially the rail sector and tube services.

57 Cohen, A. & Shaheen, S. (2018), Planning for shared mobility

58 https://road.cc/content/news/how-coronavirus-has-changed-your-riding-habits-272379, accessed 14th May 2020.

59 https://www.gov.uk/government/news/2-billion-package-to-create-new-era-for-cycling-and-walking, accessed 14th May 2020.

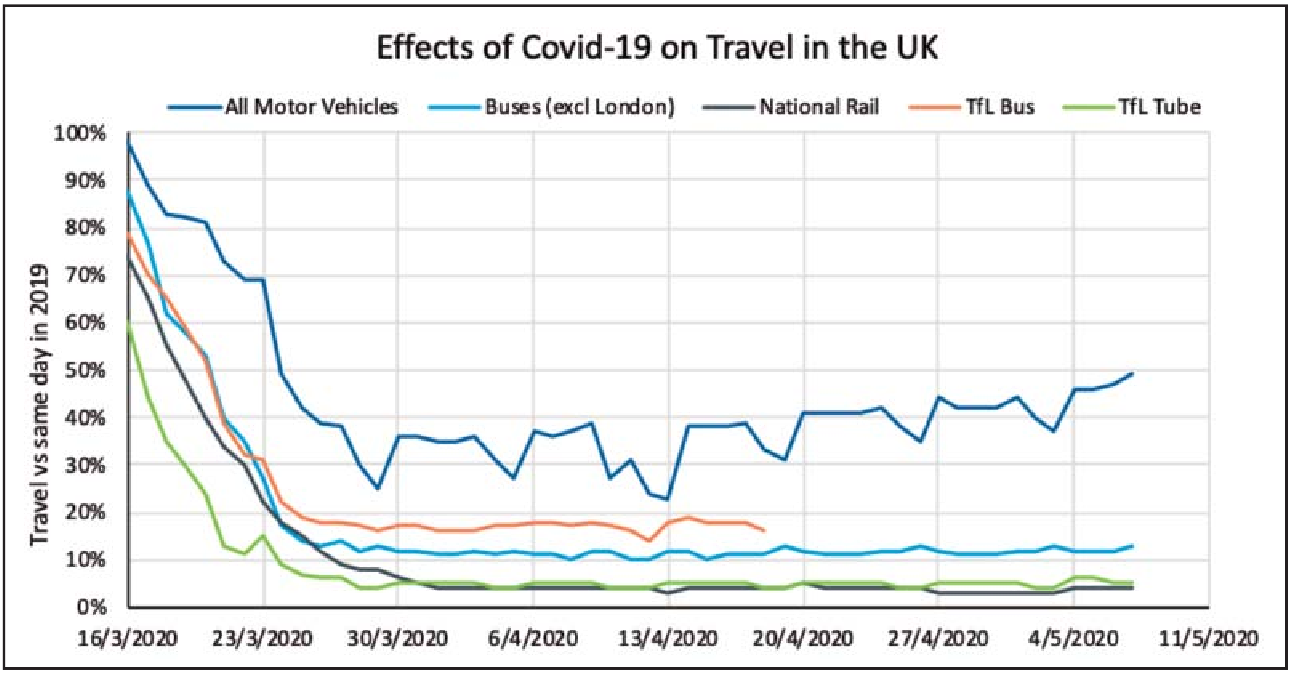


Figure 29: *Comparison of daily vehicle mileages in 2020 vs same day in 2019*[60]

A prediction has been made for the overall effect on travel for the rest of 2020 to understand the short-term impact on emissions. Figure 30 shows an estimation of the impact of covid-19 on annual motor vehicle traffic levels has been produced, based on the following assumptions:

- No second peak/relapse of Covid-19;
- Continued social distancing in early summer, as per expectation laid-out in the 10th of May announcements; and
- Reaching Covid-19 alert level 2 around August/September with most schools going back.

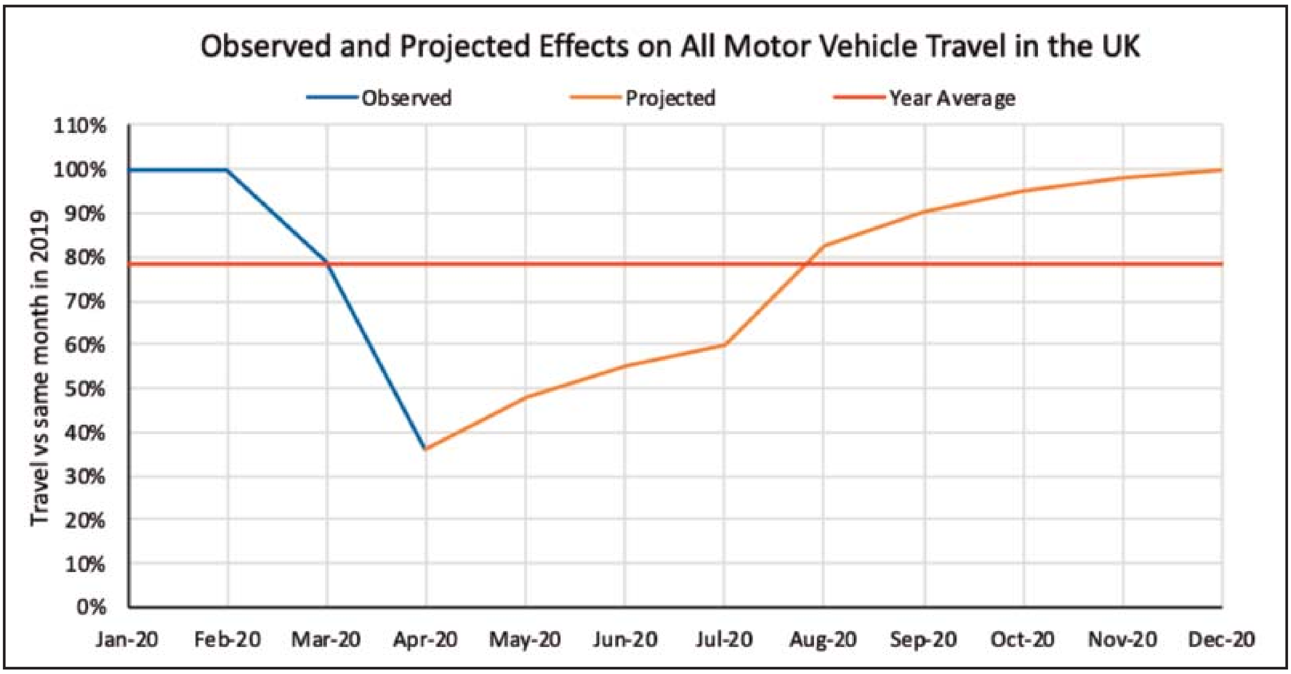


Figure 30: *Observed and projected motor vehicle mileages in 2020 vs 2019*

60 Gov.uk, Datasets to accompany coronavirus press conference: 9 May 2020

Overall, Covid-19 is predicted to lead to around a 20% decrease of road transport emissions of CO_2, NOX and PM in 2020 compared to 2019. This absolute level of emissions change would not be realised on the 2035 Ban scenario until around 2033 for CO_2, 2030 for NOx, and 2024 for PM.

The covid-19 crisis clearly demonstrates the large step change needed in road transport in order to achieve meaningful and large scale emissions reductions.

4.3 Damage Costs Mitigated Due to Emissions

Known damage costs for each emission type have been applied to the savings achieved by each scenario to estimate and monetise the social benefits of these emissions savings. These assumptions account for inflation and are the agreed DfT figures for the year 2030 (CO_2[61], NOx[62], PM[63]). The results are displayed in Table 15 for 2030.

! Note that these assume a continued growth of the vehicle parc, rather than the static or shrinking parc modelled in Figure 28.

***Table 15:** Projected annual costs mitigated in 2030.*

	CO2 Annual Cost Saving	NOx Annual Cost Saving	PM Annual Cost Saving	Total Annual Cost Saving
2030 - Medium	£901,000	£9,139,000	£10,621,000	**£20,661,000**
2030 - 2035 Ban	£12,816,000	£13,486,000	£11,725,000	**£38,027,000**
2030 - 2032 Ban	£24,261,000	£17,661,000	£12,784,000	**£54,706,000**

It is beyond the scope of this strategy to undertake a detailed air quality damage cost assessment. However, the estimates provided here show that the monetised social benefits of reducing emissions through EV uptake can be significant, equating approximately 1/3 of 1% of the Black Country's 2018 GDP[64]. The annual mitigated costs are indicative based on average damage cost values and costs will vary depending on factors such as whether emissions occur in an urban or rural location. Therefore, a scheme which reduces emissions in a dense urban area will have a greater monetary value than a similar scheme in a sparsely populated rural area.

More detailed appraisals should be undertaken as part of business case analysis to support investment in targeted local measures to promote EV uptake because there are significant social cost benefits associated with reducing emissions and these increase in inverse proportion to the reduction in emissions achieved.

4.4 Noise

4.4.1 Noise from Transport

Noise from conventional vehicles affects human health and damages the environment. The World Health Organization (WHO) estimates that the noise impact of road traffic is second only to pollution as the biggest environmental impact of vehicles[65]. Excessive noise pollution is a known annoyance, affecting sleep and potentially affecting those who are vulnerable to dementia or stroke.

In the UK, 90% of people hear road traffic noise while at home. 10% of these regard this noise source as highly annoying[66]. EVs have a reputation for being quieter than conventional ICE vehicles.

61 £0.105 per kg in 2030, DfT WebTag table A3.4 – Non traded values of CO2e
62 £18.20 per kg in 2030, DfT WebTag table A3.2 – Damage cost values by pollutant
63 £232.73 per kg in 2030, DfT WebTag table A3.2 – Damage cost values by pollutant
64 https://www.the-blackcountry.com/upload/GVA%20Dec%202019%20BC(2).pdf, accessed 14th April 2020.
65 WHO (2011), New evidence from WHO on health effects of traffic-related noise in Europe
66 Watts, G.R. et al. (2006), 'Tyre /Road Noise - Assessment of the Existing and Proposed Tyre Noise Limits' - TRL report PPR077

While this is certainly true when comparing engine noise while the vehicle is static, this is not necessarily the case when the vehicle is moving.

Noise in vehicles is known to be generated from three main sources:[67]

- Propulsion noise – this dominates at low speeds;
- Tyre / road contact noise – this dominates at high speeds; and
- Aerodynamic noise – this increases as the vehicle accelerates.

Noise levels increase with vehicle speed as shown in Figure 31. The continuous lines show noise from average individual passenger cars and the dotted lines show noise from HGVs.

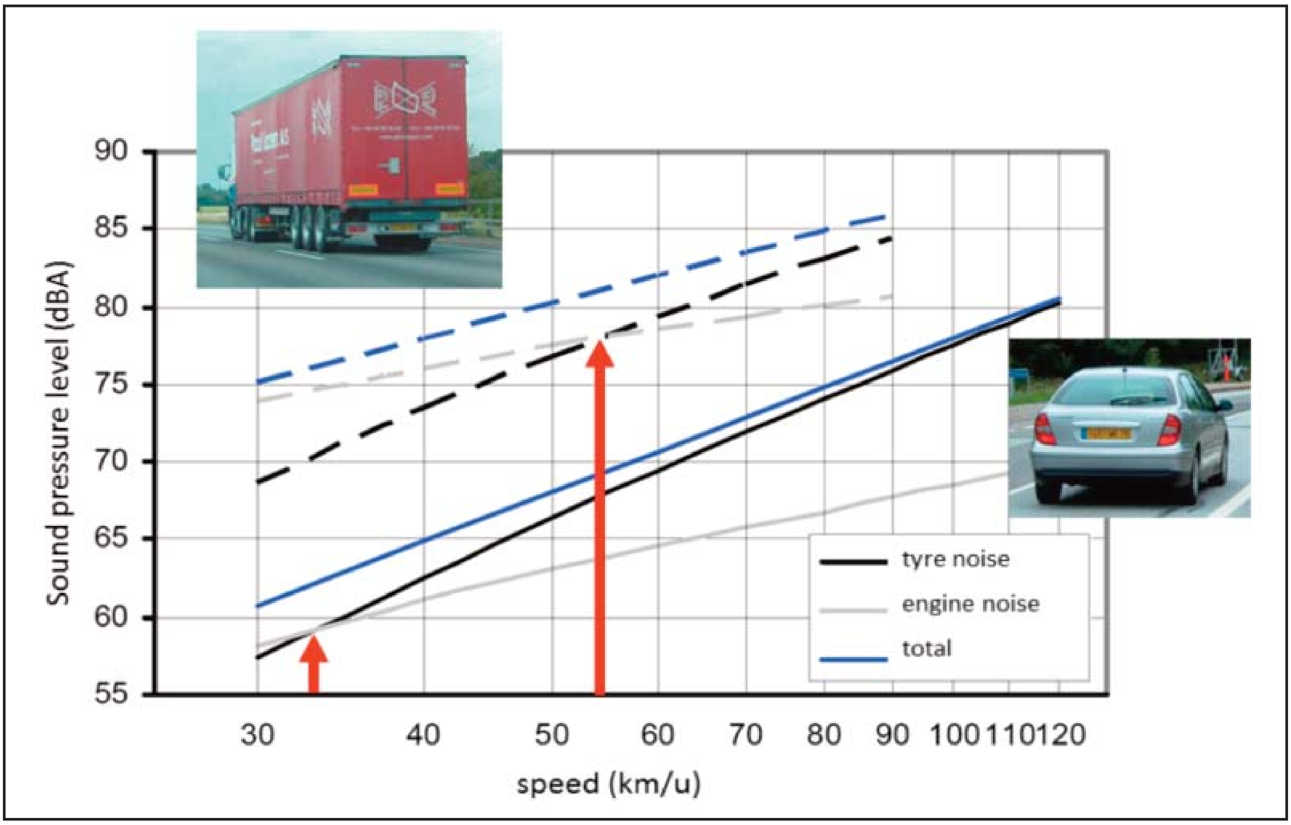


Figure 31: *Noise level and corresponding vehicle speeds for an individual passenger car and HGV*[68]

Factors other than speed that influence these three sources of noise include engine type, fuel type, vehicle type, tyres, road surface, vehicle age, state of maintenance and frontal area.

While it is clear from Figure 31 that engine noise plays a major role in sound pressure levels at low vehicle speeds, there is a limit to the noise reduction that electric vehicles can provide, and at speeds higher than ~30 km/h, tyre/road contact noise dominates so there is a decreasing noise reduction benefit to an electric vehicle.

Additionally, as the weight of a vehicle increases the tyre/road contact noise also increases, providing diminishing returns on electric vehicles, which are heavier than conventional ICE vehicles currently due to the weight of the battery packs.

It is also worth noting that the noise profiles in Figure 31 are for individual vehicles. As more vehicles are added to the system the noise pressure level will begin to increase till reaching a plateau at a given vehicle number.

67 SEStran & TRI (2014), 'Greening Logistics: Sustainable Best Practices'

68 Euro Cities (2015), 'Low-noise road surfaces'

4.4.2 Comparison of EV and ICE Noise Profile

Figure 32 shows the noise profile of an electric and ICE vehicle at constant speeds of 10, 20 and 20 km/h. Both vehicles had the same tyres on and were tested on the same road surface in order to mitigate differences due to road and tire noise.

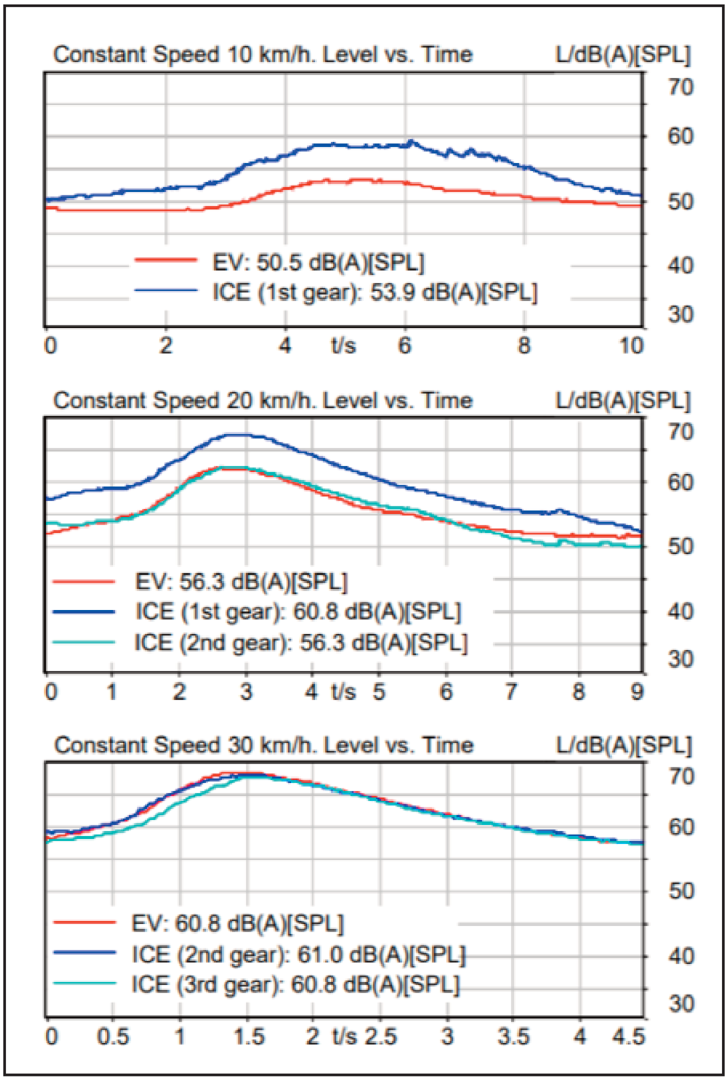


Figure 32: *EV vs ICE constant speed noise profile*[69]

At 30 km/h, there is little difference between the two vehicles irrelevant of the gear selected in the ICE vehicle. At 20 km/h, there is little difference between the electric and ICE vehicle when the appropriate gear is selected in the ICE vehicle. However, when “under geared”, the ICE vehicle is 4.5 dB louder. At 10 km/h, the ICE vehicle is 3.4 dB louder than the electric vehicle.

The ICE vehicle is louder at lower speeds and the gear selected by the ICE vehicle is equally important in the noise profile of the vehicle.

This is because at higher engine revs an ICE vehicle is louder, hence by selecting a higher gear and reducing the engine revs, the noise profile of an ICE can be lowered.

4.4.3 Calculated Benefits and Mitigated Costs

The noise pollution benefits of an EV are only seen at low speeds, typically below ~30 km/h. This is especially during acceleration at low speeds or away from standing. Due to this, it is expected that the adoption of EVs will likely only affect roads with speeds limits of 20 mph (32 km/h) and below.

69 *Genuit, K. (2010), Future Acoustics of Electric Vehicles*

However, it should be noted that The United Nations Economic Commission for Europe (UNECE) has adopted a technical standard for electric vehicle noise generators, when vehicles are travelling at speeds <12 mph, to improve pedestrian safety. Legislation has required electric vehicles entering the UK market to comply from July 2019.

It is therefore likely that the largest benefit that EVs can bring regarding a reduction in noise pollution will be restricted to roads where the average speed is between 12 mph and 20 mph (20- 30 km/h). Therefore, analysis of the calculated benefits and mitigated costs has only been conducted for 12 mph.

Table 16 shows UK government Tag data for 2030 of the monetary value per household of changes in noise level split into five main areas that noise effects. The total effect of a change of 1 dB from 60 dB to 59 dB is worth £9.61.

Table 16: *Monetary value of changes in noise level per household*[70]

	Amenity	Direct AMI	Stroke	Dementia	Sleep disturbance	Total
59 dB	£43.63	£9.58	£4.53	£6.84	£70.96	£135.55
60 dB	£46.99	£11.88	£4.55	£6.86	£74.89	£145.16
Difference/dB	£3.36	£2.29	£0.01	£0.01	£3.93	£9.61

Taking the maximum noise differential of 4.5 dB at 12 mph (20 km/h in Figure 32), an estimate of the upper limit noise differential for the full vehicle parc has been estimated using the EV uptake scenarios.

Using a cost of £9.61 per dB, the total effect of noise mitigation has been estimated for the Black Country's 485,800 households[71]. Unsurprisingly, a higher uptake of EVs results in a larger reduction in noise at the roadside with the 2032 Ban the most effective scenario from a noise perspective.

Table 17: *Effect of EVs on noise at the roadside at 20 mph in 2030*

	Max. EV noise differential (dB)	% of EVs in the vehicle parc in 2030	Estimated noise difference (dB)	Cost per household (£)	Total Cost to Black Country (£)
2030 - Medium	4.5	7.1%	0.32	£3.07	£1,492,000
2030 - 2035 Ban		16.2%	0.73	£7.01	£3,405,000
2030 - 2032 Ban		25.0%	1.13	£10.82	£5,254,000

Using these assumptions, the maximum mitigated damage cost benefits from noise reduction are approximately one quarter of the benefits from CO2, NOX or PM reductions individually.

Tyre/road contact technology

Newly manufactured tyres can reduce traffic noise by two to four decibels[72]. Under current regulations all type approval tyres must be labelled for noise at point of sale and must meet criteria for noise generation[73]. However, there is little incentive for vehicle owners and operators to choose quieter tyres. The EU has acknowledged that incentives would be needed to increase uptake of low noise tyres, though there are no plans in place to develop such incentives.

70 DfT WebTag table A3.1 – Monetary value of changes in noise level
71 Office for National Statistics, Estimated number of households by local authorities of England, 2004 to 2016
72 Taylor, R. (2012), 'An investigation into the effect of historic noise policy interventions: Final Report: Annex 3'
73 European Federation for Transport and Environment (2009), 'Tyre Labelling COM (2008) 0779 – COD'

Connected and Autonomous Vehicles

Connected and Autonomous Vehicles (CAVs) are known to reduce and smooth accelerating and braking. This is likely to reduce noise emissions as accelerating vehicles emit more noise than those at a constant speed, with acceleration accounting for 10% of all traffic noise[74]. Table 18 shows the effect of accelerating on vehicle noise at 50 km/h (~31 mph)[75].

Table 18: *Effects of moderate and harsh acceleration of vehicles compared to 50 km/h constant speed*

Acceleration	Noise Influence	Note
0.5 m/s2	+2.1 dB	Moderate acceleration
1.0 m/s2	+4.5 dB	High acceleration

4.5 Economic Benefits of EV Charging Infrastructure

The installation and operation of EV charging infrastructure can also have regional and local economic benefits. These include:

- **Regeneration:** Increasing patronage of local businesses, improving access to employment and improving public health.
- **Planning:** Ensuring new-build houses are fit for the future, retaining value as the UK transitions towards 100% electric forms of mobility.
- **Business growth:** Enabling fleets to use EVs, generating operational cost savings that can support growth and create jobs.
- **Skills & employment:** Increasing demand for skilled labour to install and maintain EV charging infrastructure
- **Tourism & trade:** Developing an environmentally-friendly image, attracting eco-conscious individuals and businesses to visit and trade.
- **Inward investment:** Encouraging and facilitating organisations of the future to invest in the local area by providing infrastructure essential to operating EVs. This is key to ensuring the region keeps pace with UK policy and the wider UK transport network and is not left behind.

Of these benefits, it is arguable the skills and employment benefits that may be most pronounced in the short term. The scale of growth required in the Black Country EV charging network will generate additional demand for skilled labour, likely focussing on the civil and electrical engineering disciplines. These skills will be in demand to install, maintain, repair and replace EV charging infrastructure. At a national level, potentially millions of EV chargepoints will need installation and maintenance in the UK, so local recruitment will have considerable advantages in reducing the time and cost needed to provide an ongoing service that meets the needs of customers.

Unlike other newly emerging industries, such as software and web development, the fundamental engineering skills required to install and maintain EV charging infrastructure have been practised by electricians for decades. The education and training infrastructure is therefore well developed and highly accessible to individuals from all backgrounds.

In order to maximise the local skills and employment development opportunities presented by the expansion of the EV charging infrastructure network, Black Country local authorities should engage with local training providers to ensure that the local labour market is ready to respond to demand. With a local labour market rich in electrical and civil engineering skills, the growth of the EV infrastructure network can serve to create long-term skilled labour.

74 Mitchell, P. (2009), 'Speed and Road Traffic Noise' – UK Noise Association

75 Ellebjerg, L. (2007), 'Noise Control through Traffic Flow Measures' - Danish Road Institute

Black Country authorities should seek to engage with local training providers to ensure that the local labour market is equipped to install and maintain any eventual Black Country EV chargepoint network.

Whilst outside the scope of this project, Cenex would be glad to support further quantification work on the economic benefits of EV Charging Infrastructure.

4.6 Conclusions

Examining the projected benefits, the following conclusions can be drawn:

Emissions Reduction:

- If the 2035 Ban scenario is followed, 1.3% CO2, 10% NOX and 25% PM road transport emissions reductions are projected by 2025.
- Only the Ban scenarios show significant changes in CO2 due to the aggressive phasing-out of petrol, diesel and hybrid vehicles, producing 50-60% reductions by 2040.
- PM reduction is good throughout due to recent standards changes which will remove NOX and PM emissions, even in the Mid scenario.
- None of the scenarios produce a net-zero car and LGV parc by 2040, meaning the road transport component of 2041 net-zero target for the West Midlands is difficult to achieve.
- However, maintaining (or slightly reducing) the vehicle parc has a significant effect on the total CO2 produced by vehicles and the 2041 target becomes within reach for road transport.

Mitigated Damage Costs:

- Total annual savings of between £20m and £55m are available from emissions reduction by 2030, depending on scenario.
- In the 2035 Ban scenario, this equates 1/3 of 1% of the Black Country's GDP.

Noise Reduction:

- The noise from the engines of petrol or diesel vehicles is louder than EVs at lower speeds, especially if higher gears are selected.
- However, the UNECE technical standard for EVs reduces this difference so that noise reductions are likely to be restricted to roads with average speeds of 12 – 20 mph.
- The maximum mitigated damage cost benefit from noise reduction is approximately one quarter of the benefits from individual CO2, NOX or PM reductions.
- Improved tyre technology or Connected and Autonomous Vehicles may add additional improvements but these technologies are not yet prevalent.

Economic Benefits:

- The economic benefit from installation or operation of EV charging infrastructure is felt regionally and locally in regeneration, planning, business growth, skills/employment, tourism/trade and inward investment.
- The skills and employment benefits are already well-developed and accessible.
- Black Country authorities should seek to engage local training providers to ensure the local labour market is ready to install and maintain chargepoints.

5 Vision (WP4)

This section brings together the baselined current situation (Section 2), projections and gap analysis (Section 3) and modelled benefits (Section 4) with the views of key stakeholders within the Black Country authorities to develop a ULEV Vision.

This vision focuses on the milestones that the Black Country would like to achieve for emissions, vehicles, infrastructure, policy and innovation over the next five years.

5.1 Stakeholder Interviews

5.1.1 Methodology

Individuals with key roles in the Black Country authorities were selected to take part in stakeholder interviews prior to the visioning workshop. The purpose of the interviews was to prepare the ground for the workshop by:

- briefing interviewees on the project;
- getting a sense of their motivations and drivers for the ULEV Strategy;
- establishing their understanding of the current situation;
- bringing some facts and figures into the conversation from the baselining, projection and benefits work; and
- understanding their level of ambition.

17 interviewees took part in 45-minute telephone interviews in March 2020 where their personal and organisation attitudes were examined, initial levels of ambition and perceived barriers were explored.

5.1.2 EV Priorities

Interviewees agreed that their councils do give some priority to EVs. However, they frequently commented that activities were uncoordinated and hampered by funding availability and demographics. It was felt that local authorities decide to do things sporadically mainly because there are no clear roles, responsibilities and acceptance of the situation in councils. Nonetheless, everyone recognised that things may ramp up soon and they are doing their best to ensure inclusive growth.

5.1.3 Rationale for EV Uptake

Respondents expressed the view that the transition to EVs is ‘inevitable’ and they should do the right thing at the right time. With this in-mind, the following underlying drivers for an ULEV strategy development were captured:

- Air quality issues;
- Climate change;
- Comply with national targets;
- Traffic congestion;
- Lack of knowledge and a better understanding of the technology;
- Strong funding initiatives;
- Energy-related drivers;
- More and more enquiries from residents;
- Council fleets need replacement; and
- On-street charging.

5.1.4 Black Country Capability

The interviewees’ opinions of the Black Country’s strengths and weaknesses in implementing an ULEV strategy are summarised in Table 19:

Table 19: Black Country strengths and weaknesses, according to interviewees

Strengths	Weaknesses
• Common strategy approach • Good team spirit among Black Country • Similar demographic • Centre of car manufacturing – a lot of manufacturing capability • Vehicle replacement budget	• Lack of a strategy • Big air quality issues – extra challenge due to vehicles passing through the area • Grid capacity constraints • Limited chargepoint infrastructure • Deprived areas • Limited resources and capability in local teams

5.1.5 Current Status and Level of Ambition

The interviewees then assessed the current status and expressed their ambition regarding emissions, vehicles, infrastructure and innovation. This part of the interview was designed with closed and open-ended questions. Closed ended response formats included single select and Likert scales, enabling quantitative analysis of the answers, which are broken down into four sub-sections, below:

Vision for emissions

Most of the interviewees replied that their area is performing 'very poorly' or 'poorly' for CO2 emissions reduction. The vast majority 'strongly agreed' that Black Country should reduce CO2 emissions in 5 years. It was recognised that a dramatic reduction is needed and that the area should follow national policy objectives.

Except for London, the West Midlands suffers from the most extensive exceedance of the EU limits for NOX in the UK. However, 47% of interviewees rated NOx reduction performance in the area 'very poor' or 'poor', 24% 'neutral', and 12% 'very good' or 'good'. 17% replied "don't know".

The statement that Black Country should reduce NOx emissions was supported by the vast majority. It was mentioned that strict emission standards should be enforced and ways should be found to encourage drivers to change their driving behaviour. Interviewees' view on PM reductions followed the same pattern.

Vision for vehicles

Most of the subjects replied that the Black Country is performing 'very poorly' in EV uptake, while the rest were 'neutral' considering the challenges due to demographics.

Nearly all agreed that the Black Country should increase the proportion of electric cars and vans by a factor of five over the coming five years. It was mentioned that although this target might sound too ambitious, there will be soon affordable models available and a second-hand vehicle market as well as benefits to acquire an EV.

60% of the respondents believed the Black Country is performing 'very poorly' or 'poorly' in council fleet electrification. It was felt that the region should take the lead and aim for a healthy percentage of zero emission council fleet.

An overwhelming majority judged that ULEV public transport is performing 'very poorly' or 'poorly'. Some proposed 100% electrification of buses while others felt that even 20% of buses being ULEVs would be challenging since most of them are privately operated.

Respondents had diverse opinions on congestion management performance in the area. A few pointed out that there is no protocol in place and there is a lot to be done, while the rest opined that there is a good knowledge and monitoring across the area. Regarding their ambition for congestion management, interviewees discussed the establishment of more clean air zones.

With regards to active travel, a small minority of the key stakeholders interviewed considered the performance of the area 'good' and just around a half labelled it 'very poor' or 'poor'. The respondents suggested that the active travel could be improved by promoting bike schemes, developing dedicated lines for cyclists, public engagement with individual transport advice and promoting work-from-home.

Vision for infrastructure

A significant proportion of the respondents mentioned that EV chargepoint provision is very patchy and insufficient, while a small minority specified that the EV provision performance is 'good', considering the current EV uptake. Most of the interviewees commented that Black Country should not increase chargepoints massively but wisely, focusing on on-street charging, car park charging provision and development of charging hubs with fully integrated payment mechanisms.

Around 90% were positive that many residents are no more than 5 minutes away from a rapid chargepoint. Just 6% of the respondents 'strongly disagreed' with the above ambition, since they suggested that installation should be in targeted locations with high utilisation potential instead.

Vision for innovation

All the respondents agreed that there are great opportunities arising from innovation. Thus, the Black Country should find a way to maintain innovation in the area. The following innovative ideas were captured in the interview:

- Renewable on-site generation using public sector buildings;
- Energy hubs and refuelling stations;
- Energy storage;
- On-street charging;
- Load management;
- Vehicle-to-Grid (V2G);
- Wireless charging;
- Connected and Autonomous vehicles for street cleaning cars;
- Hydrogen and fuel cell large vehicles; and
- Data analysis for traffic regulation.

5.1.6 Output Data

The full script, interview notes and response analysis can be found in the Supporting Documentation accompanying this report.

5.2 Workshop

5.2.1 Methodology

Using the outputs from the interviews, a workshop was constructed to create consensus between the local authorities on the vision by indicating the overarching direction for emissions, vehicles, infrastructure, policy, innovation for the ULEV programme.

Due to the covid-19 lockdown, the meeting was conducted as an interactive online conference, rather than a traditional face-to-face workshop. 22 participants attended (16 from Black Country and TfWM, 4 from Cenex and 2 from Cenex's design agency), held on Microsoft Teams with feedback via sli.do. Each section of the agenda started with an initial presentation of evidence from the research and findings from the interviews. Then participants used the sli.do Q&A feature to ask questions or clarifications before voting on polls to determine if there was consensus.

Despite the digital nature of what would normally require in-person attendance, all participants felt that the format was effective and therefore the outputs were valid.

5.2.2 Poll results

Underlying Drivers

82% of participants felt that the Black Country is lagging behind the West Midlands regarding the ULEV performance. Strikingly, nearly three quarters felt the Black Country should lead the way in the West Midlands while roughly one quarter replied that Black Country should maintain the current performance.

In order of importance, the top drivers for the development of an ULEV strategy were climate change, air quality and economic growth. National legislation, requests from residents and congestion followed behind.

Vision for emissions

Throughout the polls for the three emissions types, most of the participants agreed that the 2035 ban scenario was the most appropriate to target. That is, Black Country should target a 1.25% transport CO2 reduction, 10% NOx reduction and a 35% reduction for PM.

Vision for vehicles

Respondents were evenly split with 30% of respondents desiring to target the Mid and 2032 ban scenarios (corresponding to a 2.5% and 6% EV uptake target in 5 years).

This result was the one where the least consensus was observed, with 1/3 of respondents moderating their responses due to their concerns about the impact of the covid-19 pandemic on the ability of drivers to switch to EVs. However, analysis of the individual responses did not show a correlation between those who voted for the Mid scenario and indicated that the economic crisis caused by covid-19.

! Given the importance of economic growth in driving a switch to EVs, the moderation of some responses here is taken as an indication of how the ULEV strategy, vision and implementation plan should be communicated at this economically challenging time, rather than an indication that ambition should be scaled back.

This result drove the decision to present the Mid, 2035 Ban and 2032 Ban scenarios in this report.

In further questions on vehicles, most of the respondents agreed that 100% of council fleet replacements should be electrified. For HGVs and buses, participants indicated that a full fleet review should be completed, and a decarbonisation plan should be agreed in 5 years.

On the topic of public transport, participants advised that key routes should be electrified, and all new licensed taxi and private hire vehicles should be ULEVs.

Despite these levels of ambitions, 83% of participants were ‘very unconfident’ or ‘unconfident’ that the net-zero 2041 target would be met. Therefore, there was strong agreement that the vehicle parc should be shrunk. A sample of ways suggested to shrink the vehicle parc was collected:

- Restrictions on residential parking;
- Working from home where possible;
- Promotion of car clubs;
- Better active travel infrastructure;
- Incentivise lift sharing; or
- Scrappage schemes.

A check-point at this stage confirmed that the infrastructure and energy implications of the workshop decisions on emissions and vehicles were acceptable and accepted.

Vision for infrastructure

All the participants agreed that Black country should aim for a minimum of five minutes' distance from a rapid charger in five years' time. Just over half of them proposed 500 meters as a minimum distance from on-street charging for densely populated areas, with a third suggesting 250m.

All participants agreed that council offices, depots, car parks and sports facilities should be equipped with a minimum level of EV charging infrastructure. A majority of respondents agreed that the requirements for active chargepoint provision at commercial, retail and industrial should go beyond the legal minimum and serve between 15 and 25% of car park spaces.

Vision for innovation

The key priorities for innovation projects and research for Black Country were prioritised as follows:

- Extension of Swift Card to purchase EV charging;
- On-street innovative charging solutions;
- On-site generation;
- Lamp-post charging;
- Energy storage; and
- Zero-emission last-mile solutions.

A number of barriers to the overall vision were captured, which might also form the basis of useful innovative research:

- Behaviour change;
- Commercial interests;
- Competition for on-street parking;
- Economic deprivation;
- Existing infrastructure;
- Funding availability;
- Grid capacity;
- Lack of action;
- Lack of affluence in the Black Country;
- Political will;
- Public resistance; and
- Resourcing.

These topics should be used to engage with research and funding organisations like Innovate UK to ensure that the Black Country becomes the location for strategic pilots of innovative solutions.

5.2.3 Detailed Results

Detailed responses from sli.do have been supplied in the Supporting Documentation accompanying this report.

5.3 ULEV Vision

5.3.1 Vision Statement

Taking the analysis, interview output and workshop results into account, the following ULEV Vision is proposed:

The Black Country will lead the West Midlands on the road to net-zero by accelerating and amplifying the EV transition in anticipation of a 2035 ban on the sale of conventional vehicles.

By 2025, this will be achieved by:

- Installing an additional 380 standard and 110 fast charging sockets;
- Coordinating with TfWM to support installation of additional rapid and ultra-rapid chargers;

- Leading by example by procuring only EVs for all new council cars and vans
- Equipping all council offices, depots, car parks and sports facilities with chargepoints;
- Publishing a local public transport decarbonisation action plan;
- Requiring most taxi and private hire vehicles to switch to ULEV;
- Encouraging businesses and retail outlets to deploy chargepoints in their car parks;
- Deploying measures to slow the growth of the vehicle parc; and
- Establishing a programme to inform and encourage the public and businesses

If successful, this will deliver:

- A 1% reduction of transport CO2 emissions;
- A 10% reduction of transport NOX emissions;
- A 35% reduction of transport PM emissions;
- An increase of the number of EVs to at least 4% of the vehicle parc;
- Over 90% of the population within 5 minutes' drive of a rapid charger; and
- Over 90% of the population within 500m of any public chargepoint.

5.3.2 Rationale

The Vision is based on the 2035 ban scenario for a number of reasons.

Firstly, this seems the most likely scenario to be adopted by the UK Government once it has completed its consultation on the adjustment of the target. Whilst the Secretary of State for Transport is on record floating a 2032 date, this was not well-received by industry and other groups as it does not give enough time for a just transition or a sufficiently wide range of alternative vehicles to be provisioned. With the disruption from covid-19 and the cancellation of the COP26 conference, the timeline for the decision may be delayed but also the level of ambition watered-down. The adoption of a 2035 ban on conventional petrol, diesel and hybrid vehicles by the UK Government would be an external factor that the Black Country authorities cannot control. Since this appears to be the most likely scenario at the time of writing, it makes sense to adopt this as the basis for the vision.

Secondly, this scenario best-fits the reasons that the Black Country wish to have a ULEV programme. When the drivers for wanting a ULEV strategy were explored in the workshop, the top three reasons were (in order of priority): climate change, air quality and economic growth. If CO¬2 reduction is the highest priority, then the emissions analysis in Section 4.2 indicates that this simply won't be achieved by the Mid or even the High scenarios. Only the 'ban' scenarios deliver CO2 reductions, and even then only after a number of years on that path. The second priority is air quality, which would imply that the strictest scenario (2030 Ban) would be best. However, this would mean taking a leading position well ahead of the wider market and the West Midlands region, which would be costly and risky. The third priority was economic growth, which was also reflected in some workshop participants moderating their ambitions due to the impacts of the covid-19 pandemic. Therefore, the least ambitious Ban scenario (that is the 2035 Ban) seems to be the best-fit for the underlying drivers as expressed by the Black Country's representatives.

Lastly, the 2035 Ban scenario seems to best balance keeping options open for future strategies. This is best illustrated by examining the possible paths between the scenarios (Figure 33).

The three solid lines are the projected number of 7 kW charging sockets for the Mid (grey), 2035 Ban (blue) and 2032 Ban (green) lines. The blue dot-dash line shows the trend if at 2025 a switch is made to the Mid scenario, the blue dash-dash line shows what is needed if at 2025 a switch is made to the 2032 Ban scenario and the grey dash-dash line shows what is required if at 2025 a switch is made from the Mid to the 2035 Ban scenario.

If the Mid scenario is selected but upon review in five years' time EV adoption rates are more in-line with the 2035 Ban or even 2032 Ban scenarios, then a significant acceleration is required in the deployment of 7 kW infrastructure to bring the Black Country in-line.

However, if the 2035 Ban scenario is selected but upon review, EV adoption rates have been slower, then nearly 2/3 of the 2030 Mid scenario requirement has already been delivered. There is no need to go backwards, so low risk of stranded assets. Instead, a solid base has been built from which to review.

In fact, if there is a requirement to accelerate to the 2032 Ban scenario, then the uplift to provide for 2030 infrastructure demand is not that different to if the 2032 Ban scenario was followed all along.

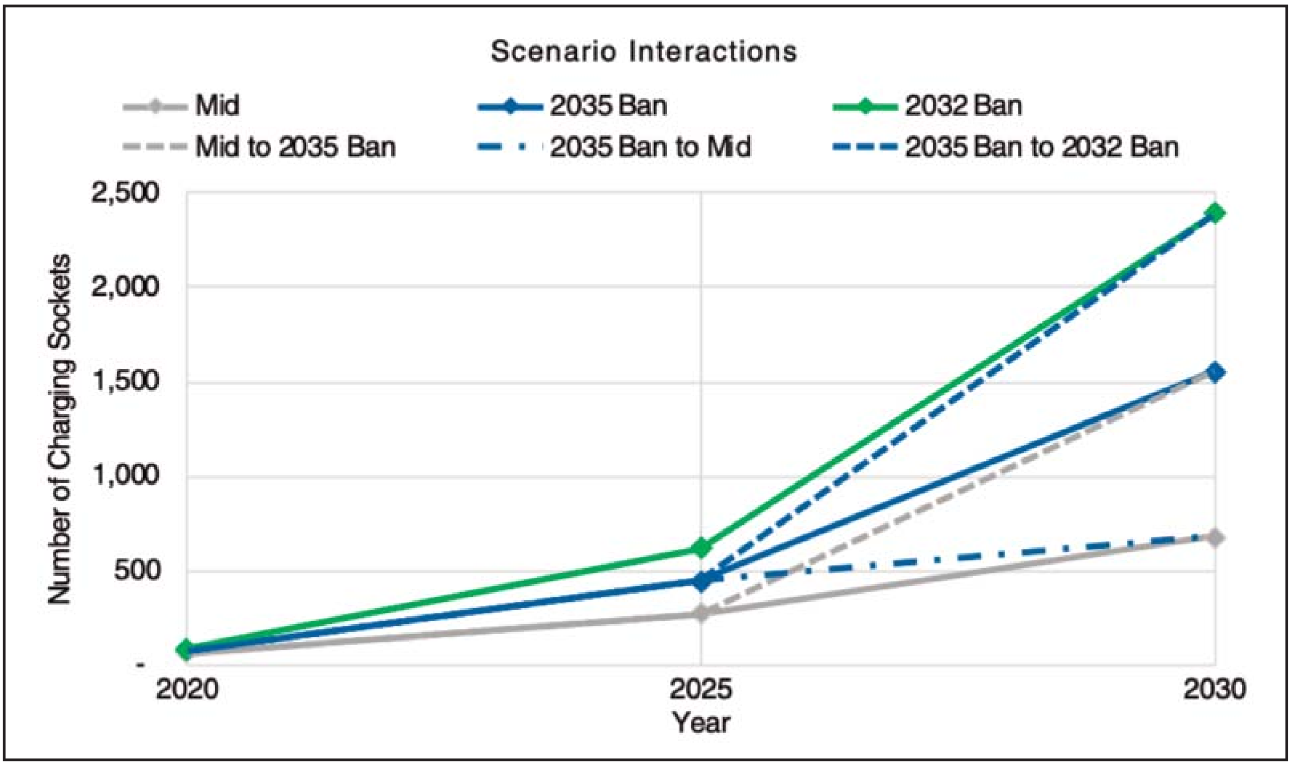


Figure 33: *Interactions between scenarios*

5.4 Infographic

With this vision in-mind, Cenex liaised with the design team from PDC to produce a graphic image which captures the Black Country's vision by incorporating ideas and objectives agreed in the workshop.

A stylised road image was chosen to allow the current status, short-term 2025 targets and longer-term (2030+) ambitions to be articulated. This will form a key document to convey the vision and help Black Country local authority staff, businesses and the public to understand what is hoped to be achieved and when.

Black Country Ultra-Low Emission Vehicle Vision

2020

Launch **Public Engagement** Programme

- Resource the ULEV **Programme**
- Initiate **Regional** Co-ordination
- Consult on **Proposal** & Adopt **Policy**
- **Full Business** Case **Development**

2021

- Secure **~£2.25m Funding**
- Deploy Measures to **Reduce Vehicle Parc**

2022

- Install First **Rapid** & **Ultra-Rapid** Charging Hubs
- All **New Council Cars / Vans** are **EVs**
- Publish Public Transport **Decarbonisation Plan**

2023

- **Refresh Planning** Policy
- All **New Taxi / PHV** Licences **EV**

2024

- Equip **Council Sites** with Chargepoints

2025

- **>90%** Black Country Land Area **Under 5 Minute** Drive from **Rapid Chargepoint**
- **380 Standard** Chargepoints Installed
- **110 Fast** Chargepoints Installed
- **Refresh** the **ULEV Vision** and **Strategy**

2028

- Wolverhampton Council **Net-Zero** Target

2030

- *Subject to scenario:*
  ~1,500 Standard Chargepoints Installed
  ~300 Fast Chargepoints Installed
- **£20m to £50m** Total Annual **Savings** from **Emission Reduction**, depending on scenario
- Walsall Council **Net-Zero** Target

The Black Country will lead the West Midlands on the road to net-zero by accelerating and amplifying the EV transition in anticipation of a 2035 ban on the sale of conventional vehicles.

Dudley Metropolitan Borough Council | Sandwell Metropolitan Borough Council | Walsall Council | City of Wolverhampton Council | Black Country LEP – Building Growth with Midlands Engine – HM Government

5.5 Conclusions

Bringing together all the work presented so far, the following ULEV vision is proposed:

The Black Country will lead the West Midlands on the road to net-zero by accelerating and amplifying the EV transition in anticipation of a 2035 ban on the sale of conventional vehicles

By 2025, this will be achieved by:

- Installing an additional 380 standard and 110 fast charging sockets;
- Coordinating with TfWM to support installation of additional rapid and ultra-rapid chargers;
- Leading by example by procuring only EVs for all new council cars and vans
- Equipping all council offices, depots, car parks and sports facilities with chargepoints;
- Publishing a local public transport decarbonisation action plan;
- Requiring most taxi and private hire vehicles to switch to ULEV;
- Using planning policy to deploy chargepoints at retail and business car parks;
- Deploying measures to slow the growth of the vehicle parc; and
- Establishing a programme to inform and encourage the public and businesses

If successful, this vision will deliver:

- A 1% reduction of transport CO2 emissions;
- A 10% reduction of transport NOX emissions;
- A 35% reduction of transport PM emissions;
- An increase of the number of EVs to at least 4% of the vehicle parc;
- Over 90% of Black Country land area within 5 minutes' drive of a rapid charger; and
- Over 95% of urban areas within 500m of any public chargepoint

An infographic has been produced to present this vision.

6 Implementation Plan (WP5)

This section takes the vision and outlines the next level of detail in the form of an implementation plan for the delivery of the vision in order to meet the agreed targets.

6.1 Infrastructure Targets

The vision gives a clear set of milestones for the Black Country to target in the coming years. These are laid out in detail in Section 3.3 on page 42, but repeated in Table 20 to give context to the implementation plan details which follow.

Table 20: *Recommended infrastructure deployment targets*

Scenario	Year	7kW	22kW	50kW	150kW	Total
2035 Ban	2020	77	21	5	4	107
	2025	443	119	30	4	596
	2030	1,555	300	90	22	1,967
	2035	2,976	687	263	116	4,042
	2040	4,004	810	282	302	5,398

The additional energy demand and impact on the distribution grid of this scenario are detailed in Section 3.4, implying an additional theoretical maximum 140 MW by 2025, rising to around 550 MW by 2030. As this analysis concluded, this energy demand is anticipated to be concentrated in suburban areas where the population is more likely to be early EV adopters and this is where the focus should be for early infrastructure investment to avoid overloading the grid.

6.2 Strategic Infrastructure Locations

Whilst the focus of the ULEV vision is likely to be on residential and destination charging, a top-down mapping exercise was conducted to identify potential EV charging infrastructure sites of regional strategic significance. This list will allow the Black Country to engage with the WMCA's regional planning for transit and charging hub locations, as well as commission more detailed site surveys.

6.2.1 Site Identification Methodology

The top 50 retail, commercial and industrial sites by land area were identified and combined with further information on existing transport hubs to inform a long-list of potential locations for EV charging hubs. The location of existing EV charging infrastructure was also considered, to ensure any new suggested sites were in locations which required the infrastructure the most.

The results of the mapping exercise are shown in Figure 34. Seven shortlisted sites are discussed further in this section.

- ! Note that the names given to each site are for geographical reference only and are not a recommendation that charging infrastructure is installed at that exact site.
- ! The sites are listed in order of their mapped locations, and not in order of which are the most suitable for installing infrastructure.
- ! Site selection has prioritised areas where there is currently little or no provision of public EV charging infrastructure.

6.2.2 Shortlisted Sites

Site 1 – Aldridge (Walsall)

With its many large industrial and retail sites, Aldridge is an ideal location for the installation of public EV charging infrastructure. It is an area which is currently not within a kilometre of any existing infrastructure. However, earlier analysis indicates is likely to have a relatively high number of EV early adopters who could make use of this.

The most suitable sites to install infrastructure here would be council-owned car parks (such as Rookery Lane) or town centre supermarket car parks (such as Morrisons). Although the main use of charging infrastructure is likely to be for residents and visitors to the town centre, there could be some transit use from those travelling into Walsall from surrounding areas.

Site 2 – Walsall Interchange (Walsall)

This interchange sits at a junction between the M6 and the A454, a major route connecting Walsall and Wolverhampton and is adjacent to two top-50 retail areas as well as two hotels. This site would therefore be appropriate for workplace or commercial use by organisations located nearby and for visitors to the retail areas and hotels as well as for people travelling along the M6.

Site 3 – Oldbury (Sandwell)

The town of Oldbury contains two of the largest retail areas and three of the largest commercial sites within the Black Country, so is well-suited for workplace and commercial charging infrastructure as well as charging for residents and visitors to the town. The sites of Sandwell Borough Council buildings also present opportunities to install infrastructure supporting the future electrification of council fleet vehicles.

Site 4 – Oldbury Roundabout (Sandwell)

Oldbury roundabout is situated at the junction of the M5 with Wolverhampton Road, which connects Wolverhampton to Birmingham, making it an ideal location for a transit hub. Several fuel stations and surrounding retail and commercial areas could be suitable locations for installing charging infrastructure. Although there is already an existing standard chargepoint located at the Asda just off the junction, this area is well suited for transit charging which would require the addition of a rapid charging infrastructure.

Site 5 – Blackheath (Sandwell)

Blackheath is the location of several large employment areas as well as sitting at a junction of several major roads. The area scored highly in the Residential Charging Index analysis (see Section 2.3.2) and a high number of likely EV early adopters who would make use of the infrastructure. Council-owned car parks in the town centre present as good locations for installing public charging infrastructure, such as Park Street and Short Street car parks. This would provide charging for visitors to the town centre and its many retail sites, workplace charging, and potentially residential charging for nearby residents with no off-street parking.

Site 6 – Bilston (Wolverhampton)

The area surrounding Bilston contains several of the Black Country's largest retail and industrial sites, so the area is well-suited for destination and workplace charging. There also two junctions of major roads as well as fuel stations in the area, making the area well-placed for transit charging. Council-owned Pinfold Street carpark (which has two electricity substations adjacent to it) and the Springvale Retail Park appear to be ideal locations for the installation of charging infrastructure.

Site 7 – Wednesfield (Wolverhampton)

Wednesfield has several large employment areas, including retail and industrial sites, leisure facilities and a nearby hospital. There is likely to be workplace and destination charging demand, as well as use by those travelling along the major road into Wolverhampton. The Bentley Bridge Retail Park and the council-owned Woodhouse Fold car park appear to be the most suitable locations for installing infrastructure in this area.

Overall, the shortlisted site that presents as the quickest win for the Black Country is Bilston (Site 6). This is due to its relatively central location in the Black Country at the junction of several major roads and its multiple large employment sites. It also has several sites at which it would be easy to install infrastructure. Additionally, this location addresses a gap where there is currently limited access to charging infrastructure.

Site 8 – Castle Gate Island (Dudley)

At the junction between the A461 and the A4123 – connecting Dudley to Sandwell, Wolverhampton and onwards to Birmingham – there is a cluster of retail, leisure, commercial and industrial activity. Large car parks accompany developments such as Castlegate Park leisure park, providing adequate space to explore the installation of an EV charging hub. The site is near key leisure and business points of interest including Castle Hill, the Black Country Living Museum and the Midland Metro & Light Rail Innovation Centre. The site is also close to residential properties, many of which do not have access to off-street parking.

Site 9 – Intu Merry Hill (Dudley)

One of the largest retail attractions in the West Midlands, Intu Merry Hill represents a high footfall development with multiple large car parks providing capacity to install multiple chargepoints. The site is also immediately south of The Waterfront commercial and leisure attractions, which itself possesses a car park of sufficient size to host a charging hub. There are currently two 7 kW chargepoints on site, with a single 50 kW rapid chargepoint nearby.

This study has taken a top-down strategic perspective to identifying sites where the installation of EV charging hubs could have significant regional benefits. Further site-level study – looking at factors such as distribution network capacity, land ownership and planning constraints – is required in order to determine the feasibility of implementing EV charging hubs at the sites described in this section.

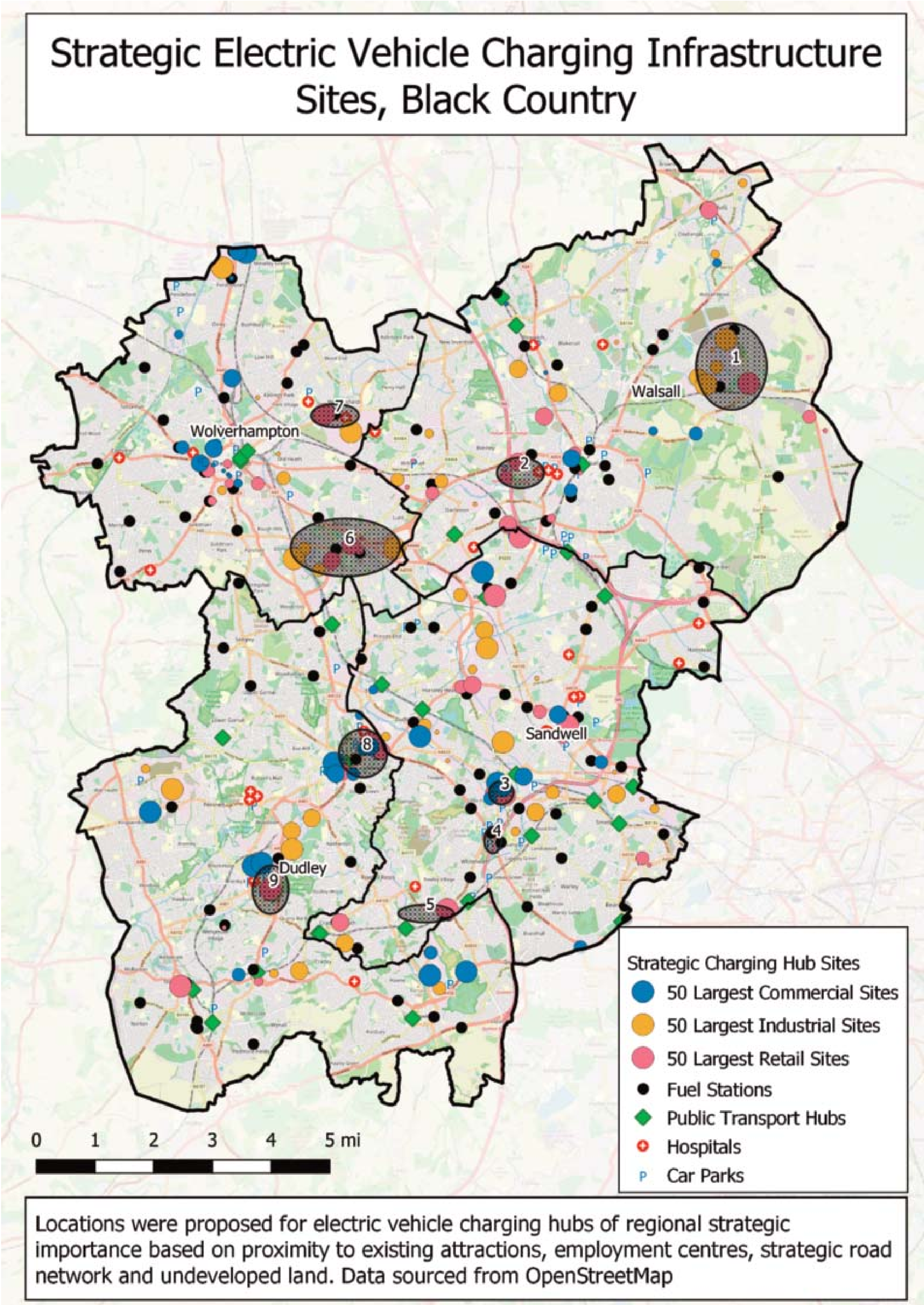


Figure 34: *Potential strategic charging hub locations*

Nine strategic locations for charging hubs have been identified as possibilities to support the ULEV Vision as the Black Country's input into the coordinated WMCA rollout.

6.3 Ownership Models

With the infrastructure targets and potential sites in-mind, an implementation plan should be constructed to deliver the required uplift in infrastructure. Firstly, an ownership strategy should be agreed to balance financial inputs, non-financial risks and benefits, to guide future procurement approaches.

6.3.1 Common Models

There are four common ownership models through which EV charging infrastructure is typically deployed. Whatever the targets of the ULEV programme, consideration should be given to the operating model(s) which the Black Country deploys.

In each model, elements of the capital cost, operating cost and revenue are shared differently between the landowner (or host) and chargepoint provider. A summary of the proportion of cost incurred and revenue retained by the landowner in different ownerships models is shown in Table 21.

Table 21: *Proportion of costs incurred and revenue retained by landowner for different ownership models*

Ownership Model	Hardware	Groundworks	Back-office	Electricity	Maintenance	Revenue
Own and Operate	100%	100%	100%	100%	100%	100%
External Operator	100%	100%	0%	100%	100%	90%
Lease	0%	0%	0%	0%	0%	20%
Concession	0%	100%	0%	0%	0%	30%

When making decisions on chargepoint ownership models, it is very important to consider the non-financial implications of each model. Whilst the most obvious distinctions between each ownership model are in how costs and revenue are shared, there is also a variable share in the contractual control over how the chargepoints are operated. In most cases, the greater the investment made by an external supplier(s), the greater the control of the supplier(s). In turn, this means that the landowner will have less control over the quality and type of service(s) provided to EV users on their site which, in a worst-case scenario, could create a negative perception of the landowner that they cannot easily address.

From a public sector perspective, the key benefit of taking EV charging infrastructure into public ownership is that the local authority can manage the infrastructure as a service to residents. Without the need to generate significant profit for shareholders, public sector chargepoint owners can set competitive usage tariffs that further incentivise the use of EVs. This also means that EV charging infrastructure can be distributed fairly across all demographics, in the knowledge that short-term losses potentially incurred by chargepoints installed in areas of lower EV adoption are likely to be covered by profit made by those installed in areas of higher EV adoption. Whilst public intervention can have benefits across all types of EV charging infrastructure, it is arguably most urgently needed in areas where private sector investment is unlikely to be forthcoming. The greatest example of such an area is residential on-street charging infrastructure, for which the business case is often weak when compared with rapid charging in high footfall destinations.

Regardless of the ownership model pursued, contractual terms should be sought that ensure both financial and reputational risk are fairly distributed and that the level of service to EV users is maintained to the satisfaction of the landowner.

6.3.2 Ownership Model Comparison

Each model is analysed qualitatively to enable a comparison between them. The key criteria for the Black Country are the suitability for specific EV charging applications and financial/operational aspects which are important for planning an EV infrastructure network.

Each model is scored from one (least ideal) to five (most ideal) against eight criteria. The definition of each criteria is shown in Table 22.

Table 22: *Definition for criteria used to score different ownership models for their suitability.*

Group	Criteria	Definition
Charging Infrastructure Types	*Residential*	Suitability to implement and operate lower-powered EV charging infrastructure in residential locations, typically using 7 kW chargepoints.
	Destination	Suitability to implement and operate mid-powered EV charging infrastructure in destinations such as retail, leisure and tourist attractions, typically using 22-50 kW chargepoints.
	Transit	Suitability to implement and operate high-powered EV charging infrastructure in transit locations such as on the strategic road network and/or motorway services, typically using chargepoints rated 50 kW or higher.
	Hub	Suitability to implement and operate clusters of high-powered EV charging infrastructure, with multiple chargepoints, typically using chargepoints rated 50 kW or higher.
Network Finance and Operation	*Revenue*	Potential to generate ongoing revenue for the local authority and/or landowner.
	Risk	Short-to-medium-term financial risk to local authority and/or landowner.
	Service	Ability for local authority and/or landowner to control the level of service provided to EV users. This accounts for factors such as network interoperability, ad-hoc payment, open data and equipment reliability
	LA Resource	The amount of internal resource required to implement and operate EV charging infrastructure under the given ownership model.

Own and Operate

The "Own and Operate" model is the most involved level of intervention for the landowner. All costs are covered and all revenue is retained by the landowner. The landowner prepares the site, including groundworks and electrical connection, procures the EV charging equipment, funds the installation of the equipment and purchases a back-office system to manage the chargepoint. All revenue is hence retained by the landowner.

By comparison with other ownerships models, Own and Operate offers the greatest revenue opportunity but also the greatest risk to the landowner. In this model, the landowner has control over all aspects of how the chargepoint is operated, including tariffs and network compatibility.

Table 23: *Assessment of Own and Operate model*

Own and Operate							
Charging Infrastructure Types				Network Finance and Operation			
Residential	Destination	Transit	Hub	Revenue	Risk	Service	LA Rescource
5	3	3	2	5	1	5	1

Where the Own and Operate business model is particularly appropriate is in providing overnight charging infrastructure in residential areas. This is because the short-term commercial business case for investing in residential charging infrastructure is often unattractive and therefore can be difficult to procure suppliers who are prepared to accept the associated short-term financial risks.

External Operator

The "External Operator" model is identical to the Own and Operate model in all regards except that the operation of the chargepoint is agreed with an external supplier. The supplier then provides the back-office system at no direct cost, in return for a share of net revenue gathered by the chargepoint.

This ownership model removes some of the operating expense associated with the chargepoint, therefore reducing the risk whilst retaining most of the revenue gathered by the chargepoint. The capital investment is still entirely provided by the landowner and, in all regards except for network compatibility, the landowner retains control of how the chargepoint is operated.

Table 24: *Assessment of External Operator model*

Own and Operate							
Charging Infrastructure Types				Network Finance and Operation			
Residential	Destination	Transit	Hub	Revenue	Risk	Service	LA Rescource
4	3	3	2	4	2	4	3

The involvement of a contracted third-party operator to share a degree of the financial risk and take on most of the operational resource reduces risk and resource requirements to the local authority. The local authority will lose some control over the level of service provided, as an external operator would require an additional amount of operational control in exchange for their investment.

Lease

The "Lease" ownership model is the model with the lowest level of investment from the landowner. In this model, all capital and operating costs are covered by an external supplier, with a small share of revenue retained by the landowner in return for making their land available to the chargepoint supplier. This model involves the least exposure to financial risk but also presents the least opportunity for revenue generation.

The Lease model is not without other risks or challenges, however. The success of this model relies on sourcing an external supplier with the appetite to accept the financial risk, which will be dependent on the type of site being offered and the revenue generating potential that it presents. In less ideal sites, external suppliers may seek additional contractual assurances to mitigate long-term risks, such as having autonomy over usage tariffs, a longer lease period, 24-hour access and/or favourable contract termination conditions.

Another key risk to the landowner is that, since the external supplier has ownership of the electrical connection point, the landowner may incur additional costs associated with asset transfer of the connection point at the end of the contract period.

Table 25*: Assessment of Lease model*

Own and Operate							
Charging Infrastructure Types				Network Finance and Operation			
Residential	Destination	Transit	Hub	Revenue	Risk	Service	LA Rescource
1	4	2	5	1	5	1	5

The attractiveness of this kind of proposition to a commercial investor relies solely on the anticipated chargepoint usage. As a result, the Lease model will typically only be appropriate in locations with the high footfall – and high-powered equipment to take advantage of it. The Lease model is therefore unsuitable for residential charging, as footfall is limited and infrastructure is typically low-power.

However, in locations that attract commercial interest, the benefits of the lease model to a local authority are reduced risk and ongoing resource requirements. These benefits come in exchange for lower revenue generation potential and little or no control on level of service provided beyond what is already offered by a supplier.

Concession

The “Concession” model is similar to the Lease model but much of the risk to the landowner is mitigated in exchange for a lower share of revenue. The key difference is that in the Concession model, the landowner provides the capital investment to establish an electrical connection point for an external supplier to install and operate a chargepoint.

The benefit of this model is that, as the landowner retains ownership of the connection point, there is no lasting obligation to the external supplier, beyond the terms of their concession. This increases the control of the landowner over the quality of service.

Table 26: *Assessment of Concession model*

Own and Operate							
Charging Infrastructure Types				Network Finance and Operation			
Residential	Destination	Transit	Hub	Revenue	Risk	Service	LA Rescource
1	3	5	3	3	3	3	3

By sharing the risk and revenue more evenly than is the case with the Lease model, a Concession model can, in some ways, be considered as the middle-ground between public intervention and private enterprise. This approach is particularly appropriate for higher powered infrastructure where meeting the cost of establishing an electrical connection point can be key to unlocking private investment – most likely to be the case in transit charging applications. This approach is less suitability to implement residential charging infrastructure as the cost of establish the connection point can often be a proportionally larger component of overall capital costs required, therefore bringing the balance of risk and revenue into question.

Summary

Table 27 summarises the assessed strengths and weaknesses of each ownership model. Given that analysis has shown that residential and destination charging represents the key gap between the Black Country’s existing EV chargepoint provision and future demand (see Section 3.5), it is recommended that Black Country authorities seek to use an ownership model that supports the delivery of infrastructure in these settings.

Therefore, in the short-term, either the Own & Operate or External Operator models are recommended to deliver the residential and destination charging infrastructure defined in the Vision.

! This approach also complements two key TfWM ULEV Report recommendations: 1) that local authorities take the lead in providing infrastructure for long-duration charging and 2) for TfWM to coordinate the delivery of Hub and Transit charging for the region.

An Own & Operate or External Operator business model is most appropriate to increase provision of residential and destination charging infrastructure in the Black Country, up to 2025.

In the long-term, as provision of transit charging infrastructure and strategic charging hubs increase through stimulation and facilitation by TfWM, it may become more appropriate for the Black Country to become more open to ownership models that allow greater private-sector involvement, such as the Lease or Concession models.

In all scenarios, the local authority should take a leading role in coordinating the private deployment of charging infrastructure to ensure a coordinated and coherent approach, and to avoid over- or under-supply for particular regions.

However, it should be noted that by 2025, much of the risk associated with investing at the present time is likely to have reduced as EV adoption rates have become clearer. Should this be the case, the Black Country authorities may decide to continue with a public-led ownership model in order to secure revenue streams.

Table 27: *Comparison of EV infrastructure ownership model relative strengths/weaknesses and appropriateness for different types of infrastructure installations.*

Ownership Model	Charging Infrastructure Types				Network Finance and Operation			
	Residential	Destination	Transit	Hub	Revenue	Risk	Service	LA Rescource
Own and Operate	5	3	3	2	5	1	5	1
External Operator	4	3	3	2	4	2	4	3
Lease	1	4	2	5	1	5	1	5
Concession	1	3	5	3	3	3	3	3

6.4 Expected Financial Costs

Alongside clarity on the possible ownership models, the implementation plan must inform future financial asks to support the ULEV programme delivery.

! The case for public intervention has already been made in Section 9.2 of the TfWM ULEV Report, so this section focuses on an assessment of the costs of the Black Country infrastructure. Both should be taken together in the formation of any future business case or investment justification.

Based on equipment and installation costs averaged from three confidential industry quotes, total cumulative capital costs for 2025 and 2030 have been estimated across three scenarios. Table 28 shows that in the 2035 Ban scenario, the installation of additional EV charging infrastructure across the Black Country is estimated to have cost around £2.25m by 2025.

Table 28: *Cumulative capital costs of additional public EV charging infrastructure installation by 2025 and 2030.*

	2025			2030		
	<	-	>	<	-	>
Dudley	£400,000	£620,000	£930,000	£1,230,000	£2,860,000	£4,490,000
Sandwell	£330,000	£540,000	£810,000	£1,020,000	£2,370,000	£3,780,000
Walsall	£320,000	£490,000	£720,000	£820,000	£2,200,000	£3,480,000
Wolverhampton	£350,000	£590,000	£810,000	£940,000	£2,590,000	£4,290,000
Total	**£1,400,000**	**£2,230,000**	**£3,270,000**	**£4,020,000**	**£10,020,000**	**£16,030,000**

Legend: *Estimates are for the Mid (<), 2035 Ban (-) and 2032 Ban (>) scenarios. Costs are exclusive of VAT and do not include any distribution network reinforcement costs.*

An estimated £2.25m of capital investment is required for additional charging infrastructure to meet demand by 2025, plus distribution network reinforcement costs.

Between 2025 and 2030, demand for public charging infrastructure is projected to increase significantly. However, the extent of this increase and therefore the level of investment required, has a significant degree of uncertainty of between £1.8m and £13.8m, depending on the rate of EV adoption over the long term. In all scenarios, it is important to note that capital costs increase from

2025 to 2030, which implies that the risk of stranded assets is minimal in this time period. This also reinforces the importance of reviewing progress at 2025 in order to respond to developments in demand.

! Capital cost estimates are exclusive of VAT and do not include additional costs associated with distribution network upgrades. These costs can vary and, in some cases, they can be considerable.

It is recommended that Black Country authorities co-ordinate with the West Midlands Combined Authority, who are working with Western Power Distribution to develop processes that can provide accurate information on distribution network capacity and reinforcement costs.

6.5 Policy Recommendations

The ULEV Vision makes clear that the Black Country wishes to be a leading area within the West Midlands region. Therefore, a broad package of measures will be required to encourage EV uptake by fleets and consumers.

6.5.1 Deliver the Infrastructure

The key pillar in this policy is the deployment of sufficient visible infrastructure in the right places and under sustainable right ownership models to give confidence to car and LGV drivers that if they make a switch, they will be able to charge whether overnight or at destinations.

Furthermore, engaging with the WMCA EV Steering and Working Groups will help to ensure that the Black Country local delivery is coordinated with the delivery of transit and hub charging options by TfWM.

Both deploying infrastructure and engaging with the region's delivery plans will be important steps towards realising the environmental, air quality and social benefits articulated in Section 4. Additionally, this will create opportunities for economic growth, especially through the use of local contractors and supply chains.

It is recommended that the indicative costs are built into capital budget plans to secure the required funding to deliver the infrastructure needed to support the uptake of EVs.

6.5.2 Lead by Example

The baselining work completed in Section 2 revealed that there are only 4 EVs and 12 hybrid vehicles in the four fleets at present, around 1% of the total fleet. With strict 2028 and 2030 internal net-zero targets at Wolverhampton and Walsall respectively, and the wider level of ambition articulated in the Vision workshop, the Black Country authorities should agree to lead by example with their own fleets. The technology is available so that 100% of car and van replacements are electric within the next five years and a review of the bus and HGV fleet can be completed to identify where ULEVs can be deployed.

It is recommended that an in-depth vehicle replacement strategy is agreed so that a clear pathway to net-zero council fleets can be outlined.

Furthermore, the council-owned or council-operated facilities within the Black Country should start to be equipped with EV charging infrastructure to act as demonstrators of the levels of infrastructure which are required. These will have the dual benefit of fulfilling some of the public charging demand as well as potentially stimulating economic demand by attracting EV drivers who would not otherwise have parked at that location.

It is recommended that a minimum level of EV charging infrastructure be installed into council offices, depots, car parks and sports facilities within the next five years.

The exact level of minimum provision can follow any updates to planning policy (see Section 6.5.4).

6.5.3 Lead through Approvals

It is harder for the Black Country authorities to deliver the vision for low-emission public transport. Yet this will be crucial if the number of journeys does not significantly change in the short-term but the vehicle parc size is managed down; public transport will need to pick up the slack. Replacement ULEV vehicles are more limited here and currently not economically viable (see Section 4.1 of the TfWM ULEV Report for more detail) but preparations can be made in the next five years to put the Black Country in a strong position to take advantage of maturing technologies.

It is recommended that key routes are electrified and a local public transport decarbonisation action plan is constructed to match the UK Government's anticipated Transport Decarbonisation Plan, to be released later this year.

The situation is slightly clearer for taxi and private hire vehicles, where good progress has already been made through the Wolverhampton rapid charger deployment for taxis. With an increasing provision of infrastructure, it will be possible to require most taxis and private hire vehicles to switch to ULEV or even EVs. Dundee City Council implemented this policy in 2016, making EVs a scored component of road passenger transport contract tendering. As a result, most of the Dundee TPH operators have started using EVs.

It is recommended to make EVs a scored variable within road passenger transport contract tenders, so that all newly licenced TPH vehicles are EVs within five years.

6.5.4 Encourage through Planning Policy

Whilst the Black Country authorities can lead the way by delivering infrastructure in the places where they have direct control (such as council-owned car parks or the area's streets), the provision of infrastructure at destinations and homes will need further stimulation. Planning policies are an effective way to ensure that infrastructure is being built-out to support the anticipated future EV uptake. By changing planning guidance, new homes and businesses can be encouraged or required to be equipped with charging infrastructure.

The 2018 EU Energy Performance of Buildings Directive (EPBD) has been transposed into UK law. This stipulates that new non-residential buildings and those undergoing renovation provide at least one charging point where there are more than ten parking spaces ('active provision') and installation of ducting and conduits in every space to allow later infrastructure deployment ('passive provision').

Current West Midlands policy recommends going beyond this legal minimum to require one charging point per domestic house with dedicated parking and one charging point per ten unallocated parking spaces[76]. For upgrades to commercial and industrial settings, 10% of parking spaces are recommended to be equipped with chargepoints.

Based on other research completed for the West of England and more recently Nottingham City Council, the West Midlands good practice planning recommendation is assessed to be too weak to deliver the level of ambition which the Black Country authorities have articulated in the vision workshop.

It is recommended that passive provision should be required for a minimum of 20% of car parking spaces for commercial, retail and industrial spaces within five years, with at least one chargepoint per business.

It is recommended that active provision should be required for 100% of on-plot allocated parking, 20% for off-plot allocated parking (with 80% passive provision), and 20% of unallocated parking (with 50% passive provision) in new or upgraded domestic properties.

76 West Midlands Low Emissions Towns and Cities Programme, Planning good practice Guide (May 2014)

Cenex is happy to share the working and research behind these recommendations with Nottingham City Council's permission.

Given the current economic context triggered by the covid-19 pandemic, it may be wise to see how requirements like these can be tied with other measures to ensure that impacts on local businesses in particular are mitigated. For instance, if a workplace parking levy were introduced, the fee could be waived for one year if the business installed a compliant charger on its premises.

6.5.5 Incentives

A raft of incentives have been evaluated in the TfWM ULEV Report. The summary of the analysis of impact, cost and ease of implementation is copied in Table 29 for context:

Table 29: *Summary of TfWM ULEV Report incentives analysis*

Criteria	Workplace Parking Levy	Grants	Public Engagement	Business Engagement	Fleet Reviews	Increased Infrastructure	Vehicle Scrappage	Incentivisation via Procurement	Stimulate the used EV market	Zero Emission Zones
Impact	G	R	A	A	G	G	G	G	R	G
Cost	G	R	A	G	A	A	R	G	G	R
Implementation	A	R	G	G	G	A	R	A	A	R
Recommended?	Y	N	Y	Y	Y	Y	N	Y	N	N

A detailed analysis of the advantages and disadvantages of these options is contained within Section 10.2 of the TfWM ULEV Report.

In-line with the TfWM ULEV Report, it is recommended that the Black Country consider implementation of workplace parking levies, public engagement, business engagement, fleet reviews, increased infrastructure, and incentivisation by procurement.

One aspect particularly worth highlighting is Public Engagement, which is one of the recommended policies. Creation of a clear strategy to engage the public in the switch to EVs and the available infrastructure will be essential to ensure that the Black Country ULEV programme's efforts do not go to waste. The premise of 'build it and they will come' underlies much of the analysis in this report. However, if the public are unaware of the availability of appropriate and reliable charging infrastructure, their range anxiety will not be addressed and the expected EV uptake will not be realised.

The Go Ultra Low (GUL) programme, launched in 2014 used a wide range of media and communications channels including radio, video on demand, online, press and the GUL website to share real-life stories of ULEV owners' experiences. More than 600,000 people visited the GUL website since October 2017, with other 115,000 landing on the tools and 19 million views of the videos. Research by OLEV found that 96% of the respondents said the adverts made them feel more positive about ULEVs and intention to purchase a ULEV increased by 19% after the campaign.

It is recommended that the Black Country uses the vision infographic from this work to create a public campaign to highlight the coming EV revolution and educate the public and businesses about the opportunities which this brings.

6.5.6 Other Policies

In the course of the workshop, a number of policies additional to those considered by the TfWM ULEV Report were put forward for consideration:

- Increased restrictions on residential parking;
- Encouraging working from home where possible;
- Promotion of car clubs;
- Better active travel infrastructure;
- Incentivising lift sharing; and/or
- Scrappage schemes.

Many of these will act to suppress the anticipated growth in the number of vehicles on Black Country roads, which can have a significant impact on the likelihood of achieving the 2041 net-zero target (see Section 4.2 for more details). A full analysis of the potential benefits and risks of all these measures is beyond the scope of this report.

It is recommended that a wider evidence-led study be commissioned to examine the ways in which journeys and the vehicle parc can be managed by the Black Country authorities.

6.6 Resourcing

In order to run the ULEV programme and fulfil the vision presented in this report, additional local government resource is required. This is especially needed if a regional EV infrastructure network is procured and operated. The number of Full-Time Equivalent (FTE) staff and their skills will vary depending on which ownership model is chosen. However, if infrastructure is installed on land owned by local authorities, some involvement is inevitable across all ownership models. Therefore, increased resource will be required to implement the ULEV vision.

In the short term, resources can be deployed more efficiently where procurement and operation are pooled over a regional level. This is because activities that would otherwise have been repeated across several local authorities can be conducted once and applied regionally. Activities that should ideally be pooled and conducted regionally include:

- Developing procurement specifications;
- Running procurement tenders;
- Contract management;
- Installation audits;
- Analysis and reporting; and
- PR and communications.

If procurement, contract management and installation audit skills are lacking in the local authorities, Cenex has experience in these aspects of the installation and delivery process and would be glad to support the Black Country, if appropriate.

An additional benefit of conducting activities such as these at a regional level is that it inherently brings consistency. This has clear benefits to the end user since the suppliers are procured to operate a consistent and interoperable regional charging network, but also brings efficiencies to contracting authorities. By delivering consistency through a rationalised approach, engagement with the public can be more easily informed and less prone to confusion, as only one source of information is required rather than several.

Should a regionalised approach to implementing the charging infrastructure network be taken, it is recommended that one full-time-equivalent officer, of a management level, is allocated and empowered to manage the procurement and operation of EV charging infrastructure across the Black Country. In addition, more ad hoc support will be required from procurement, parking, transport planning and highways officers from across each Black Country authority.

Table 30 illustrates the local government officer roles typically involved in the procurement and operation of an EV charging infrastructure network. Alongside these roles, suggestions have been made for approximate FTE requirement in each role, as well as the responsibilities of that role within the context of the EV charging infrastructure network.

> ! The information in Table 30 most accurately illustrates the resource requirements under an Own and Operate or External Operator model but would also be broadly appropriate for a Concession model.

Under a Lease model, ongoing operational requirements would be minimal and the majority of the EV Infrastructure Lead role would effectively be carried out as part of a local authority's ongoing contract management function. This would reduce the FTE requirement of the "EV Infrastructure Lead" officer to around 0.2-0.4 FTE.

> ! Where appropriate, Black Country authorities should endeavour to co-ordinate activities with the West Midlands Combined Authority in order to further centralise resource and maximise resource efficiency. This is particularly beneficial in the context of high-powered charging hubs on or near the strategic road network, where the catchment of potential users is likely to span beyond the Black Country.

Table 30: *Roles involved with procurement and operation of a regional EV charging infrastructure network, with suggestiosn for approximate FTE and responsibilities.*

Officer	Approx. FTE	Level (RASCI role)	Responsibilities
Black Country EV Infrastructure Lead	1	Management (Responsible)	Oversee development of procurement specification; Co-ordinate bids for external funding; Contract manage infrastructure supplier(s); Identify sites for EV infrastructure installation; Conduct ongoing analysis and reports of network growth and usage; First point of contact for Black Country local authority officers; Co-ordinate delivery activities with WMCA and other local and regional authorities as appropriate.
Transport Planning	0.05	Leadership (Accountable)	Provide strategic direction and sponsorship; Gain and maintain interdepartmental buy-in; Brief and respond to direction of elected members, as appropriate; Report to directors; Co-ordinate strategic decisions with WMCA and other local and regional authorities, as appropriate.
Procurement	0.1	Delivery (Support)	Set up EV infrastructure procurement processes and run initial EV infrastructure procurement round; Manage updates to procurement specification as and when new requirements emerge.
Parking	0.1	Delivery (Support)	Implement TRO and facilitate installation for off-street car parks and manage EV-only parking bay enforcement.
Highways	0.1	Delivery (Support)	Implement TRO and facilitate installation for on-street parking bays.
PR and Communications	0.05	Delivery (Support & Informed)	Raise public awareness of expansion to EV infrastructure network; Design branding of network, if appropriate.

Officer	Approx. FTE	Level (RASCI role)	Responsibilities
Transport Planning Management	0.03	Management (Consulted)	Provide information and guidance to ensure that expansion of EV infrastructure network is co-ordinated with wider transport planning activities.
Place Directorate Leadership	0.01	Leadership (Informed)	Ensure wider Place (or equivalent department) initiatives are aware of EV infrastructure network expansion and are in a position to identify and benefit from synergies.

It is recommended that the Black Country authorities cost up this resourcing plan as they have a clearer insight into the expected costs of FTE at the different levels.

6.7 Conclusions

In addition to the points already captured by the vision, further conclusions drawn from the implementation plan are:

Strategic Infrastructure Locations:

- 7 sites have been shortlisted as being of particular strategic significance and should be fed into the WMCA's planning for transit and charging hub locations.

Ownership Models:

- The costs incurred and revenue retained by the landowner varies dramatically by model.
- Non-financial implications must be accounted-for, including contractual control, user experience and risk.
- The Own and Operate or External Operator business models are most appropriate to increase the provision of residential and destination charging infrastructure up to 2025.
- In all scenarios, the local authority should take a leading role in coordinating the private deployment of charging infrastructure to ensure a coordinated and coherent approach, and to avoid over- or under-supply for particular regions.

Financial Costs:

- The case for public intervention has already been made in the TfWM ULEV Report.
- An estimated £2.25m of capital investment is required for additional charging infrastructure to meet projected demand in 2025, plus distribution network reinforcement costs and connection fees.
- The Black Country should coordinate with the WMCA who are working with WPD to develop processes that can provide accurate information on distribution network capacity and reinforcement/connection costs.

Policy Recommendations not included in the Vision:

- Build indicative costs into capital budget plans to secure the required funding to deliver the vision.
- Agree an in-depth vehicle replacement strategy so a clear pathway to net-zero council fleets can be outlined.
- Commission a wider evidence-led study to examine the ways in which journeys and the vehicle parc can be managed by the Black Country authorities.

Resourcing:

- Resource the ULEV programme across all four Black Country authorities to achieve efficiencies and more effective coordination.
- Appoint one FTE officer of a management level to manage the procurement and operation of EV charging infrastructure across the Black Country.
- Support the EV Infrastructure Lead with resource from transport planning, procurement, parking, highways, PR/communications, transport planning management and Place Directorate Leadership.
- Cost-up the resourcing plan so it can be included in the next round of budgets.

7 Abbreviations

Abbreviation	Explanation
AC	Alternating Current
AES	Advanced Encryption Standard
AIP	Automotive Industrial Partnership for Skills
APC	Advanced Propulsion Centre
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
B100	High-blend Biodiesel
BAU	Business as Usual
BCA	British Car Auctions
BEIS	Department for Business, Energy and Industrial Strategy
BEV	Battery Electric Vehicle
BID	Business Improvement Districts
BiK	Benefit in Kind
Bio-CNG	Biomethane Compressed Natural Gas
Bio-LNG	Biomethane Liquified Natural Gas
CAV	Connected Autonomous Vehicle
CAZ	Clean Air Zone
CCC	Committee on Climate Change
CCS	Combined Charging System
CNG	Compressed Natural Gas
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CPNO	Chargepoint Network Operator
DC	Direct Current
DCC	Dundee City Council
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DNO	Distribution Network Operator
EC	European Commission
EIZ	Energy Innovation Zones
E-REV	Extended Range Electric Vehicles
EU	European Union
EV	Electric Vehicle

Abbreviation	Explanation
EVSE	Electric Vehicle Supply Equipment
FAME	Fatty Acid Methyl Ester (High-blend Biodiesel)
FTA	Freight Transport Association
GHG	Greenhouse Gas
GPRS	General Packet Radio Services
GUL	Go Ultra Low
GVA	Gross Value Added
GVW	Gross Vehicle Weight
HDV	Heavy Duty Vehicles
HGV	Heavy Goods Vehicles
HRS	Hydrogen Refuelling Station
HVO	Hydrotreated Vegetable Oil
ICE	Internal Combustion Engine
kVA	Kilo-Volt Amp
kW	Kilowatt
kWh	Kilowatt-hours
LEVC	London Electric Vehicles Company
LGV	Light Goods Vehicles
LowCVP	Low Carbon Vehicle Partnership
LPG	Liquified Petroleum Gas
MaaS	Mobility-as-a-Service
MSOA	Middle-layer Super Output Area
NAMA	National Association of Motor Auctions
NO2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
NRMM	Non-Road Mobile Machinery *(i.e. construction equipment, fork-lift trucks, garden equipment etc)*
OCPI	Open Clearing House Protocol
OCPP	Open Chargepoint Protocol
OEM	Original Equipment Manufacturer
OLEV	Office for Low Emission Vehicles
ORCS	On-street Residential Charging Scheme
OSCP	Open Smart Charging Protocol
PHEV	Plug-in Hybrid Electric Vehicles
PiV	Plug-in Vehicles

Abbreviation	Explanation
PLC	Powerline Communications
PM	Particulate Matter
R&D	Research and Development
RDE	Real Driving Emissions test procedure
RFID	Radio Frequency ID
RHA	Road Haulage Association
SAP	Skills Advisory Panel
SME	Small Medium Enterprise
SO2	Sulphur Dioxide
SoC	State of Charge
SOC	Strategic Outline Case
SRN	Strategic Road Network
SUV	Sports Utility Vehicle
TCO	Total Cost of Ownership
TfWM	Transport for West Midlands
TPH	Taxi and Private Hire
TRWP	Tyre and road wear particles
UCO	Used Cooking Oil
uCPMS	Umbrella Chargepoint Management System
UK	United Kingdom
ULEV	Ultra-Low Emission Vehicle
ULEZ	Ultra-Low Emission Zone
V2G	Vehicle-to-Grid
VPN	Virtual Private Network
WCS	Workplace Charging Scheme
WHO	World Health Organisation
WLC	Whole Life Costs
WMCA	West Midlands Combined Authority
WP	Work Package
WPL	Workplace Parking Levy
WTW	Well-to-Wheel
ZEZ	Zero Emission Zones

8 Appendix 1: Residential Charging Index Methodology

Section 2.3.2 presents the likely location of need for residential charging. This Appendix outlines the full methodology and assumptions used in calculating the Residential Charging Index.

8.1 Input Data

Building on the early adopter mapping (see Section 2.3.1), additional factors and data are included in the analysis of the locations which are relatively more likely to require or benefit from public residential charging infrastructure. These are laid-out in in detail in Table 31.

All datasets used have been obtained from the UK Census 2011 and are valid down to the Medium Layer Super Output Area (MSOA) level. This means that findings can be mapped into zones with a mean population of 7,200 individuals.

Table 31: *Factors considered within the residential charging index and the data sources used*

Factor	Dataset(s) used
Vehicle ownership	Vehicle ownership by household; Total population; and Datasets combined to determine vehicles per person as a relative indicator of vehicle ownership.
Vehicle usage Affluence	Method of commute, specifically number of people commuting either as a car driver or passenger; and Distance of commute. Number of households deprived on one or more dimension; and
	National Statistics Socio-economic Classification (NS-SEC), specifically the number of people falling within NS-SEC categories 1 to 4, representing more advantaged groups.
Off-street parking availability	Households by building type, specifically the number of detached and semi-detached houses (which have been considered to be more likely to have off-street parking).

8.2 Methodology

Each MSOA is scored relatively for each factor, on a scale of -100 to 100, based on how it ranks against other output areas. This means an MSOA with the median value will score zero, an MSOA with the most favourable value will score 100 and an MSOA with the least favourable value will score -100. The scores from each factor are weighted and added together to form a total which reflects the relative suitability of each MSOA for public residential charging infrastructure.

Therefore, a score of zero indicates an that the area is neither particularly suited nor unsuited to public residential charging infrastructure. A positive score shows that the area is more suited than average for public residential charging infrastructure and a negative score shows that the area is less suited than average for public residential charging infrastructure installation.

! The relativistic nature of the scores mean that comparisons can be made between MSOAs.

8.3 Weighting

Acknowledging that certain factors listed in Table 31 will have a stronger impact on the suitability of a geographical area for public residential charging, a weighting is used to enhance the validity of the results.

As no research has yet been conducted to determine the relativity of different factors impacting EV ownership, Cenex conducted an internal peer review exercise, drawing upon the expertise and experience of nine members of staff, with backgrounds in the transport sector, energy industry and local government. Each participant was asked to rank seven different demographic indicators in order of how important they believed those indicators were to identify areas where public residential charging was required. Once these rankings were collected, the scores for each indicator were added up to calculate a weighting value, proportional to how highly or lowly each factor was ranked. The results are shown in Table 32.

Table 32: *Weightings attributed to factors in the residential charging index*

Factor	Related Factor	Sum of Ranks (lower = higher priority)	Weighting
Method of commute	Vehicle usage	36	88%
Off-street parking availability	Off-street parking availability	11	290%
Annual earnings	Affluence	34	94%
Vehicle ownership rate	Vehicle ownership	23	139%
Daily mileage	Vehicle usage	38	84%
Deprivation	Affluence	37	86%
Population density	Off-street parking availability	44	72%

Given the assumptions and calculations outlined, above, Figure 17 (page 34) shows the resulting Residential Charging Index for the Black Country.

9 Appendix 2: Infrastructure Forecasting Methodology

The projected EV uptake as presented in Figure 20 (page 41) is translated to infrastructure demand by modelling based on assumptions about typical annual mileage, battery sizes of current and future EVs and the likely number of vehicles of different specifications. A typical set of charging speeds (slow, standard, fast and rapid) for EV charging infrastructure is assumed so that the likely charging output by charger and sessions per day can be calculated.

The tables, below, lay out the assumptions in more detail. The daily mileage is taken from the National Travel Survey[77].

Table 33: *Vehicle usage assumptions*

Vehicle Usage	Value
Daily mileage	21.4 miles
Domestic off-street parking availability	69% (averaged across the study area)
Reduced usage by those parking off-street	5%

The assumed usage of infrastructure is based on data collected by OLEV, looking at usage of public-funded standard[78], fast and rapid[79] chargepoints. The assumed average use for standard, fast and rapid charging is shown in Table 34, and the amount of time between charges has been assumed based on the likely use case of the chargepoint. For example, rapid chargers are more likely to be installed in high-turnover car parks, where EV users unplug their vehicle promptly once they have received a full charge. In comparison, standard and fast chargepoints are more likely to be installed in car parks where EV users may be away from their vehicle and therefore not be able to return as soon as their vehicle is fully charged.

Table 34: *Infrastructure utilisation assumptions*

Infrastructure type	Max charge duration (hours)	Between charges (hours)	Daily in-use period (hours)	Max utilisation
7 kW	12	12	24	50%
22 kW	2	1	15	42%
50 kW	0.5	0.5	16	33%
150 kW	0.5	0.25	16	44%

The proportion of charging taking place using differently powered chargepoints is based on the Zap-Map Annual Survey 2019[80] and the longer-term assumption that there will be a transition from fast or rapid infrastructure to ultra-rapid, with a remaining need for slow or standard charging, as shown in Table 35.

77 *National Travel Survey, accessed 14th April 2020.*

78 *Electric Chargepoint Analysis 2017: Public Sector Fasts, accessed 14th April 2020.*

79 *Electric Chargepoint Analysis 2017: Local Authority Rapids (revised), accessed 14th April 2020.*

80 *Zap-map EV charging survey 2019, accessed 14th April 2020.*

***Table 35:** Assumed proportion of chargepoint type usage*

	2018	2021	2024	2027	2030	2033	2036	2039	2042
7kW	26%	25%	25%	25%	25%	20%	20%	20%	20%
22kW	51%	45%	40%	30%	25%	20%	15%	15%	10%
50kW	22%	25%	20%	20%	15%	15%	15%	10%	10%
150kW	1%	5%	15%	25%	35%	45%	50%	55%	60%

***Table 36:** Assumed plug-in vehicle technology specifications*

	Battery size (kWh)	Max charge power (kW)	Usable battery (%)	Recharge trigger (% charge)
BEV, future generation	90	150	90%	5%
BEV, next generation	60	150	90%	10%
BEV, current generation	45	50	90%	15%
BEV, previous generation	24	50	90%	20%
PHEV, current generation	12	50	90%	0%
PHEV, previous generation	6	7	90%	0%
E-REV	20	50	90%	0%

The vehicle parc is expected to move towards the ‘BEV Next Generation’ and ‘BEV Future Generation’ archetype over time, with ‘PHEV Previous Generation’, BEV Previous Generation’ and ‘BEV Current Generation’ archetypes absent from West Midlands roads by 2042. Some E-REVs will remain, and the current generation PHEVs will decline with time. Table 37 shows these assumptions.

***Table 37:** Assumed proportion of plug-in vehicle parc*

	2018	2021	2024	2027	2030	2033	2036	2039	2042
BEV, future generation	5%	5%	5%	10%	15%	20%	30%	35%	40%
BEV, next generation	5%	5%	10%	15%	25%	30%	35%	40%	45%
BEV, current generation	10%	15%	20%	25%	20%	15%	10%	5%	0%
BEV, previous generation	25%	20%	15%	10%	5%	5%	0%	0%	0%
PHEV, current generation	30%	35%	35%	30%	25%	20%	20%	15%	10%
PHEV, previous generation	20%	15%	10%	5%	5%	5%	0%	0%	0%
E-REV	5%	5%	5%	5%	5%	5%	5%	5%	5%

Black Country Transport

in partnership with

Black Country *LEP*

MIDLANDS ENGINE
HM Government

Transport for West Midlands

Dudley
Metropolitan Borough Council

Sandwell
Metropolitan Borough Council

Walsall Council

CITY OF WOLVERHAMPTON COUNCIL