



City of Wolverhampton Council

OUR NET ZERO CITY: 2041

CITY OF
WOLVERHAMPTON
COUNCIL



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Abbreviations

Abbreviation	Definition
ASHP	Air Source Heat Pump
BCT	Black Country Transport
BEES	Building Energy Efficient Survey
BEIS	Department for Business Energy and Industrial Strategy
BID	Business Improvement District
CO ₂ e	Carbon Dioxide Equivalent
DECC	Department of Energy and Climate Change
DLUHC	Department for Levelling Up, Housing and Communities
DVLA	Driver and Vehicle Licensing Agency
EPC	Energy Performance Certificate
EV	Electric Vehicle
FHS	Future Homes Standard
FTE	Full-Time Equivalent
GSHP	Ground Source Heat Pump
HGV	Heavy Goods Vehicle
KPI	Key Performance Indicator
LCWIP	Local Cycling and Walking Infrastructure Plan
LGV	Light Goods Vehicle
NAEI	National Atmospheric Emissions Inventory
NGED	National Grid Electricity Distribution
ONS	Office for National Statistics
PV	Photovoltaic
SME	Small or Medium Enterprise
UK	United Kingdom
ULEV	Ultra-Low Emission Vehicle
VAT	Value Added Tax
WMCA	West Midlands Combined Authority

Key Report Definitions

- **Action Plan:** Converts the broader targets presented in the Route Map into a specific set of actions that need to be adopted to meet interim milestones. It can contain short-, medium- or long-term actions, but crucially it provides direction on how the targets can be broken down into tangible, deliverable steps.
- **Net Zero Pathway Modelling:** The approach that this report adopted to calculate the overarching and sectoral (road transport, energy supply, domestic, and industrial and commercial) carbon reductions needed by certain dates to reach net zero targets.
- **Net Zero:** Generally interpreted as reducing carbon emissions as close to zero as possible, with any residual being removed from the atmosphere with greenhouse gas removal.
- **Route Map:** High-level visual tool that deconstructs the, often distant, 2041 net zero target into clear and tangible intermediate goals aligned to milestones at 2026, 2031, 2036 and 2041.
- **Scope 1 Emissions:** The emissions from the combustion of fuel from owned or controlled sources within the city boundary, they are considered a direct source of emissions. Scope 1 emissions are included within the scope of this Strategy.
- **Scope 2 Emissions:** The emissions from the purchase of electricity, they are considered an indirect emissions source as the emissions are a consequence of activities within the city boundary but occur at a source owned by another location outside of the city. Scope 2 emissions are included within the scope of this Strategy.
- **Scope 3 Emissions:** The emissions that result from activities or assets not owned or controlled by entities within the city boundary, but that indirectly impact value chains outside of the city boundary's direct control. Scope 3 emissions are the indirect emissions that take place upstream/downstream of the city boundary (e.g. during the production and transportation of goods). Scope 3 emissions are not within the scope of this Strategy.

1 Executive Summary

1.1 Overview

Wolverhampton has achieved a 44% reduction in total CO₂ emissions over the last 16 years. Building upon this success and aiming to continue this trajectory towards the ambitious net zero 2041 goal, the City of Wolverhampton Council (the Council) has commissioned City Science to develop a Net Zero Strategy and Action Plan. This strategic initiative, developed in close collaboration with stakeholders, presents a partner-led framework to accelerate decarbonisation across the city, ensuring the equitable receipt of net zero benefits and wider co-benefits, maximising circular economy and wider economic opportunities and regeneration.

1.2 Net Zero Evidence Base

Understanding the current context and key emitting sectors across the city was critical to develop an impactful Strategy and Action Plan. This is summarised below (see Chapter 3 and 4 for more detail).

Key Sector	Emission Contribution	Wider Context
Domestic Energy 	39%	Approximately 63% of properties across Wolverhampton have a low energy efficiency rating, with a notable correlation between these homes and higher levels of deprivation. This highlights an opportunity to target actions in these areas (e.g. retrofit) in order to reduce energy costs and improve health and comfort .
Transport 	27%	Wolverhampton is a car-orientated city, with approximately 72% of households having access to one or more private vehicles. Transport emissions are dominated by road vehicles (99% of emissions), 66% of these from cars, emphasising the significance of demand reduction and sustainable transport initiatives.
Industry & Commercial 	27%	Gas and electricity dominate industrial and commercial energy use, (50% and 35%, respectively). The sector has witnessed reductions in electricity emissions due to cleaner grids and improved energy efficiency, underscoring the potential benefits of further investments in renewables and retrofit technologies. A significant portion of non-domestic buildings also have low energy efficient ratings, indicating scope for energy efficiency enhancements. Key employment sectors include: Transport and Storage: Highlighting the opportunity presented by vehicle decarbonisation - including the provision of electric vehicle (EV) charging solutions. Construction: Extensive regeneration projects are underway, posing challenges such as embodied carbon, energy consumption, and reliance on carbon-intensive construction methods. However, there is an opportunity to upskill the sector and leverage its capacity to embedded circular economy construction principles and maximise local investment.
Public 	7%	Key public sector organisations located in the city are collaborating via the Anchor Network (e.g. the Council, University of Wolverhampton, City of Wolverhampton College, Wolverhampton Homes and the Royal Wolverhampton National Health Service Trust).

Key Sector	Emission Contribution	Wider Context
Energy Supply 	Influences emissions across all sectors.	Gas remains the primary fuel source for energy consumption in Wolverhampton and is used for space and water heating in buildings, however the city is actively pursuing and implementing renewable initiatives (e.g. Bowmans Harbour).

Table 1-1: Overview of Net Zero Evidence Base Findings

1.3 Net Zero Pathway & Route Map

The Net Zero Scenario, see Figure 1-1, and Route Map, see Figure 5-4, outline a recommended pathway to deliver the Council’s net zero by 2041 ambition for the city, presenting an overview of the overarching strategic vision and breaking it down into interim targets to reach by key milestones. It identifies that in the context of the current policy and technological landscape, a substantial 96% reduction from 2021 emissions levels is required. Delivering this goal will require significant acceleration of the current decarbonisation trajectory. The modelling assumptions are ambitious and faster-paced than national projections, which are working towards net zero by 2050. These findings highlight the speed and scale of change necessary to enable delivery of the 2041 target. Advancements across various sectors will be required, with key priorities including an accelerated rate of building decarbonisation across all sectors (i.e. homes, commercial and industrial), and enabling modal shift from private vehicles to sustainable travel modes.

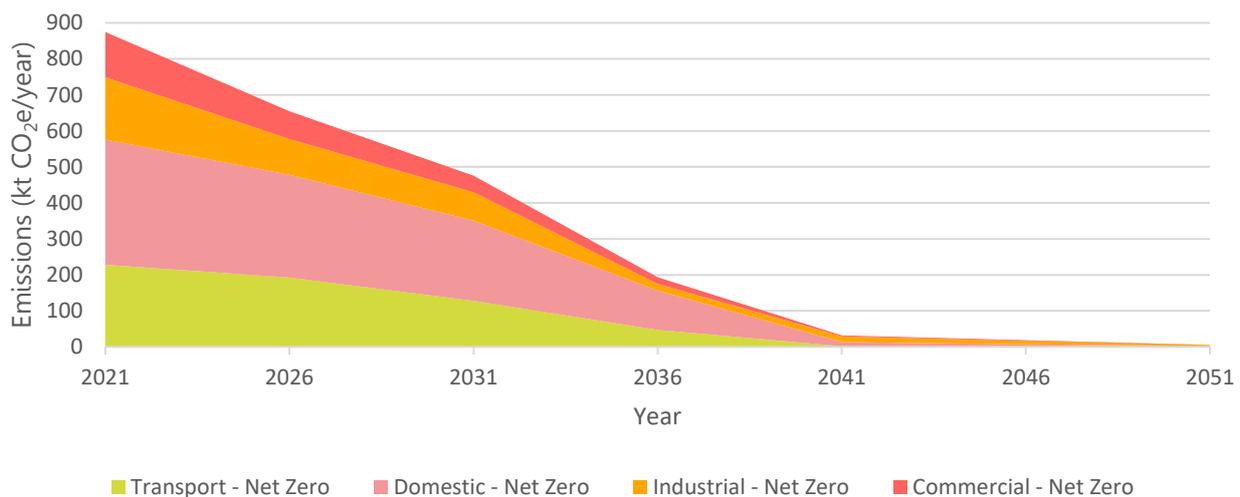


Figure 1-1: Carbon Emissions Pathway for the Net Zero Scenario by Sector

1.4 Action Plan

Informed by the Net Zero Evidence Base, Net Zero Pathway & Route Map and extensive collaboration with stakeholders, this Strategy presents an Action Plan consisting of a portfolio of 20 actions to accelerate Wolverhampton’s net zero journey (see Table 6-2). The Actions are categorised across thematic areas, such as the key emitting sectors, circular economy and nature recovery. Example actions include developing domestic and non-domestic retrofit programmes, promoting modal shift and sustainable transport, knowledge sharing and collaboration amongst key stakeholders and increasing green skills. Crucially, all actions have been developed to align with and build-on wider city engagement, ambitions, and priorities. To accelerate decarbonisation progress in line with Wolverhampton’s 2041 target, we propose that all 20 actions are mobilised over the next year. Additionally, all actions are subject to continuous refinement and evaluation, to ensure alignment with corporate objectives and the broader context (e.g. Medium Term Financial Strategy and West Midlands Combined Authority (WMCA) Single Settlement).

1.5 Monitoring & Next Steps

To achieve net zero, it will be vital to consistently monitor and review the Strategy and Action Plan. To support this process, 5-yearly carbon budgets have been developed (see Figure 5-3) as well as proposed key performance indicators (KPIs) for each action to enable the Council to track progress effectively. Ongoing collaboration between residents, businesses and key stakeholders will also be an integral component to successful delivery. By co-developing a range of actions, with a breadth of action owners and champions, and promoting distributed leadership, this Action Plan builds-on relevant expertise and maximise impact to secure local buy-in and mobilise decarbonisation progress.

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2 Introduction

2.1 Context

The Council has commissioned City Science to develop a Net Zero Strategy and Action Plan for achieving net zero across the city by 2041. The aim of this Strategy is to provide a clear, partner-led strategic framework for achieving net zero, ensuring the equitable receipt of decarbonisation benefits, maximising circular economy opportunities and clear alignment with the ambitions of the Council’s ‘Our City: Our Plan’ (see Section 2.2.2), outcomes of the previous citizen’s assembly (City of Wolverhampton Council, 2020) (see Section 3.1.1) and wider economic opportunities.

2.2 Objectives, Themes & Principles

2.2.1 Objectives

The strategy was commissions to:



Figure 2-1: Strategy Objectives

2.2.2 Aligning with Our City : Our Plan

Our City: Our Plan (2022) sets out how the Council will continue to work alongside its local, regional and national partners to improve outcomes for local people. Delivery of this ambition is supported by six priorities and three overarching principles. Climate action is a key element of the plan, and this Net Zero 2041 Strategy aims to supplement and compliment those objectives and build on this framework, leveraging the city’s existing assets and initiatives, to ensure a fair, innovative and equitable journey towards net zero emissions in Wolverhampton.



Figure 2-2: Our City Our Plan Priorities and Principles (City of Wolverhampton Council, 2022)

2.2.3 Themes

Our analysis has identified four key emitting sectors that are complemented by four cross-cutting themes. Together they provide a foundation for the Strategy that will support a holistic approach to Action Plan development. The key emitting sectors and the cross-cutting themes are outlined in Figure 2-3.

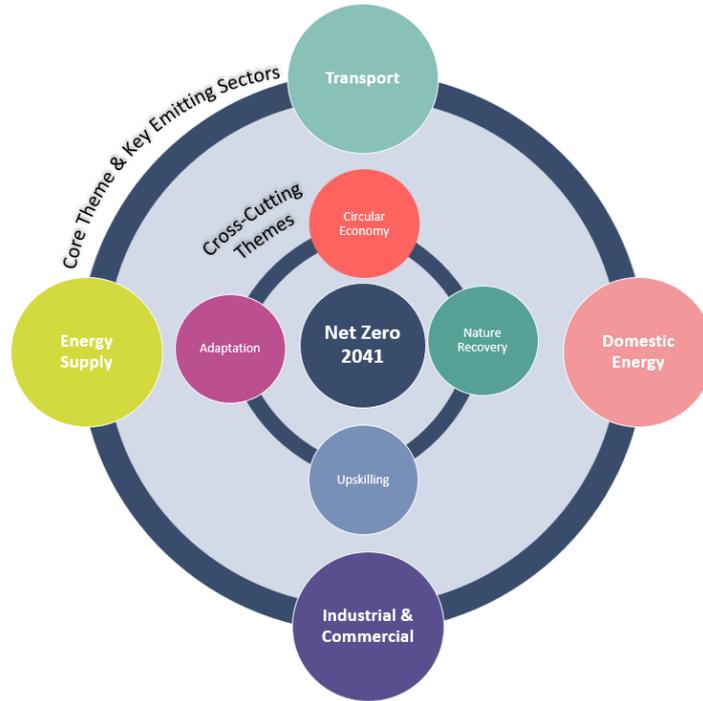


Figure 2-3: Strategy's Core & Cross-Cutting Themes

2.2.4 Principles

On top of the core principles of the City Plan the following additional 4 principles will underpin the strategy and resulting actions:

<p>1. Resilience: Planning for new and emerging technologies, future skills needs and the potential impacts of climate change.</p>	<p>2. Collaboration: The Strategy will be developed and delivered in partnership with key city stakeholders.</p>	<p>3. Engagement & Awareness: Driving behaviour change through direct engagement.</p>	<p>Leadership: Enabling and empowering ownership and accountability for delivery at a corporate, community and individual</p>
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Figure 2-4: Strategy Principles

2.2.5 Aims

The actions aims have been developed and provisionally agreed based on the actions that have been outlined within the action plan to

- 1 Residents & Businesses are well informed and empowered to take climate action
- 2 Wolverhampton runs on smart local low-carbon heat and power
- 3 Wulfrunians enjoy warm and energy-efficient homes in Net Zero Neighbourhoods
- 4 Sustainable businesses, jobs and skills to create a green and circular economy
- 5 Equal access to sustainable transport across the City
- 6 Wulfrunians enjoy equal access to a nature-friendly and climate-resilient city

3 Local & Broader Context

Chapter at a Glance

This Chapter provides an insight into the localised context for which this Net Zero Strategy and Action Plan will be delivered, including relevant policy, demographic and socio-economic factors and the urgency for action based on anticipated climate change impacts.

3.1 Policy Landscape

To ensure this Strategy aligns with the current and emerging political landscape, over 40 key relevant national, regional and local policies were reviewed (see Figure 3-1). Key policies include:

- **National:** Ten Point Plan for a Green Revolution, Net Zero Strategy: Build Back Greener, Transport Decarbonisation Plan and the Heat & Buildings Strategy.
- **Regional:** West Midlands Combined Authority (WMCA) 2041 and the 5-Year Plan, Regional Energy Strategy for the West Midlands, West Midlands Local Transport Plan 5 Core Strategy and the WMCA Circular Economy Roadmap.
- **Sub-Regional:** Black Country Innovation Zone, Black Country Transport (BCT) Ultra-low Emission Vehicle (ULEV) Strategy and Repowering the Black Country.
- **Local:** Future Generations: Our Climate Commitment, Our City: Our Plan, New Horizons – Our Vision for the City of Wolverhampton 2030, the emerging Wolverhampton Local Plan, Wolverhampton City Heat Network Feasibility and the Strategic Economic Plan 2019 – 2024.

As a result, the Strategy directly reflects the policy landscape, and addresses key gaps within the local authority area. In parallel, it provides a robust policy framework for strengthening future iterations of the Council Plan, Good Growth Strategy, and Local Plan.

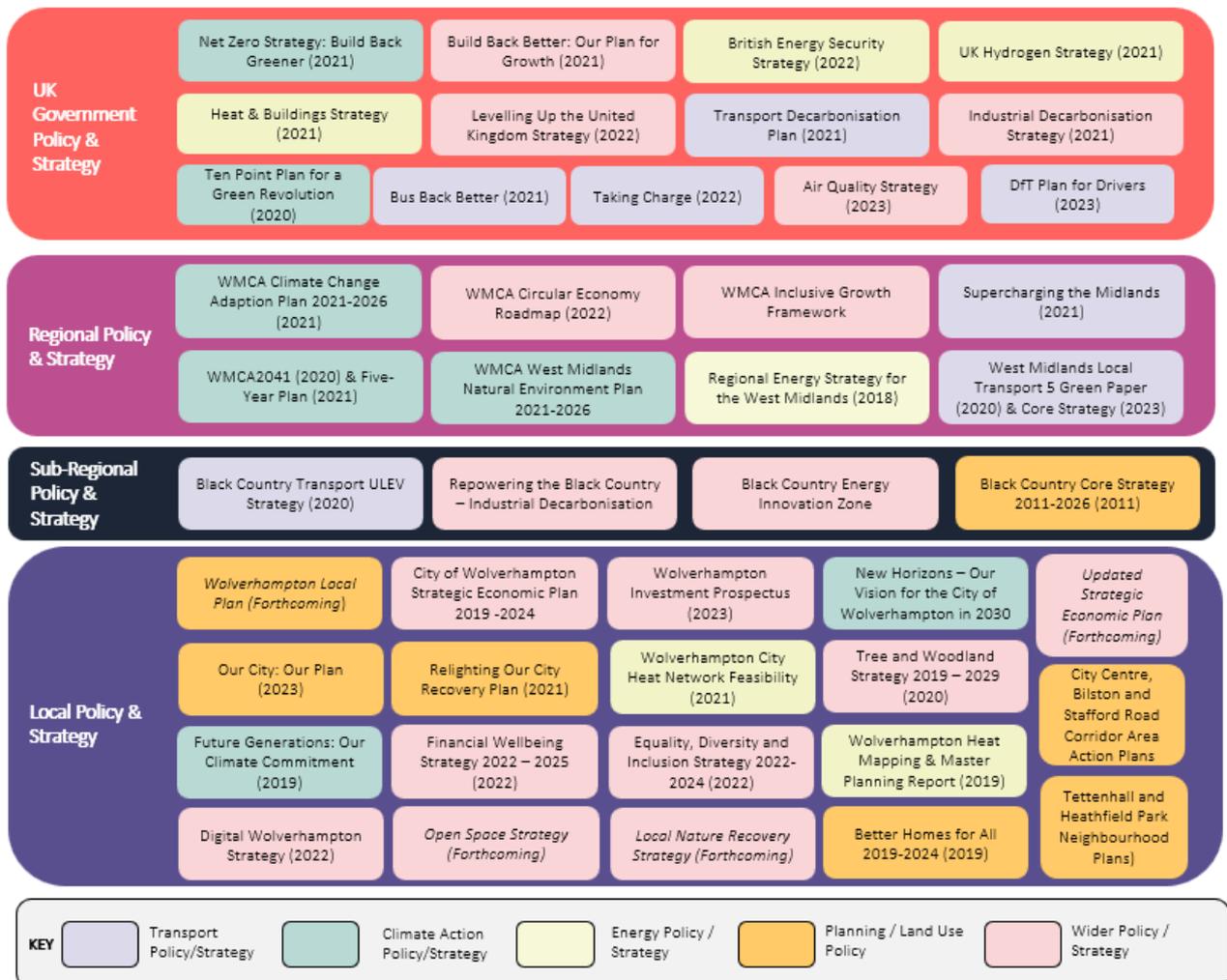


Figure 3-1: Policy & Strategy Overview

3.1.1 Citizens Assembly

To ensure the Strategy builds on previous work, we reviewed the findings from the citizen’s assembly held in 2019. This focused on exploring resident’s view on how Wolverhampton should respond to climate change (City of Wolverhampton Council, 2020), including a 2.5-hour workshop whereby eight key principles for tackling climate change in Wolverhampton were identified. These have informed the development of the Strategy and Action Plan (see Table 3-1).

Principle	Alignment with the Net Zero Strategy & Action Plan
Climate change plans and activity should be communicated clearly and widely.	Publishing the Strategy informs Wolverhampton residents about proposed actions by the Council and aims to raise awareness about ongoing green initiatives, activities and opportunities, ensuring clear and widespread communication of climate-related plans and efforts within the community.
Behaviour change should feel voluntary and be incentivised.	By fostering extensive stakeholder engagement in the development of the Action Plan, the Strategy prioritises a bottom-up approach, empowering communities to actively participate in broader city-wide initiatives.
The ‘ask’ should be appropriate to people’s abilities and needs – actions should be achievable and realistic.	A key principle of the Strategy is Fair and Equal, therefore all actions have been developed to be equitable, balanced and proportionate. Proposed delivery timelines have been set out for each action as well as each action undergoing assessments regarding feasibility, cost, and impact to ensure achievability.
Getting involved should be as accessible as possible and vulnerable residents should continue to be supported.	The Strategy has actively explored innovative financial mechanisms, ensuring that investments aimed at addressing climate change do not detract from essential services for residents as well as supporting those in need of additional financial support with net zero initiatives (e.g. retrofit and EVs). We have provided high-level financial estimates for each action, seeking to maximise external funding opportunities. These estimates are presented in an easily accessible and transparent manner to ensure clarity and openness regarding plans and associated costs.
The cost impact of actions on residents and the Council should be considered.	
The Council should be transparent about its plans and associated costs.	
Activities should be genuinely sustainable and/or effective and reducing carbon emissions.	Carbon impacts have been considered, where possible, for each action to support prioritisation and ensure effective carbon emission reduction. This approach not only aids in achieving the Route Map targets and carbon budgets but also fosters tangible, impactful change
Some plans should have an immediate impact in order to motivate further change.	We have identified short-term actions aimed at rapidly stimulating local action and mobilisation. These initiatives are designed to deliver ‘easy wins’, fostering enthusiasm and momentum for broader change within the community.

Table 3-1: How the Strategy Aligns with the Citizens Assembly

3.2 Socio-economic Factors

3.2.1 Population & Demographics

The population of Wolverhampton has increased by 5.7% since the previous Census, from around 249,500 in 2011 to 253,700 in 2021, which is lower than the growth experienced at a regional (6.2%) and national (6.7%) level (ONS, 2022a). The population breakdown of Wolverhampton is like that of the West Midlands and England, with a slightly higher younger population (21.5%). However, there has been an increase of 6.6% in people aged 65 and over in the last decade (ONS, 2022a).

3.2.2 Deprivation

In Wolverhampton, 21% of the population was classified as income-deprived in 2019, making it the 11th most income-deprived place in England (ONS, 2021a). Key hotspots of deprivation (see Figure 3-2) are located within the city centre, the north, east and southeast of the city (e.g. Bilston, Rough Hills, Low Hill, Wednesfield and Heath Town). In contrast, the west of the city reflects on average, lower levels of deprivation but these areas are still intermixed with pockets of higher deprived areas (e.g. Merry Hill). A key principle underpinning the Strategy is Fair and Equal. Therefore, identifying and prioritising these regions is essential to ensure that all neighbourhoods benefit from a net zero transition.

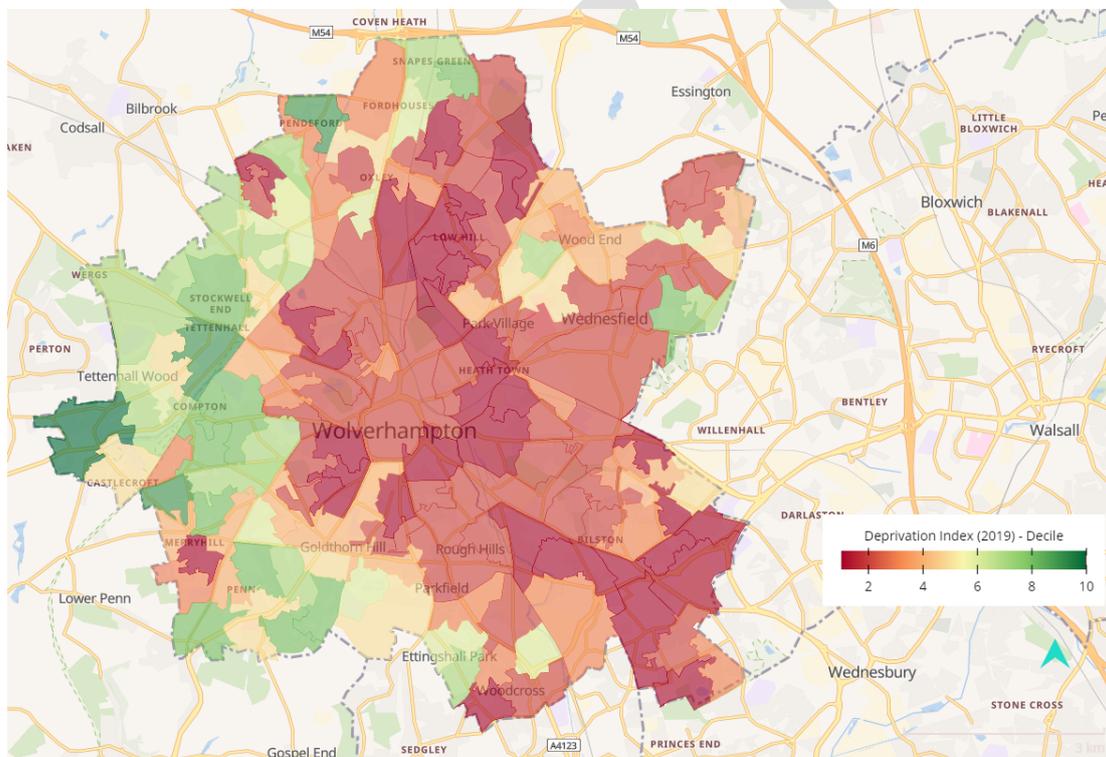


Figure 3-2: Deprivation Index (Decile)

3.2.3 Housing

In 2021, 63% of the city was made up of detached or semi-detached housing, followed by flats (17%), terraced (16%) and shared accommodation or other (3%) (ONS, 2023a). 55% of these homes were owned outright or with a mortgage, 25% where socially rented and 19% of privately rented (ONS, 2023c). This highlights that just under half of residents (44%) are dependent on landlords (e.g. to apply retrofit measures to their homes).

On average, domestic energy efficiency standards are low across the city, reflecting a key opportunity. Key pockets of housing that could be prioritised (e.g. Energy Performance Certificate (EPC) E homes) are highlighted in Figure 3-3 (e.g. South of Bilston, Heath Town to Wednesfield and South of Oxley). Additionally, low energy efficient homes correlate with higher levels of deprivation, highlighting the potential opportunity to target measures at these homes (e.g. energy efficiency) to address social inequalities.

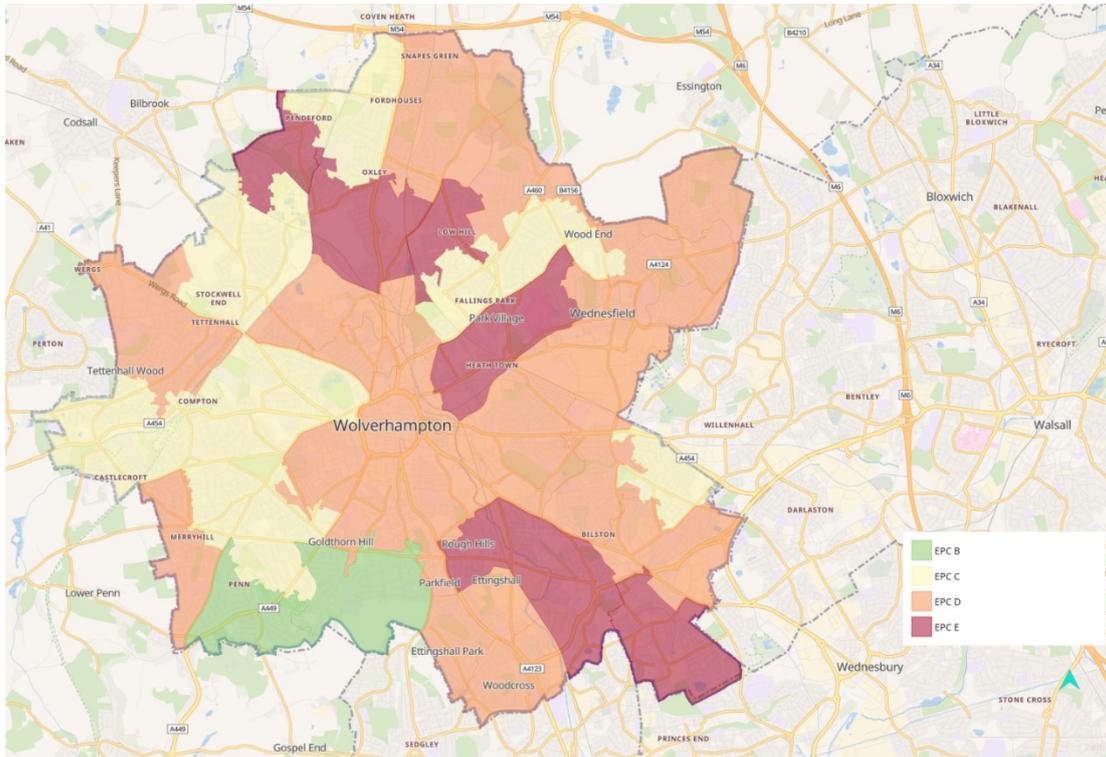


Figure 3-3: Average Housing EPC

3.2.4 Transport

Almost three quarters of households within Wolverhampton have access to one or more private vehicles (72%) (ONS, 2021b). Areas of lower access include the city centre, the west of the city and some areas around the region’s boundary which may align with areas (e.g. the city centre) that have greater access to public transport. The mobility needs of the almost 30% of households without access to a car must also be considered to ensure the Strategy is fair and equal.

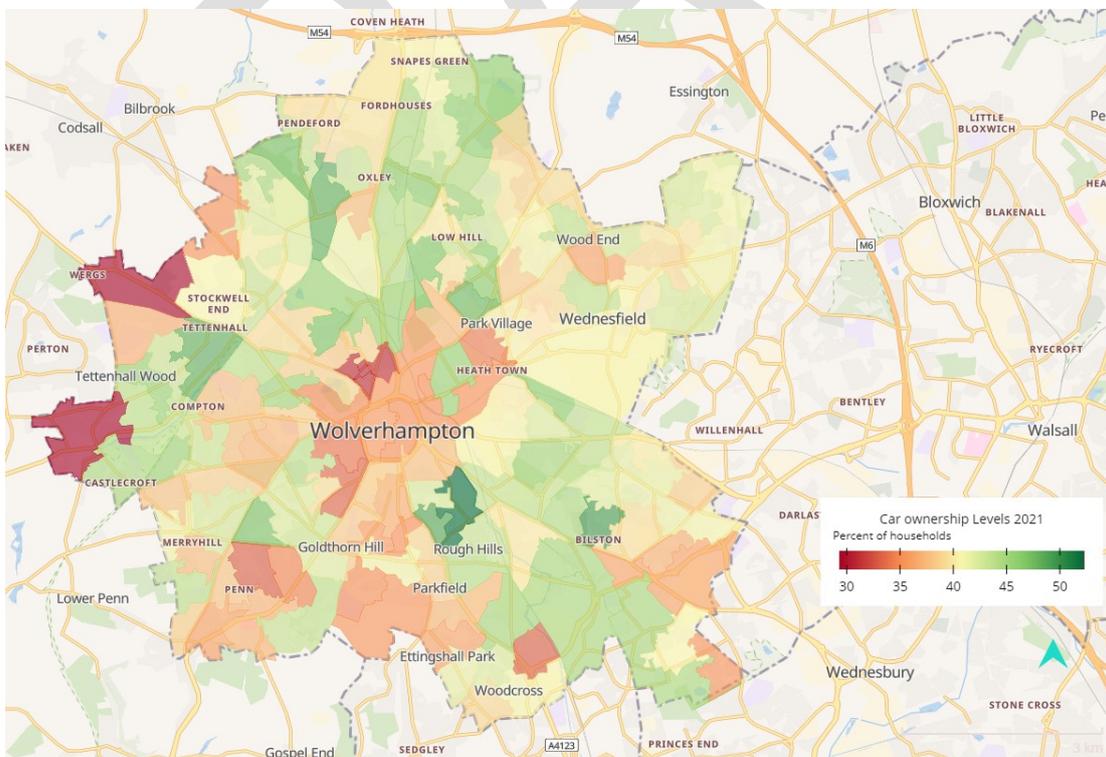


Figure 3-4: Percentage of Houses with Access to One Car (ONS, 2021b)

3.2.5 Employment & Business

Key employment sectors (ONS, 2022b) include:

- Transport & Storage (16%)

- Construction (13%)
- Retail (10%)
- Business Administration & Support Services (10%)
- Professional, Scientific & Technical (8%)

Transport & Storage encompasses a wide range of industries involving the movement and storage of people and goods which are likely to be more vehicle dependant (e.g. delivery vehicles, freight). This highlights the opportunity presented by vehicle decarbonisation, such as low and zero emission solutions – including the provision of EV charging solutions. The construction sector is the second largest sector, reflecting both a challenge and an opportunity for upskilling the sector and leveraging its capacity to support city regeneration and decarbonisation through examples such as retrofit, whilst embedding circular construction principles and maximising local investment in line with principles of the Wolverhampton Pound.

3.2.6 Future Regeneration Opportunities

In 2022, Wolverhampton was named as one of the pathfinder locations for Levelling Up and boosting local employment and skills is a key element of the city’s levelling up agenda. As reflected by the dominance of the construction sector, substantial regeneration is planned across Wolverhampton.

Initiative	Overview	Opportunity
City Centre	Growing the city centre residential offering is a key priority with a strong pipeline of opportunities for over 1,000 homes providing more than 1,000 construction jobs as well as apprenticeship and training opportunities for students from the University of Wolverhampton (INVEST, 2023).	The Strategy presents a significant opportunity to shape the development of low carbon and energy-efficient homes, while also fostering the cultivation of net zero skills essential for their delivery.
Green Innovation Corridor:	The Corridor will build upon Wolverhampton’s existing sustainable construction and circular economy credentials to connect key assets (e.g. Wolverhampton’s Science Park and the University’s Springfield Campus with the City Centre and i54). i54 has delivered over 2,700 jobs on one of the UK’s most successful Enterprise Zones with potential for over 900 more on a Western extension (INVEST, 2023).	The Strategy will foster business collaboration and facilitate knowledge sharing, ensuring that the city meets its long-term economic and decarbonisation goals, positioning it as a trailblazer in sustainability initiatives.
Canal Renaissance	Over £10m has been allocated to Wednesfield and Bilston Town Centres from the UK Government’s Towns Fund (INVEST, 2023) The ongoing transformation of the canal network presents a wide range of major opportunities to deliver growth that benefits the community as well as to create jobs within the green economy (e.g. the 6.9MW Bowman’s Harbour Solar Farm). The canal network is a key asset that the city can continue to harness.	By promoting a place-based approach, the Strategy explores the potential of circular construction and placemaking strategies to optimise the utilisation of current blue and green infrastructure, facilitating biodiversity net gain and promoting active travel.

Table 3-2: Overview of Future Generation Initiatives and Strategy Opportunities

3.3 Impacts of Doing Nothing

To provide an insight into the impacts of inaction, we explored key climate change impacts across three warming scenarios, from 1.5°C to 3-4°C, and applied these to the local context.

3.3.1 Key Challenges

The review has highlighted key challenges, as outlined in Table 3-3, which focus on the effects of increasing extreme weather events, health impacts and broader economic consequences.

Theme	Challenge
Temperature	Mean daily summer temperatures in the Midlands could increase to 25°C, resulting in significant disruption to Wolverhampton’s transport networks and infrastructure (e.g. rail, water and electricity).
Drought	Across Europe drought periods could more than triple (Carbon Brief, 2018), which will potentially have a huge impact on Wolverhampton’s food availability and cost.
Flooding	Current flood risk areas coincide with higher levels of deprivation (e.g Bilston). Existing infrastructure is also at risk, including primary substations to the north and southwest and public transport infrastructure/routes impacted across the city in some capacity. Rainfall extremes are forecasted to more than double (Carbon Brief, 2018), exacerbating existing flood risk zones, having a disproportionate impact of climate change on the most deprived communities and causing high levels of disruption.
Health	<p>Wolverhampton ranked in the bottom 10% of local authority areas in England for health in 2021 (ONS, 2023b). Physiological risk factors (e.g. obesity, heart conditions, above average alcohol consumption, lack of physical activity and unhealthy diet) and mortality were the worst scoring indices.</p> <p>The elderly are particularly vulnerable to heat related illnesses, with 90% of the estimated 2,500 excess deaths that accord during the three 2020 summer heatwaves relating to those aged over 65 years of age (Public Health England, 2020).</p>
Economic	Localised gross domestic product loss for Wolverhampton, because of climate change impacts, could reach between 2.1% - 7.6% by the end of the century (London School of Economics, 2022).

Table 3-3: Key Climate Change Impact Challenges

3.3.2 Key Opportunities

The review also highlighted several key opportunities (see Table 3-4), specifically potentially alleviating energy bills and achieving a multitude of health co-benefits.

Theme	Opportunity
Temperature	Winter will see a rise in average minimum temperatures, which could provide some benefits by reducing winter home energy bills, including for more vulnerable communities, as well as a decrease in excess deaths due to cold.
Health	Interventions can produce a range of co-benefits that support addressing public health issues (e.g. warmer homes mitigating physical and mental health impacts, active travel alleviating obesity levels and modal shift tackling localised air and noise pollution). In addition, these concerns tend to impact more deprived areas that have less green infrastructure or have older and more polluting vehicles.

Table 3-4: Key Climate Change Impact Opportunities

This analysis highlights the significance of limiting global temperatures to minimise the local and national impact of climate change. It points to the importance of the Council’s 2041 net zero goal and the need to accelerate action through the Strategy and Action Plan.

3.4 Key Findings



- **Climate Change Impacts:** The city of Wolverhampton is experiencing a demographic shift, with an increasing proportion of residents aged 65 and over, making them more vulnerable to climate change impacts. However, projected rises in winter minimum temperatures offer some relief, potentially reducing home energy bills and mitigating excess cold-related deaths.
- **Equitable:** In Wolverhampton, 21% of the population was classified as income-deprived in 2019, making it the 11th most income-deprived place in England. The Strategy's core principle of Fair and Equal necessitates the identification and prioritisation of these areas to ensure equitable benefits from the transition to net zero.
- **Tackling Social Inequalities:** Domestic energy efficiency standards in Wolverhampton are generally low, particularly in areas of income deprivation where residents may struggle to afford retrofit measures. Targeting energy efficiency and retrofit programmes at these homes presents an opportunity to address social inequalities.
- **Co-benefits:** Nearly three-quarters of households in Wolverhampton have access to one or more private vehicles, indicating a high reliance on automobility. Sustainable transport initiatives not only aim to mitigate emissions but also offer additional benefits such as promoting active travel to combat obesity and reducing localised air and noise pollution through modal shift.
- **Vehicle-Dependent Employment Sectors:** The Transport & Storage sector represents the largest employment sector in Wolverhampton, with potentially a significant reliance on vehicles such as delivery vans and freight trucks. This highlights the opportunity for vehicle decarbonisation, including the provision of low and zero-emission solutions such as EV charging infrastructure.
- **Integrating Net Zero into Regeneration Projects:** Extensive regeneration projects are underway across Wolverhampton, posing challenges such as embodied carbon, energy consumption, and reliance on carbon-intensive construction methods. The Strategy serves as a framework to embed net zero principles into future regeneration initiatives, promoting green economic outcomes through circular economy practices, skills development, and retrofit programmes.

4 Net Zero Evidence Base

Chapter at a Glance

This Chapter provides an overview of the emission evidence base that underpins the Strategy, highlighting key carbon-intensive sectors and historical emission trends.

4.1 Baseline Emissions

4.1.1 Emissions by Sector

The largest emitting sectors (see Figure 4-1) are domestic (39%), transport (27%), industry (20%), public (7%) and commercial (7%). When looking at sectoral contributions historically, Table 4-1 shows that although transport is the joint second major source of emissions in Wolverhampton, it has seen the smallest reduction in the last 16 years (a trend that is mirrored across the UK). In contrast, the commercial sector saw the greatest reduction (75%) over the same period. Waste management emissions accounted for only 0.25 ktCO₂e in 2021.

2021 CO₂ Emissions By Sector

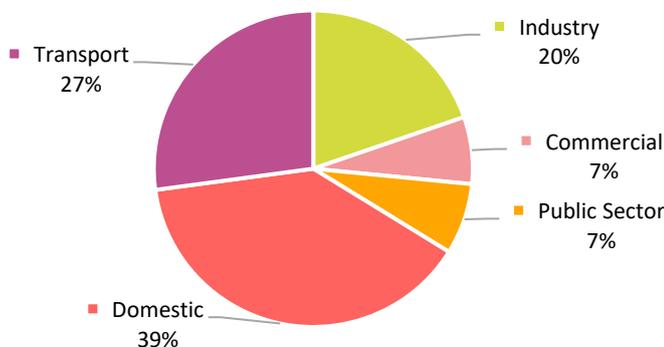


Figure 4-1: Wolverhampton CO₂ Emissions by Sector in 2021 (BEIS, 2021a)

Sector	Total CO ₂ Emissions (ktCO ₂ e)		Reduction (%)
	2005	2021	
Domestic	562	348	41%
Transport	345	242	29%
Industrial	332	176	47%
Public	114	65	43%
Commercial	247	61	75%

Table 4-1: CO₂ Emission Reductions Between 2005 & 2021 for the Highest Emitting Sectors in Wolverhampton (BEIS, 2021a)

4.1.2 Overview

To report carbon emissions consistently, where possible this report uses kilotons of carbon dioxide emissions equivalent (ktCO₂e), a common unit for carbon emissions reporting. In 2021, Wolverhampton's total carbon dioxide (CO₂) emissions stood at 896 ktCO₂e. Notably, the city has achieved a remarkable reduction of 44% in total CO₂ emissions over a 16-year period. This reduction surpasses the declines observed across both the West Midlands (36%) and the UK (39%).

Area	Total CO ₂ Emissions (ktCO ₂ e)		2005-2021 Reduction
	2005	2021	
Wolverhampton	1,600	900	44%
West Midlands	44,100	28,100	36%
UK	533,900	323,500	39%

Table 4-2: Total CO₂ Emissions Comparing 2005 & 2021 in Wolverhampton, West Midlands & UK (BEIS, 2021a)

4.1.2.1 Domestic

In 2021, the domestic sector was the largest contributor to emissions, comprising over a third (39%) of total emissions. The predominant source of these emissions stems from gas usage (see Figure 4-2). Although emissions from electricity were significant in the past, over the last 10 years it has declined steadily contributing significantly to overall emissions reductions. In contrast, gas emissions remain the major source of emissions despite showing some declines over the years.

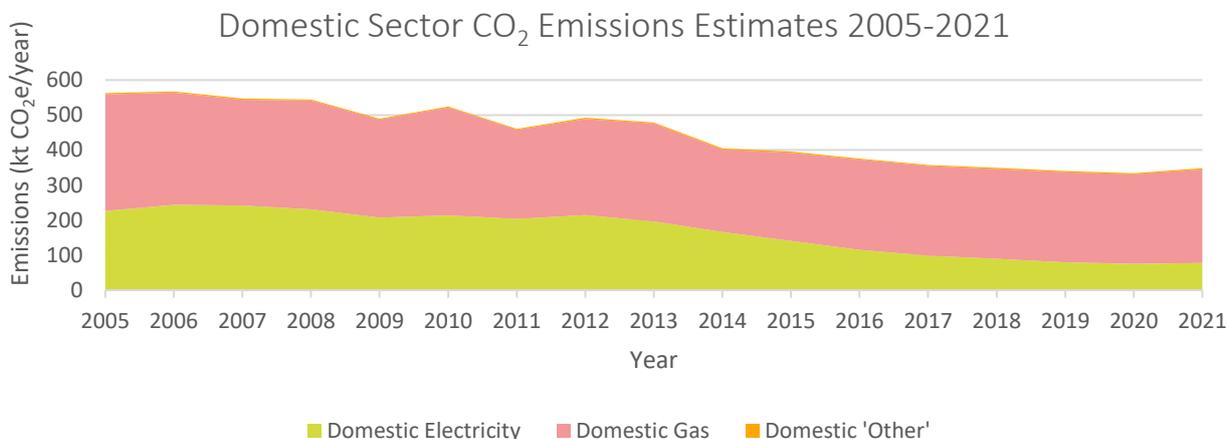


Figure 4-2: Domestic Sector CO₂ Emissions 2005-2021 by Type (BEIS, 2021a)

Of the existing domestic properties, 37% have an EPC rated A to C as seen from Figure 4-3. The other 63% properties are rated D-G (DLUHC, 2021), highlighting an opportunity to leverage improving energy efficiency as a key driver for change.

EPC Rating of Domestic Properties

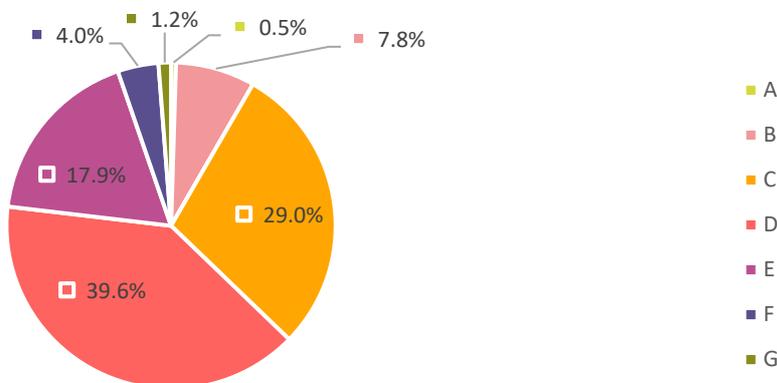


Figure 4-3: EPC Rating of Domestic Properties (DLUHC, 2021)

4.1.2.2 Transport

Carbon emissions from transport are dominated by road vehicles. In 2020 96% of emissions (208 ktCO₂) originated from cars, light good vehicles (LGVs) and heavy good vehicles (HGVs), with public transport (bus and rail) only accounting for 4%. Figure 4-4 shows the breakdown in road emissions by vehicle type, highlighting car being by far the largest emitter at 66% of total transport emissions, followed by LGVs at 20%, then HGVs at 10%, buses at 2% and motorcycles at less than 1%. It also demonstrates the change in road emissions over time, illustrating minimal reductions in transport emissions over the last 15 years across all modes. This could be explained by the upward trend observed in vehicle ownership in Wolverhampton, increasing by 16% between 2010 and 2011 (DVLA, 2022), alongside the impact of vehicle sizes increasing (which is a trend reflected across the UK). The marked drop in car emissions from 2019 and 2020 reflects the COVID-19 pandemic travel restrictions and changes to working patterns.

Road Vehicle Carbon Emissions in Wolverhampton by Year & Vehicle Type

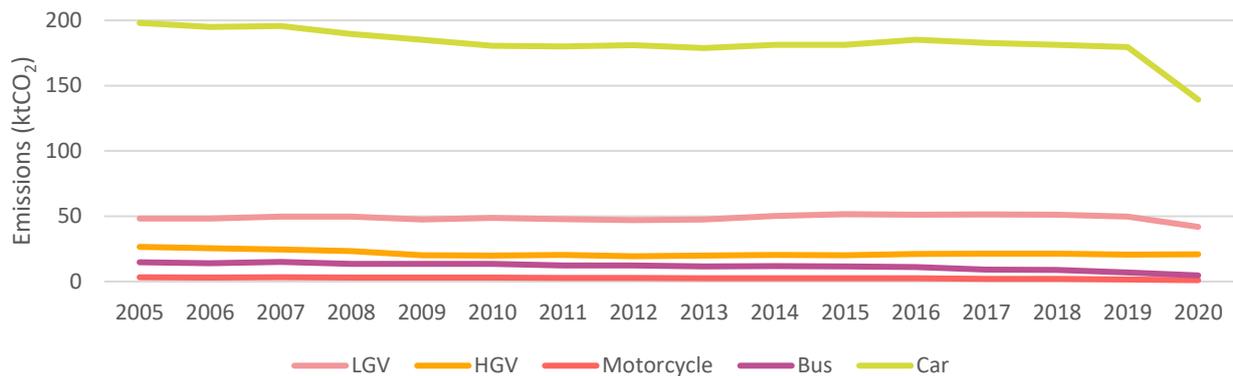


Figure 4-4: Road Vehicle Carbon Emissions (ktCO₂) in Wolverhampton by Year & Vehicle Type (Source: City Science)

4.1.2.3 Industrial, Commercial & Public

In 2021, emissions from the industrial and commercial sectors accounted for 27% of Wolverhampton's total emissions, placing it joint second (alongside transport) among the most significant emitting sectors. This category encompasses non-domestic building emissions (including electricity, gas and other fuel consumption), large industrial installations and agricultural-related carbon emissions. Additionally, public sector emissions are included due to overlapping factors.

Since 2005, the industrial and commercial Sector has witnessed substantial reductions in emissions, with a remarkable decrease of 47% and 43% respectively. Most of these reductions stem from electricity usage, primarily attributed to the decarbonisation of the energy grid. This transition has seen renewables and gas replace coal, coupled with advancements in energy efficiency measures.

According to the non-domestic EPC register for Wolverhampton (DLUHC, 2021), 30% of properties have an EPC rating of C while 59% have an EPC rating of D or lower (see Figure 4-5). This highlights that improving energy efficiency is also a key opportunity for non-domestic buildings.

EPC Rating of Non-Domestic Properties

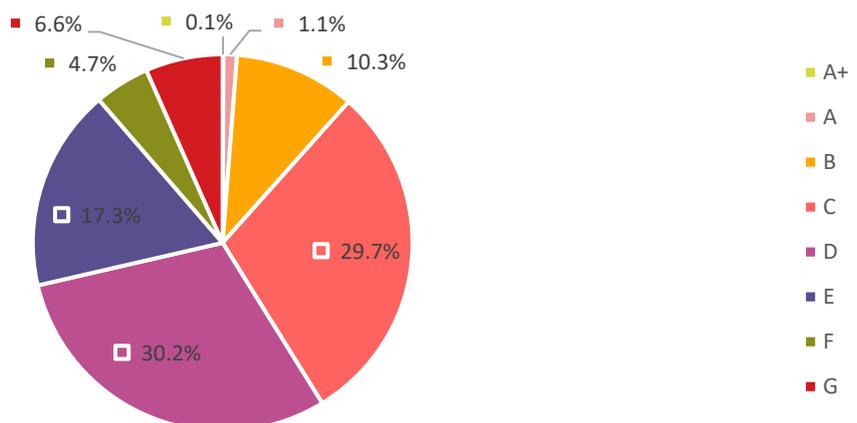


Figure 4-5: EPC Rating of Non-Domestic Properties (DLUHC, 2021)

The public sector is the fourth largest emitter, responsible for 7% of Wolverhampton's emissions, due to the scale of the sector e.g. Council is the largest employer. Key public sector organisations located in the city are represented by the Anchor Network. The Council's corporate estate accounts for approximately seven tonnes of CO₂, with ambitions to be carbon neutral by 2028 (City of Wolverhampton Council, 2022). Reaching this target will ultimately contribute to achieving Strategy outcomes. The largest carbon emitters in Wolverhampton in 2020 are shown in Figure 4-6.

Largest 2020 Carbon Emitters

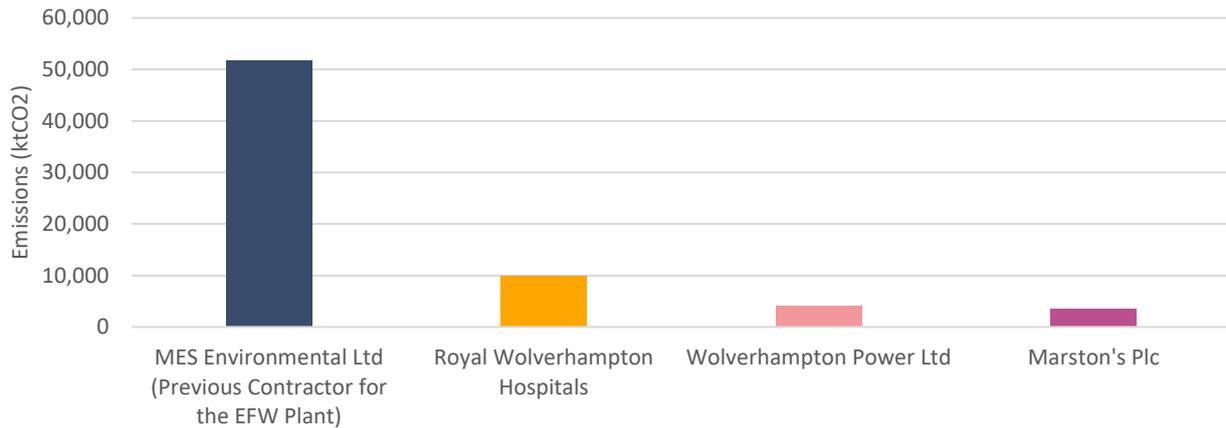


Figure 4-6: Largest Commercial & Industrial Carbon Emitters in Wolverhampton in 2020 (NAEI, 2020)

4.1.2.4 Energy Supply

The main fuel type for energy use in Wolverhampton (see Figure 4-7) is gas, used for space and water heating in buildings. The transport sector is mostly reliant on petroleum due to the current prevalence of petrol and diesel vehicles.

Wolverhampton’s Energy Use by Sector (GWh)

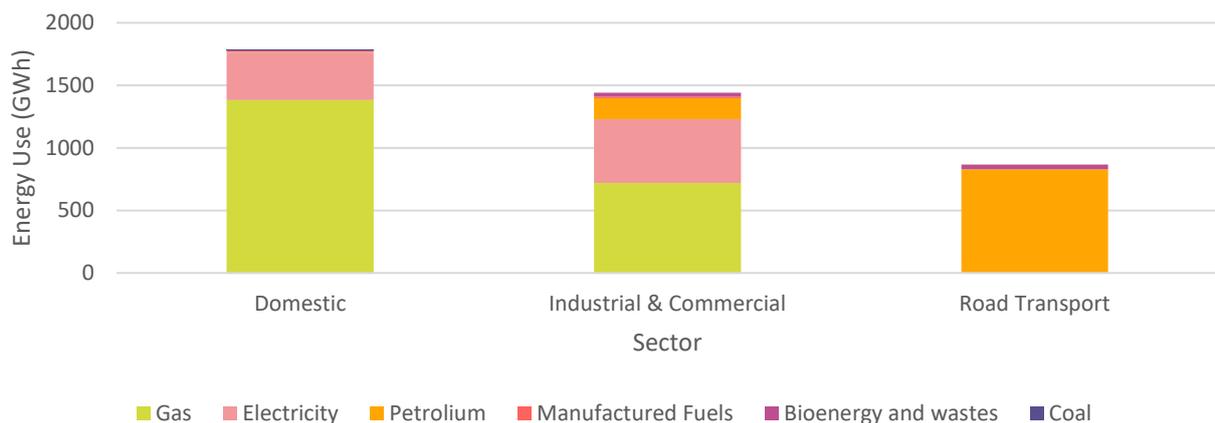


Figure 4-7: Wolverhampton’s Energy Use by Sector & Fuel Type (2021) (BEIS, 2021b)

Wolverhampton’s total estimated annual renewable energy generation was 15.6GWh - this will increase to circa 21.5GWh once Bowmans Harbour begins functioning. This is a fraction of the energy used by gas and electricity but has seen a 21% increase over the past 10 years (BEIS, 2021c). As shown in Figure 4-8, it is comprised of:

- **Photovoltaics (PV):** Use of solar energy to generate electricity.
- **Plant Biomass:** Organic materials derived from plants, such as trees, crops, agricultural residues, and other vegetation, used as a renewable energy source to generate heat, electricity, or biofuels.

Estimated Annual Renewable Generation (GWh)

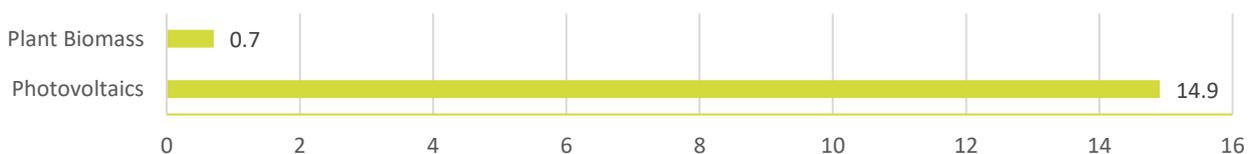


Figure 4-8: Wolverhampton's Renewable Energy Generation, 2021 (BEIS, 2021c)

4.3 Key Findings



- **Key Emission Sectors:** Wolverhampton's largest emitting sectors include domestic (39%), transport (27%), industrial and commercial (27%), and public sector (7%). While this breakdown highlights the diverse sources of emissions, it also presents an opportunity for targeted interventions to maximise impact.
- **Domestic Emissions:** The domestic sector stands out as a significant contributor to emissions, primarily driven by gas usage. With 63% of properties rated EPC D-G, there is substantial potential for retrofit solutions to improve energy efficiency and reduce emissions, presenting a key opportunity for potential actions.
- **Transport Challenges:** Wolverhampton is a car-orientated city with transport emissions dominated by road vehicles (99% of emissions) and cars accounting for 66% of these. Addressing this reliance on private vehicles and promoting sustainable transportation alternatives poses a significant challenge but also offers opportunities for emission reductions through modal shift initiatives.
- **Industrial & Commercial Emissions:** Gas and electricity dominate industrial and commercial energy use, (50% and 35%, respectively). The sector has witnessed reductions in electricity emissions due to cleaner grids and improved energy efficiency, underscoring the potential benefits of further investments in renewables and energy efficiency. A significant portion of non-domestic buildings have low EPC ratings, indicating scope for energy efficiency enhancements.
- **Public Sector Emissions:** Collaboration with the public sector presents a significant opportunity for driving change, especially as the Council have worked closely with the Anchor Network to devise and develop the Strategy.

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5 Net Zero Pathway

Chapter at a Glance

This Chapter sets out emissions pathway scenarios for the city demonstrating specific measures and the scale of those measures required to achieve net zero by 2041. Informed by this analysis, carbon budgets were developed for five-year periods until 2041 and are outlined in this section.

5.1 Methodology Overview

The pathway modelling provides a sense of the scale, timing and type of measures that need to be adopted to put Wolverhampton on a path to net zero by 2041. It has been carried out using a sector-based approach to form sector-specific actions and carbon budgets. The modelling covers the largest emitting sectors, including domestic, transport, industrial and commercial (including public sector). Energy supply emissions were also included, to capture the potential generation and the associated Scope 2 emissions. The key modelling assumptions used for each sector as well as specific inputs and outputs can be found in Appendix A: Pathway Model Assumptions.

5.2 Scenario Pathways

This section sets out the emissions pathways for Wolverhampton’s four highest emitting sectors for the Do Nothing and Net Zero Scenarios.

5.2.1 Do Nothing

Figure 5-1 outlines the Do Nothing Scenario which represents a future state where no further action is taken aside from meeting and aligning with current national policies. The pathway does not reach net zero by 2041 nor 2051, mainly due to the residual emissions in the transport and domestic sectors, alongside some residual emissions in the industrial and commercial sectors. Note that assumptions around carbon capture and storage and carbon offsetting have not been included.

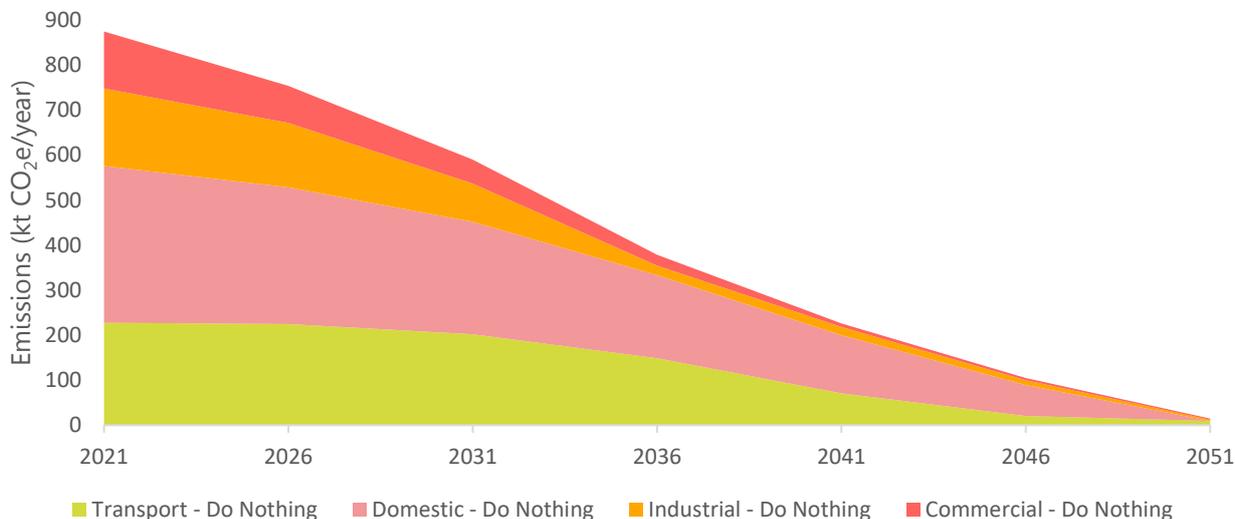


Figure 5-1: Carbon Emissions Pathway for the Do Nothing Scenario by Sector

5.2.2 Net Zero

The Net Zero Scenario, see Figure 5-2, brings Wolverhampton close to achieving net zero carbon emissions by the year 2041, representing a substantial 96% reduction from 2021 emission levels. This scenario outlines a significantly accelerated trajectory of decarbonisation compared to the Do Nothing Scenario, with a marked decrease in carbon emissions. It assumes advancements across various sectors, such as increased modal shift and enhanced efforts in retrofitting existing buildings and constructing new developments, surpassing the progress expected in the Do Nothing Scenario.

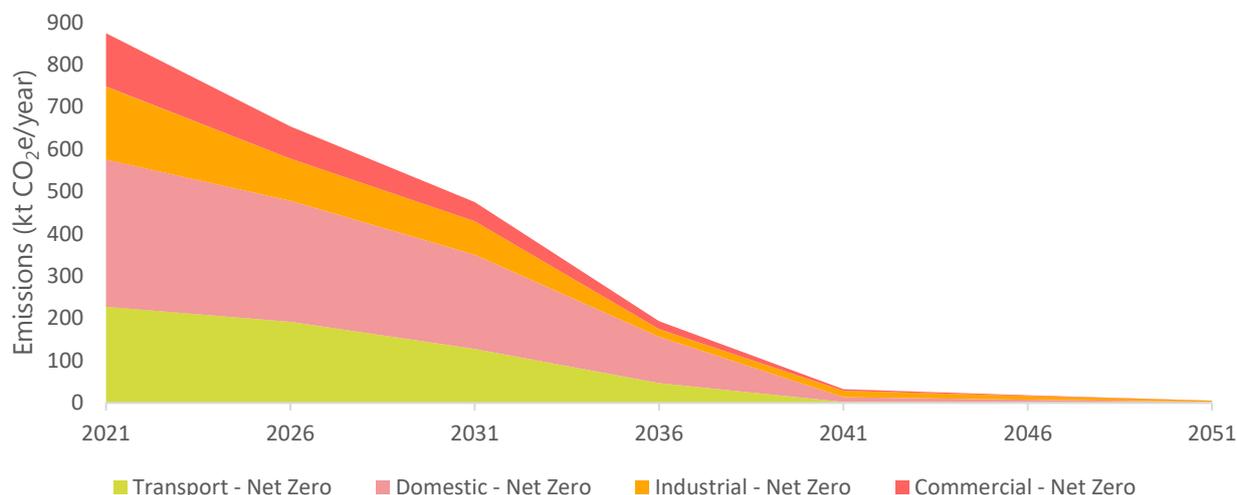


Figure 5-2: Carbon Emissions Pathway for the Net Zero Scenario by Sector

The residual emissions in 2041 (32 ktCO₂e) mainly consist of industrial (51%) and domestic (33%) emissions. The residual emissions are because hydrogen and electricity are assumed not to be net zero by 2041 (based on UK Government Green Book projections). As the future source of hydrogen is uncertain, the model has assumed that hydrogen will be produced in the UK and therefore the carbon intensity is based on the electricity grid. As the grid is not net zero in 2041, neither is hydrogen. The assumptions are ambitious and much faster than national projections, requiring significant action and engagement. The pathway highlights the importance of engaging with the industrial sector, prioritising modal shift and an accelerated rate of domestic building decarbonisation.

5.3 Net Zero Carbon Budgets

Five-yearly carbon budgets have been calculated for the Net Zero Scenario. Carbon budgets are the maximum quantity of cumulative emissions which can be emitted within those five-year periods that will not exceed the projected pathway. The budgets have been developed for each of the four sectors to act as a useful tool to enable the Green City Partner Board to assess risks, set goals and continually monitor progress. Figure 5-3 shows the carbon emissions budgets by sector, shown as cumulative values. Further information on monitoring and evaluation is outlined in Section 6.7.

Carbon Budget Period	Total (ktCO ₂ e)	Transport	Domestic	Industrial	Commercial
2022 - 2026	3,790	1,030	1,630	670	460
2027 - 2031	2,710	770	1,230	430	280
2032 - 2036	1,510	400	770	200	140
2037 - 2041	680	100	440	90	50
Total Reduction from Baseline	96%	99%	97%	91%	98%

Figure 5-3: Five-Yearly Carbon Emission Budgets by Sector for the 2041 Net Zero Scenario (ktCO₂e)

5.4 Net Zero Route Map

The 2041 net zero target for Wolverhampton can feel distant. However, by deconstructing goals into a trajectory of emissions, a clear and tangible pathway to success can be presented. A key output of this work is therefore a high-level Route Map (see Figure 5-4). This focusses on the highest emitting sectors and provides an overview of Wolverhampton’s net zero vision to 2041, supported by clear interim targets. The Route Map provides targets aligned to milestones in 2026, 2031, 2036 and 2041

which provides a monitoring framework (see Appendix B: Route Map Monitoring Table) that will motivate, advance and continually drive forward a reduction in CO₂e emissions in Wolverhampton.

5.5 Key Findings

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- **Scale of the Challenge:** There is a long way to go for Wolverhampton to reach net zero. This pathway development process has highlighted the speed and scale of change necessary to decarbonise. Achieving net zero by 2041 will require significant changes from sectors including industry, transport and domestic. The challenge and longer-term goals will become greater should short-term targets not be met.
 - **Technology & Innovation:** To deliver on the net zero pathway outlined in the Strategy, innovation and new technologies will be required (e.g. high levels of electrification in transport will need to be met with a significant increase in chargepoint infrastructure, and a range of renewable solutions to suit different use cases across domestic, commercial and industrial sectors). Innovation will also be necessary to drive down the costs of these types of infrastructure and make them accessible to all, avoiding exacerbating existing inequalities.
 - **Finance & Funding:** The decarbonisation solutions described in the Strategy cannot be delivered without a comprehensive approach to funding, finance and grants. Significant investment will be required to provide people with the technology they need to decarbonise their homes, transport and businesses. See Chapter 7 for further detail on how the Strategy could be financed.
 - **Commitment from National Government:** Current national commitments fall short of net zero by 2050. Moreover, any change in the political landscape and delays to the ambitions set by the Government present further challenges in their impact on local government influence and funding.
 - **Sphere of Influence:** The Council lacks powers and direct influence in some key areas, such as the industrial sector. As demonstrated by the net zero pathway, it has been challenging to input realistic assumptions to decarbonise this sector. Although the existing influence of the Council in this sector is minimal, it has highlighted the need to collaborate with industry to act and further reduce forecasted emissions.
 - **Collaboration:** To tackle many of the areas that need to be decarbonised, the Council will need to work with other agencies, both in the public and private sectors to deliver. See Chapter 6 for further detail on the Action Plan development process and how each action seeks to support distributed leadership and collaboration across the city.

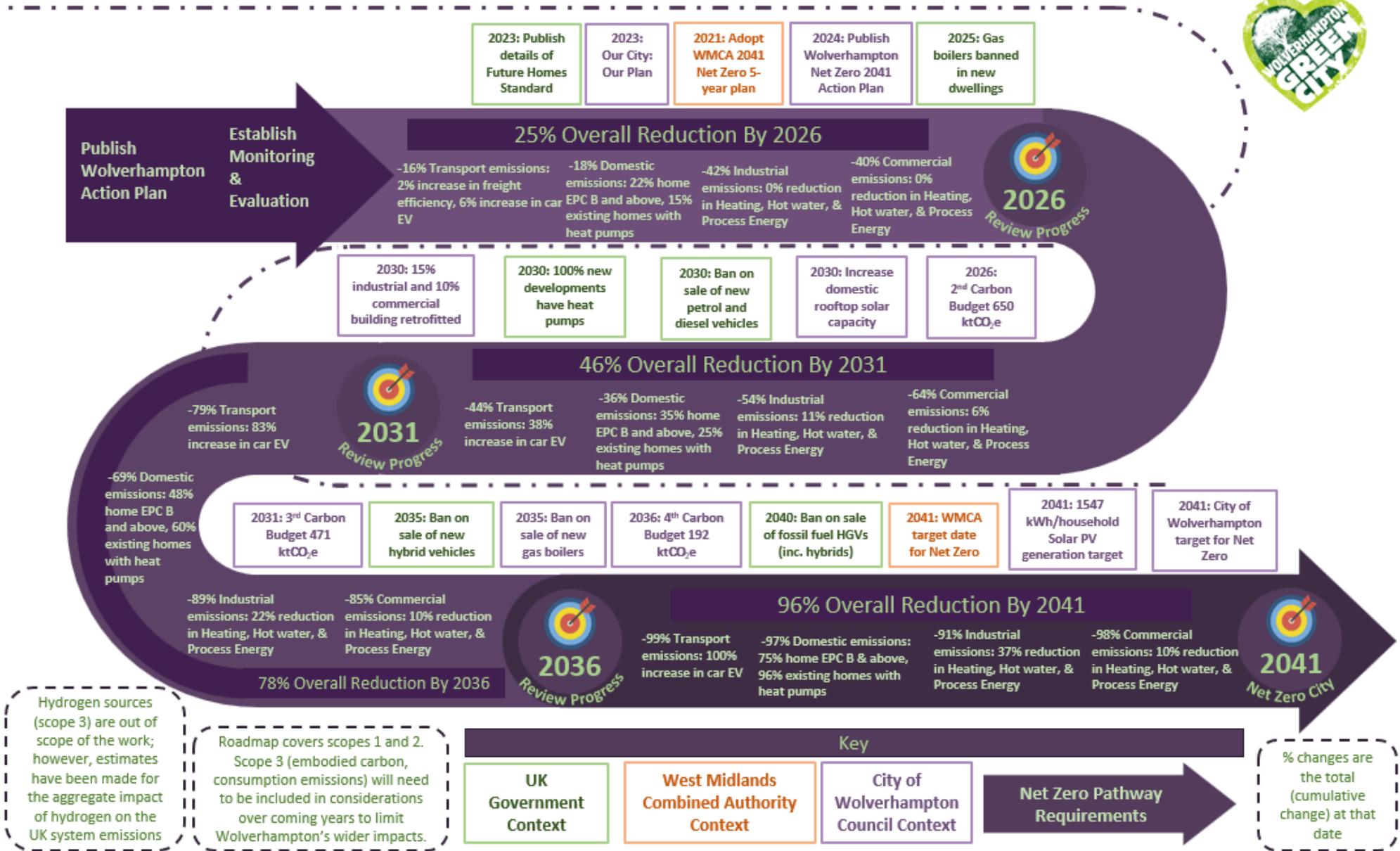


Figure 5-4: Net Zero Pathway Route Map

6 Action Plan

Chapter at a Glance

This Chapter sets out the key actions required to accelerate Wolverhampton’s delivery of net zero emissions over the next decade. It outlines the action development process, key governance arrangements, the 20 action business cases and potential risks.

6.1 Action Plan Purpose

The purpose of the Action Plan is to provide direction, channelling the wider decarbonisation focus into a set of actions that can or need to be started over the short-term and to achieve carbon reductions in line with the outlined carbon budgets. The Action Plan provides a portfolio of options, some of which will deliver measurable results over the short-term to empower and demonstrate success, and others that will be multi-year programmes necessary for longer-term success, helping to set Wolverhampton on the right trajectory to address the Route Map targets. Successful progress across the portfolio of actions will demonstrate that significant savings can be delivered through local action.

6.2 Action Development Process

A key starting point in developing the Action Plan was to identify initiatives and projects that are already in motion, to ensure that the actions build on and complement existing work. The Route Map and modelling have evidenced that there is a need to substantially scale up current activities and, whilst we recognise existing projects, we must also acknowledge that they require significant expansion to meet the Route Map’s ambitions.

The Action Plan has been developed to create a set of realistic and tailored steps that simultaneously build on and accelerate Wolverhampton’s net zero transition. The Action Plan was informed by the Net Zero Pathway Modelling and the key sectoral milestones identified within the Route Map (see Chapter 5). The success of the Action Plan will be underpinned by collaboration including from businesses, policy makers and residents. Therefore, the actions have been informed by an extensive stakeholder engagement process (see Figure 6-1).



Figure 6-1: Action Development Process Overview

Co-producing the actions in partnership with key stakeholders ensures that the final set of actions build on local expertise and knowledge and, crucially, that key stakeholder buy-in has been obtained to support city-wide ownership and shared responsibility for action implementation. Alongside collaborative sessions facilitated by City Science, the draft Action Plan has been refined and finalised by Council Officers. Sustained buy-in and collaboration will remain essential for propelling the actions forward and achieving maximum success. Table 6-1 provides further detail of the stakeholder engagement process.

Development Stage	Engagement Activities
1-1 Interviews	Five in-depth sessions were held with key stakeholders to understand existing low-carbon initiatives and activities within Wolverhampton and to identify any gaps.
Action Planning Workshops	Following the 1-1's, four thematic workshops were held: <ol style="list-style-type: none"> 1. Domestic, Industrial and Commercial 2. Energy Supply 3. Transport 4. Circular Economy, Land-Use Planning & Adaption/Resilience They explored the gaps and opportunities across the key carbon emitting sectors, identifying preliminary action concepts.
Gap Analysis & Quantitative Prioritisation	Suggested action outputs from the workshop sessions were collated and categorised and similar actions aggregated. Actions with three or more votes from workshop participants were analysed using a multi-criteria assessment that took account of: expected carbon impact, cost, alignment with the Route Map, alignment to existing strategies and existing categories, co-benefits and sphere of influence. A gap analysis was undertaken to ensure the suite of actions taken forward to the prioritisation stage was sufficient to meaningfully respond to the Route Map ambitions across all areas. Actions were then prioritised through applying a priority score derived from the multi-criteria assessment and were subsequently ranked.
Action Focus Groups	The action prioritisation stage and 1-1 interviews provided key themes which were used to inform the focus groups. Four focus groups were held in total which supported the development of high-level businesses cases for the top four priority actions for that relevant theme. For each action, discussion focused on the relevant implementation steps, funding requirements, owners/champions, any risks and dependencies and the necessary skills required for delivery.
Action Plan Consultation	The Action Plan development process concluded with an Action Plan Consultation Session where a draft of the initial priority actions was presented to senior Climate Leaders for feedback. An additional finance focused session was held with senior finance Officers to explore avenues to support the delivery of the actions. Following stakeholder feedback, the actions were updated to ensure they built on existing activities (avoiding duplication) and were ambitious yet feasible, with the ability to execute meaningful change over the next three to five years.

Table 6-1: Stakeholder Engagement Activities by Stage

The following sections provide an outline of the priority actions. These actions build on existing activities to support the significant scale up of measures required to meet Wolverhampton’s net zero commitments. Whilst ambitious, these short-term actions are embedded in realism to support successful delivery.

6.3 Action Plan

6.3.1 Overview

Table 6-2 provides the Action Plan categorised by key sector. Note that actions are not ordered by priority. Due to the urgency of reaching net zero, and to accelerate decarbonisation progress in line with Wolverhampton’s 2041 target, we propose that all 20 actions are mobilised over the next year. However, we recognise that some actions are more complex than others. We have therefore allocated each action with a timeframe within the respective business cases, as follows:

- **Short-term:** Actions which can be successfully implemented over the next 12 months.

- **Medium-term:** Actions which can be successfully implemented or scaled over the next two to three years.
- **Long-term:** Actions which can be successfully implemented or scaled over the next five+ years.

The Action Plan also includes several cross-cutting actions including enabling conditions (such as skills) and some measures that go beyond Scope 1 and 2 – for example the actions to address emissions from the construction sector. The inclusion of these actions reflects the priorities of key stakeholders and supports a wider portfolio of carbon reductions. They also reflect a whole-system approach to decarbonisation which aligns with the Council’s vision.

Finance Modelling & Carbon Impacts

To support prioritisation and to give an insight into the cost and carbon impact, we have included high-level financial estimates and indicative carbon savings based on outlined assumptions for as many actions as possible. However, given the nuanced nature of our approach, we are unable to provide a standardised metric across all 20 actions. It is also essential to acknowledge that many actions, despite lacking quantification, yield numerous additional co-benefits for their community, such as enhanced air quality, addressing fuel poverty, and improved health, which cannot be fully captured through a single standardised metric but play an important role in realising the full benefits of a net zero transition.

6.3.2 Alignment to Wider Plans

As acknowledged in Chapter 2, supporting strategic alignment has been a key priority during development of this Net Zero Strategy and Action Plan. All actions are subject to continuous refinement and evaluation, to ensure alignment with corporate objectives and the broader context (e.g. Medium Term Financial Strategy and WMCA Single Settlement).

Our City: Our Plan (2022) sets out how the Council will continue to work alongside its local, regional and national partners to improve outcomes for local people. Delivery of this ambition is supported by six priorities and three overarching principles as seen in Figure 6-2.



Figure 6-2: Our City Our Plan Priorities and Principles (City of Wolverhampton Council, 2022)

Table 6-2 highlights how each of the actions align with the Our City: Our Plan ambitions, priorities and support the improvement of outcomes for local people.

Table 6-2: How the Action Plan aligns with Our City Outcomes

Our Net Zero City Aims	No	Priority Action	Our City Outcomes					
			1	2	3	4	5	6
1. Residents & Businesses are well informed and empowered to take climate action	1.1	Establish forum for businesses to work together to reduce emissions					✓	✓
	1.2	Deliver a city-wide awareness and engagement programme for low-carbon heating solutions				✓	✓	✓
	1.3	In partnership with stakeholders, provide access to information and training on achieving Net Zero.				✓	✓	✓
2. Wolverhampton runs on smart local low carbon heat and power	2.1	Identify opportunities for power generation and storage to serve local communities	✓			✓	✓	✓
	2.2	Make solar panels available at a lower cost throughout the city	✓	✓		✓	✓	✓
	2.3	Create a city-wide heating network				✓	✓	✓
3. Wulfrunians enjoy warm and energy efficient homes in Net Zero Neighbourhoods	3.1	Devise a retrofit programme across all homes to increase energy efficiency	✓	✓		✓	✓	
	3.2	Make sure every new development across the city meets the highest standards of energy efficiency and sustainability	✓	✓		✓		✓
	3.3	Develop a fund to support community-led initiatives to achieving Net Zero			✓	✓		✓
4. Sustainable businesses, jobs and skills to create a green and circular economy	4.1	Create local centres for last-mile deliveries (delivery hubs)					✓	✓
	4.2	Continue to support energy efficiency and retrofit in businesses				✓	✓	✓
	4.3	Increase access to sharing or re-use hubs across the city						✓
	4.3	Ensure council promotes sustainable practices through its supply chain (e.g. circular economy)						✓
	4.5	Develop a plan for growing green skills and jobs in the city	✓			✓	✓	✓
5. Equal access to sustainable transport across the City	5.1	Increase number of public electric vehicle chargepoints	✓			✓	✓	✓
	5.2	Develop a plan for sustainable parking across the city			✓	✓		✓
	5.3	Improve walking and cycling routes in the city		✓	✓	✓		
	5.4	Establish incentives for using sustainable modes of transport		✓	✓	✓		✓
6. Wulfrunians enjoy equal access to a nature friendly and climate resilient city	6.1	Improve quality of open green spaces and natural waterways with our partners			✓	✓		✓
	6.2	Increase wildlife/biodiversity and plant coverage underused public and private-sector land			✓	✓		✓



6.4 The 20 Priority Action Business Cases

The actions below are numbered to align with the aims and priorities listed on page 25. These actions are not in the same order as above.

6.4.1 Transport

Delivery Timescale: Short-term		Theme: Vehicle Electrification
Action 5.1: Increase number of public electric vehicle chargepoints		
Overview	The purpose of this action is to accelerate EV chargepoint roll out and increase uptake and accessibility across the city. This action complements existing projects (e.g. the Local EV Infrastructure funding secured by BCT).	
Route Map Alignment	This action will help accelerate the uptake of EVs by improving access to infrastructure, aligning with the Route Map requirement of 38% increase in EV miles by 2031.	
Governance	Owner: BCT ULEV Programme Manager	
	Champion(s): The Council, Private Sector and National Grid Electricity Distribution (NGED)	
Implementation Steps	<ol style="list-style-type: none"> 1. Review the BCT ULEV Strategy and conduct updated needs assessment to identify key infrastructure gaps and opportunities including how EV infrastructure can support other net zero initiatives (e.g. solar canopies). 2. Support and complete the procurement process of the West Midlands-wide EV charging contract. 3. Engage with residents and businesses and promote the existing BCT chargepoint request form to support the location prioritisation process and ensure a fair, equitable and accessible spatial spread of infrastructure. 4. Engage with chargepoint operators to explore delivery models, focusing on fully funded options to accelerate delivery/raise revenue potential. 5. Deliver a first neighbourhood charging hub. 6. Develop a campaign to raise awareness of delivered sites, building on previous success of a neighbourhood charging hub. 	
Funding Requirements	Engagement with chargepoint operators who can offer fully funded models, government funding schemes (e.g. Local EV Infrastructure Fund and On-street Residential Chargepoint Scheme) and private sector investment.	
Cost Benefit	<p>Revenue Cost: Dependent on private/public sector model. If the charging operator benefits from 100% of the charging revenue, then the maintenance costs are likely to sit with them, however, this is highly dependent on the model decided between the Council and provider.</p> <p>Capital Cost: The Council has identified they are proposing to input 410 slow chargers, 77 fast charges and 6 rapid chargers. The cost would need to be agreed with the charge point operator and would be dependent on the funding model (e.g. fully funded, joint venture).</p>	
	Co-benefits: Improved air quality, attracting new investment, supporting social equity by providing a solution for residents without access to off-street parking.	
Carbon Impact	If the Council successfully meets the specific ChargePoint targets outlined in the BCT ULEV Strategy within the context of the 2035 Ban Scenario, these chargepoints have the potential to yield an estimated annual reduction of approximately 8.4 KtCO ₂ e once operational, assuming a 50% utilisation rate.	
Risks & Dependencies	<p>Key risks include:</p> <ul style="list-style-type: none"> • Resource: To expand, maintain, support infrastructure expansion at the pace/scale that is needed, alongside the skills to negotiate best value contracts with suppliers (both for residents and the Council). • Network: Historical issues with reliability and fluctuating cost of energy). 	

	<ul style="list-style-type: none"> • Adoption & Implementation: Cost of vehicles, uncertainty of future funding and on-street parking pressures.
KPIs	Number of charge point sockets delivered; ChargePoint utilisation levels; kWh energy consumed; price per kWh to consumers (to support social equality).

Delivery Timescale: Short-term		Theme: Parking
Action 5.2: Develop a plan for sustainable parking across the city.		
Overview	Through management of Council-owned car parks and on-street facilities (e.g. parking bays) the Council can utilise their parking influence to support delivery of net zero. This action aims to influence and build on the city’s emerging Council Parking Strategy to ensure that net zero considerations are acknowledged and embedded as a key principle, and to support development of an accompanying action plan.	
Route Map Alignment	By 2031 the Route Map ambition is to achieve a 44% reduction in transport emissions.	
Governance	Owner: The Council Parking Team	
	Champion(s): The Council, Green Cities and Circular Economy Team, Regeneration Business Champions	
Implementation Steps	<ol style="list-style-type: none"> 1. Define and agree key parking objectives. 2. Review previous Parking Strategy to understand any changes to current parking stock. 3. Review parking tariffs against peer cities. 4. Use data to understand usage patterns (e.g. pay and display). 5. Identify opportunities to repurpose underutilised car parks for other means (e.g. regeneration, mobility hubs). 6. Align with the city’s Regeneration Strategy to co-identify key opportunities for parking to support wider transport strategy (e.g. park and rides, mobility hubs, cycle storage, renewable generation, EV chargepoints). 7. Engage with stakeholders (e.g. businesses and community groups) throughout development to secure buy-in and collaboratively identify opportunities. 8. Develop an action plan with clear roles and responsibilities for delivery. 9. Publish updated Parking Strategy & Action Plan. 	
Funding Requirements	Explore existing internal funding pots or resources.	
Cost Benefit	<p>Revenue Cost: We acknowledge that a Parking Strategy is already in development. Development of an accompanying Action Plan could cost circa £15,000 to £20,000 if delivered externally or could be delivered in house using internal resources.</p> <p>Capital Cost: This is to be determined once the strategic approach is decided. These costs might be reduced through partnering with a parking provider such as RingGo.</p> <p>Co-benefits: Improve Air quality, promote sustainable transport modes and enhanced transport connectivity (e.g. park and rides), improve health and maximise use of the city’s assets.</p>	
	Carbon Impacts	
	<p>It is not feasible to define the carbon impact, as specific measures have not been defined and agreed.</p>	
Risks & Dependencies	Risks include resistance to proposed measures (e.g. reallocation of space); supporting equity for priority groups (e.g. blue badge holders); and competing objectives (e.g. income stream vs. decarbonisation).	

KPIs	Total number of car parks; number of parking spaces; utilisation of parking spaces; number of blue badge bays; number of EV chargepoints; repurposing of space; renewable energy generation.
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Timescale: Long-term		Theme: Demand Reduction
Action 5.3: Improve walking and cycling routes in the city		
Overview	Continue to identify and develop new strategic active travel infrastructure building on the forthcoming Local Cycling and Walking Infrastructure Plan (LCWIP) to make active travel more accessible and attractive.	
Route Map Alignment	By 2031 the Route Map requires a 23% demand reduction in personal vehicle miles which can be supported by walking and cycling through completing short-distance travel through active modes.	
Governance	Owner: The Council Transport Strategy Team Champion(s): WMCA, Sustrans, education facilities	
Implementation Steps	<ol style="list-style-type: none"> 1. Engage with key stakeholders (e.g. Sustrans) to support delivery and implementation of the city’s LCWIP. 2. Identify funding to enable delivery of the LCWIP. 3. Refine and finalise relevant scheme designs. 4. Stakeholder engagement/consultation/marketing campaign to gain feedback and support. 5. Develop detailed route designs. 6. Prioritise scheme delivery (e.g. prioritising high impact and/or low-cost routes). 	
Funding Requirements	This action could be funded by the DfT/Active Travel England’s Capability and Ambition Fund, the City Region Sustainable Transport Settlement Funding or alternative funding sources such as the Sustrans Paths for Everyone Fund or the Canal & Rivers Trust.	
Cost Benefit	<p>Revenue Cost: The Council’s LCWIP is already in progress, therefore, the main revenue costs are managing the project and consulting and engaging with stakeholders to support the development of scheme designs. This could be carried out internally without additional costs.</p> <p>Capital Cost: Approximately £104,000 per km of active travel route construction (Sustrans, 2017).</p> <p>Co-benefits: Public health benefits of a shift to active travel; improving air quality; support more connected communities; enhance social inclusion for individuals without car access.</p>	
Carbon Impacts	When comparing the increase in personal miles travelled used in active modes versus completing that same increase in a car, this action could save a total of 8.5 – 13.5 Kt CO _{2e} by 2031.	
Risks & Dependencies	This action will require early engagement across communities and from transport providers to support the co-design of schemes and ensure timely delivery. Additionally, this action is reliant on long-term funding and political buy-in to implement solutions.	
KPIs	Miles of new schemes delivered per annum; increase in active travel mode share per annum.	

Delivery Timescale: Medium-term		Theme: Modal Shift
Action 5.4: Establish incentives for using sustainable modes of transport		
Overview	Reduce private car use by targeting places with appropriate demand reduction and mode shift messages. Messaging could focus on the cost-effectiveness of buses, Park and Ride provision, free provision for seniors and discounted youth fares.	
Route Map Alignment	96% of transport emissions originate from road vehicles. Providing sustainable alternatives is crucial to deliver Route Map goals of reducing transport emissions by 44% by 2031.	
Governance	Owner: WMCA	
	Champion(s): The Council, transport operators, local businesses, active travel groups	
Implementation Steps	<ol style="list-style-type: none"> 1. Conduct travel behaviour analysis to understand factors influencing transport choices and common barriers to sustainable travel. 1. Map out current journeys to identify key demand reduction and mode shift opportunities (e.g. mobility hubs, contactless payments, improving active travel infrastructure and car clubs). 2. Engage with community action groups to develop initiatives and schemes with the local community. 3. Work with transport providers (e.g. National Express) and businesses (e.g. Wolverhampton Business Improvement District (BID)) to implement incentives (e.g. employer transport schemes, staff travel credit programmes, integrated price caps, cycling storage). 4. Develop tailored marketing campaigns communicating benefits of sustainable travel, focusing on co-benefits and consider initially targeting groups who already have discounted access (e.g. students, elderly and under 18s e.g. Student Bus Pass). Actively promote e-bikes as an option for covering distances of up to 10 miles. 5. Compliment campaign by collaborating with schools and businesses across Wolverhampton to develop tailored sustainable travel plans. 	
Funding Requirements	This action could be funded by the City Region Sustainable Transport Settlement Funding, support from BIDs and employer contributions and private contractors through concessions arrangements (e.g. for car clubs).	
Cost Benefit	<p>Revenue Cost: The cost of carrying out analysis and engaging with community and transport providers equates to approximately £25,000 (part time Project Manager).</p> <p>The costs of delivering marketing and promotional campaigns depends on the method of delivery.</p>	
	<p>Co-benefits: Reduced car dependency and congestion, potential increases in bus patronage creates income to invest in improved services, improved air quality and road safety.</p>	
Carbon Impacts	Informed by the pathway assumptions relating to forecasted public transport and car use, this action could save approximately 100 ktCO ₂ e by 2031.	
Risks & Dependencies	Risks include shifting from the existing high levels of car dependency; current transport offering not supporting modal shift (e.g. issues with reliability/frequency/cost); public perception of mass transport (e.g. cars are seen as a status symbol); and the ongoing funding to support initiatives.	
KPIs	Increase in bus patronage, walking and cycling trips per annum.	

Delivery Timescale: Long-term		Theme: Freight Decarbonisation
Action 4.1: Create local centres for last-mile deliveries (delivery hubs)		
Overview	To achieve the necessary reduction in road vehicle transport emissions, all aspects of transport should be considered including freight. LGVs and HGVs together accounted for approximately 30% of the city’s road transport emissions in 2020. Transport & Storage is one of the biggest employment sectors, accounting for 15% of total enterprise in Wolverhampton. This reflects a key opportunity to engage with freight operators to support the acceleration of zero emission vehicles or freight consolidation opportunities.	
Route Map Alignment	The Route Map aims for freight trips to become 2% more efficient each year.	
Governance	Owner: BCT or WMCA	
	Champion(s): The Council, freight industry representatives, BIDs	
Implementation Steps	<ol style="list-style-type: none"> 1. Conduct mapping to identify key freight partners and stakeholders. 2. Establish a freight forum to support ongoing engagement with the freight industry and understand last mile delivery needs. 3. Engage with landowners to identify potential sites (e.g. DPD, Royal Mail). 4. Secure funding to support delivery. 5. Issue formal call for sites. 6. Develop and deliver suitable sites. 7. Ongoing monitoring. 	
Funding Requirements	Explore internal officer resourcing to support stakeholder engagement and site identification.	
Cost Benefit	<p>Revenue Cost: Stakeholder management to be carried out internally. The management of delivery hub sites could cost anywhere between £50,000 - £100,000 p.a. plus the cost of site rental at approximately £11 per sq ft (Colliers, 2024).</p> <p>Capital Cost: This would be dependent on whether the mobility hub site was purchased or leased, for the purpose of this Strategy we have assumed it would be a lease agreement.</p>	
	Co-Benefits: Reduced congestion, improve air quality, Improve Public Health	
Carbon Impacts	This cannot be determined until the specific number of sites, locations and goods moved are finalised during action development.	
Risks & Dependencies	Land use challenges leading to difficulties obtaining suitable locations; potential resistance from residents or businesses near proposed hub sites; lack of industry engagement and resources (both internally and within the private sector) to maintain ongoing engagement.	
KPIs	Number of suitable sites identified; number of sites delivered including number and speed of ChargePoint sockets delivered; chargepoint usage; number of freight organisations using last mile hubs.	

6.4.2 Domestic Energy



Delivery Timescale: Medium-term		Theme: Domestic Retrofit
Action 3.1: Devise a retrofit programme across all homes to increase energy efficiency.		
Overview	Current retrofit initiatives must undergo substantial expansion. This action builds on existing schemes including Wolverhampton Homes and the	

	Sustainable Warmth Scheme. These schemes must be scaled up and available to all housing sectors to meet the ambitions of the Route Map.
Route Map Alignment	Over the next decade, domestic retrofit needs to rapidly scale up from approximately 9,300 homes being an EPC B in 2021 to 39,800 homes in 2031 (over 300% increase).
Governance	Owner: Council - Housing Team
	Champion(s): Wolverhampton Homes, WMCA, retrofit suppliers, private landlords, Department for Levelling Up, Housing and Communities
Implementation Steps	<ol style="list-style-type: none"> 1. Collaborate with Wolverhampton Homes and The 3 Cities to understand specific domestic retrofit needs and share learnings. 2. Conduct a mapping exercise to identify priority/suitable homes to target. 3. Secure funding to support delivery of initial pilot sites. 4. Engage with landlords through existing platforms (e.g. The Home for Landlords) to understand demand and secure buy-in. 5. Engage with local retrofit suppliers and develop a list of accredited suppliers to support programme delivery. 6. Build-on insights from the Net Zero Neighbourhood Project to assess the funding landscape for at scale delivery. 7. Identify a range of funding mechanisms to support initial energy assessments and overarching retrofit initiatives across all housing types. 8. Build a 'one-stop-shop' user friendly website that serves as a central hub for the programme, collaborating with third parties if required. 9. Develop a communications campaign to raise awareness. 10. Develop case studies to demonstrate retrofit benefits (e.g. Net Zero Neighbourhood Demonstrator). 11. Secure additional funding and launch more comprehensive programme(s). 12. Establish mechanisms for collecting feedback to integrate improvements.
Funding Requirements	This action could be financed through Government funding sources (e.g. Innovate UK, Local Authorities Delivery Funding and the Social Housing Decarbonisation Fund), private financing (e.g. landlords) and the Housing Revenue Account. Additionally, we have considered more innovative financial models in the Finance and Implementation Plan (see Chapter 7) that consider asset bundling in order to deliver low return assets such as retrofit.
Cost Benefit	<p>Revenue Cost: The development of this project will primarily be through engagement with landlords and local retrofit suppliers and the development of case studies. This could either be carried out internally or through an external hire or contract at approximately £25,000-£50,000.</p> <p>Capital Cost: Currently, the average rating for homes in Wolverhampton is EPC D (66) (ONS, 2019), therefore, the retrofit costs to get to obtain EPC C is on average £5,500 to obtain an EPC C (Knight Frank, 2022), however we are aiming for an EPC B therefore we will assume approximately £2,000 uplift in retrofit costs, therefore this will cost approximately £7,500 per property on average. For 30,000 additional homes this will amount to £225m. However, the capital cost to the Council will be determined greatly by what is under the Council's control and what is needed to stimulate private investment – the cost to the council is dependent on the method of financing implemented. For instance, most of this capital cost could be undertaken by the homeowner, this could be incentivised through market stimulus such as, green mortgages, green loans, or incentives provided by the National or Local Government. Alternatively, the Council could</p>

	facilitate the retrofit financially either through grants, the single settlement agreement, or innovative financing solutions.
	Co-benefits: Cleaner and greener homes; alleviating fuel poverty; lower energy bills for consumers; increased grid flexibility; growth in the low carbon economy; and job creation/economic growth if delivered by local suppliers (Wolverhampton £).
Carbon Impact	If just over 30,000 homes are retrofitted to EPC B by 2031 this would realise an estimated carbon saving of 47.7 KtCO ₂ e.
Risks & Dependencies	Key risks include a high percentage of non-traditional homes; the availability of trained and trusted installers; low uptake rate amongst residents and landlords; unaffordability of measures (even amongst ‘able to pay’ households); and finite, sometimes difficult to access, grant and Government funding.
KPIs	Energy efficiency measures delivered; number of homes retrofitted to above an EPC B; Energy Company Obligation installs per annum; number of measures per household; number of fuel poor households supported.



6.4.3 Industrial & Commercial

Delivery Timescale: Medium-term		Theme: Business Retrofit
Action 4.2: Continue to support energy efficiency and retrofit in businesses		
Overview	The industrial and commercial Sector accounted for 27% of total Wolverhampton emissions in 2021. Fostering a sustainable and energy-efficient business sector is vital to support net zero ambitions, growing the low carbon economy and showcasing ongoing innovation across Wolverhampton. This action builds-on, integrates and aligns with regional programmes such as the WMCA Business Energy Advice Service to scale up business retrofit to ensure Route Map ambitions are realised.	
Route Map Alignment	2031 Route Map ambitions include: <ul style="list-style-type: none"> • 54% reduction in industrial emissions (11% reduction in heating, hot water, and process energy) • 64% reduction in commercial emissions (6% reduction in heating, hot water, and process energy) 	
Governance	Owner: Green Cities and Circular Economy Team	
	Champion(s): WMCA	
Implementation Steps	<ol style="list-style-type: none"> 1. Conduct initial retrofit needs assessment into industrial and commercial buildings (e.g. age and life cycle of buildings). 2. Prioritise key businesses and areas to inform targeted outreach. 3. Develop a targeted and comprehensive engagement programme, collaborating with organisations such as Solar for Schools, to promote the benefits of retrofit. 4. Identify key funding mechanisms to support initiatives. 5. Build dedicated Council programme website page that signposts initiatives, funding opportunities and WMCA Business Energy Advice Service. 6. Launch programme. 7. As businesses begin to successfully participate in the programme, develop case studies showcasing these success stories. 8. Attend business sustainability conferences regularly, using these opportunities to network with businesses, share updates, and gather industry insights. 	

	9. Integrate, maintain and expand the Business Sustainability Partnership Forum (see Action 8) as a platform to promote the programme through continuously building relationships and sharing knowledge.
Funding Requirements	Delivery is currently supported through the UK Shared Prosperity Fund, additional funding will need to be sought for continuation of the programme.
Cost Benefit	Revenue Cost: Outsourcing of retrofit needs assessments cost approximately £300 per property (iaa, 2024) this could be supported by a retrofit coordinator/specialist costing approximately £50,000 - £60,000 per annum (on site visits). Capital Cost: The cost of retrofit will be primarily carried out by the commercial enterprise, additionally, it will be dependent on the commercial property and the requirements of their operation.
Carbon Impacts	Co-benefits: Future-proofing local businesses; growth in low carbon economy; job creation; and increased grid resilience/flexibility. Comparing the energy savings between the forecasted retrofit measures and the baseline (assuming gas heating with no changes to decarbonise heat sources (e.g. ASHP), the total estimated carbon savings that could be achieved from 2020 to 2030 are 7KtCO ₂ e.
Risks & Dependencies	Limited funding pot secured for the region as well as complex grant application processes; ensuring steady supplier of accredited installers to accommodate retrofit demand; and securing business buy-in
KPIs	Energy efficiency measures delivered; number of commercial buildings retrofitted to above an EPC C; number of measures per building; number of businesses supported; gas consumption (kWh).

Delivery Timescale: Short-term		Theme: Collaboration
Action 1.1: Establish forum for businesses to work together to reduce emissions		
Overview	The city hosts several large emitters, with the industrial, commercial and public sector accounting for 34% of total emissions in 2021. This action enables the city's largest emitters to work collectively to reduce emissions and share insights and best practice supporting ongoing collaboration and driving innovation across Wolverhampton.	
Route Map Alignment	Working collaboratively across the city will be vital to unlocking net zero and achieving a 42% and 40% reduction in industrial and commercial emissions, respectively, by 2026.	
Governance	Owner: Wolverhampton BID or Business Champions Champion(s): Anchor Network, large emitters (identified in Evidence Base), businesses demonstrating best practice, City Economy portfolio holder	
Implementation Steps	<ol style="list-style-type: none"> 1. Identify and agree key membership organisations alongside other representation from industry and Small and Medium Enterprises (SMEs). 2. Leverage existing relationships (e.g Sustainability West Midlands Network, Wolverhampton BID and Green City Partner Board) to establish the Forum. 3. Define the Forum's aim, terms of reference, structure, scope and key activity areas. 4. Identify how the Forum will link to, support and integrate with existing groups, projects and decarbonisation plans (e.g. Action 7). 5. Mobilise the Forum. 	

	<ol style="list-style-type: none"> 6. Develop a joint Forum action plan with clear net zero targets and interim milestones for member organisations. 7. Provide a communication function (e.g. offering updates on WMCA Business Energy Advice Service). 8. Develop and cascade best practice case studies. 9. Host a city-wide annual Business Sustainability Partnership Conference, providing a platform to communicate groups success and support collaborative working.
Funding Requirements	Direct funding of this action may not be necessary, however, reducing barriers to entry may be a more cost-effective approach.
Cost Benefit	Revenue Cost: Cost through the hiring of a project manager ~£50,000 p.a. to coordinate the forum. Additionally, there would need to be a budget for the conference. This would depend on whether the Council could host it in their own buildings or whether space would need to be hired, therefore, costs are likely to be £70 - £120 per person for venue hire (Squaremeal, 2021).
Carbon Impacts	Co-benefits: Develop stakeholder relationships; potential to reduce costs via economies of scale; mitigate risks via knowledge sharing; attracting new investment into the city; supporting local businesses to thrive.
Risks & Dependencies	If the top five largest emitters in Wolverhampton decarbonise before 2041, this could achieve a carbon saving of approximately 69 KtCO ₂ .
KPIs	The Forum will need to be delivery focused, leveraging common environmental, social and governance principles to drive change on specific topics. Setting clear timelines and milestones will be key, however accessing data to track progress may be difficult due to confidentiality concerns.
	Emission reductions per annum per business; number of membership organisations per annum.



6.4.4 Energy Supply

Delivery Timescale: Long-term		Theme: Energy Supply
Action 2.1: Identify opportunities for power generation and storage to serve local communities.		
Overview	Micro grids can support a transition to a net zero energy system as they are generally powered by renewable electricity or combined heat and power systems. Paired with battery storage, these networks can support delivery of net zero, whilst enabling grid flexibility and resilience. There are opportunities to integrate with the city's existing Net Zero Neighbourhood Demonstrator project.	
Route Map Alignment	The main fuel type in Wolverhampton is gas, accounting for 66% of the domestic and 34% of the non-domestic sector's energy supply. Diversifying this energy mix will be essential to realising the scale of emission reductions required by 2031 across domestic, industrial and commercial sectors.	
Governance	Owner: The Council Green City and Circular Economy Team and Cabinet Member for City Environment and Climate Change	
	Champion(s): NGED, local suppliers	
Implementation Steps	1. Engage with suppliers, NGED and local stakeholders to develop a set of principles for site identification (e.g. available land, number of properties, types of infrastructure, energy demand).	

	<ol style="list-style-type: none"> 2. Work with NGED to understand and map grid constraints, exploring opportunities to align with existing NGED Network Development Plan. 3. Apply principles, geospatial analysis and data from the WMCA Local Area Energy Plan+ to conduct an initial site prioritisation exercise at a neighbourhood level. 4. Develop proof of concept framework to test delivery model, demonstrate scheme success and apply learnings. Explore opportunities for this pilot to integrate with Net Zero Neighbourhood Demonstrator project. 5. Perform site assessment to evaluate feasibility of implementing initiative at identified pilot location, including engagement with impacted stakeholders to secure buy-in. 6. Secure funding. 7. Procure consortium of local delivery suppliers to develop innovation pilot. 8. Deliver Pilot scheme and gather feedback, integrating this to improve processes. 9. Begin roll-out of initiative to previously pre-identified priority areas, ensuring continual engagement with local communities.
Funding Requirements	This action could be funded through green bonds; the Strategic Innovation Fund; community schemes such as crowd sourcing or community municipal investment; private capital from energy companies; and alternative routes such as the West Midlands Pension Fund.
Cost Benefit	<p>Revenue Cost: This action primarily looks at the development phase of microgrid creation, therefore, using the Wales Centre for Alternative Technologies case study (Scott, 2016) on microgrid development the cost can range between £100k and £1million, depending on the extent of the microgrid and environment surrounding the development costs. These costs need to include all design, permitting and leasing, consenting, legal, financing, surveying and testing costs to take an idea of the microgrid from concept to the point that it is fully understood, consented, and ready to be implemented.</p> <p>Capital Cost: The cost of capital stated by Wales Centre for Alternative Technologies is between £0.1million to £5million with the upper end of the applying to medium voltage with large generators and batteries.</p> <p>Co-benefits: Increased energy resilience; energy cost savings; community empowerment; clean and green neighbourhoods; job creation; and local economic development.</p>
Carbon Impacts	Informed by projections regarding the adoption of solar PV technology, by the year 2031, this initiative has the potential to significantly contribute to offsetting grid emissions, estimated at 10.5 KtCO _{2e} .
Risks & Dependencies	Lack of available land and difficulties with securing permits; grid constraints; resistance or opposition from local communities; and limited funding to progress pilot scheme.
KPIs	Number of pilots delivered; funding secured; customer/community satisfaction.

Delivery Timescale: Medium-term	Theme: Renewables
Action 2.2: Make solar panels available at a lower cost throughout the city	
Overview	Increase Wolverhampton’s locally generated solar capacity on existing buildings, both commercial and domestic. Alongside potential heat network opportunities, solar energy is one of Wolverhampton’s greatest low carbon energy generation resources. This action looks to mitigate a key barrier to

	implementation, which is cost, in order to expand solar PV electricity generation across the city.
Route Map Alignment	Solar PV generation needs to increase to 204 GWh by 2031 in comparison to 15 GWh in 2021.
Governance	Owner: The Council Green City and Circular Economy Team and Cabinet Member for City Environment and Climate Change Champion(s): NGED, Renewable suppliers, community groups, local businesses, local Councillors
Implementation Steps	<ol style="list-style-type: none"> 1. Engage with landlords, residents and suppliers to understand opportunities, gaps and barriers of a bulk purchasing scheme and overall solar uptake. 2. Ensure alignment with Wolverhampton Homes and the 3 Cities programmes which both aim to conduct Wolverhampton-wide retrofit schemes. 3. Evaluate the financial feasibility and possible funding sources/models for the bulk purchasing scheme, considering factors such as costs, potential savings and affordability for housing providers and residents. 4. Establish partnerships with local reputable vendors and suppliers. Negotiate favourable terms to ensure cost-effectiveness and economies of scale. 5. Develop the scheme, building it into an existing framework or procuring a specific delivery partner, for ease of management. 6. Test the bulk purchasing scheme in a pilot phase, exploring ways to integrate with ongoing programmes of work such as Net Zero Neighbourhoods Micro Grids. Assess the effectiveness of the measures and gather feedback. 7. Develop case study of pilot success and cascade results across social media platforms to attract further investment. 8. Widen and launch framework.
Funding Requirements	Delivery could be supported through investment from renewable suppliers, community solar schemes or crowd sourcing and green bonds.
Cost Benefit	<p>Revenue Cost: Engagement with suppliers and partners to establish this scheme plus the procurement process will require significant resourcing. To deliver this project we could estimate that it will be approximately £75,000 with £50,000 allocated to the person running the scheme and £25,000 for subcontracting/outsourcing or procurement software costs.</p> <p>Capital Cost: Approximately £3,600 per household. The upfront cost of solar panels is approximately £1,300 per kW for a medium construction operating below 4kW at 11% capacity (BEIS, 2020). Therefore, this could cost each household on average £2,600 to install solar PV (excluding maintenance) with an additional £1,000 for an inverter to create 1,550 kWh per household on average. The labour costs are not included in these figures.</p> <p>Co-benefits: Affordable access to renewables; opportunities to boost local low carbon economy; and improved grid resilience and reliability.</p>
Carbon Impacts	Informed by projections regarding the adoption of solar PV technology, by the year 2031, this initiative has the potential to significantly contribute to offsetting grid emissions, estimated at 10.5 KtCO ₂ e.
Risks & Dependencies	Labour availability and building trust with suppliers; scalability concerns (e.g. securing buy-in); and structural reinforcement costs; and funding and attracting institutional investment
KPIs	The number and size of the installations per annum; customer satisfaction with the scheme; amount of kWh/building.



6.4.5 Nature Recovery

Delivery Timescale: Medium-term		Theme: Nature Recovery
Action 6.1: Improve quality of open green spaces and natural waterways with our partners		
Overview	Identify suitable sites, potential partners and funding sources to support the delivery of new habitat creation as well as habitat restoration projects, to support biodiversity net gain and nature recovery initiatives. This action will support the implementation of the Council’s Nature Recovery Strategy and Open Space Strategy Action Plan, building on the success of existing schemes (e.g. Wolverhampton and Canal & River Trust’s successful tree planting initiatives). This includes the Council’s Queen’s Green Canopy project which saw over 46,000 trees planted across the city.	
Route Map Alignment	The Route Map acknowledges that some emissions sources are difficult to decarbonise. In these cases, this action can support locally-based carbon offsetting or in-setting of solutions as well as promoting a host of co-benefits.	
Governance	<p>Owner: The Council</p> <p>Champion(s): WMCA, Local Nature Partnership, Canals & River Trust and Wildlife Trust</p>	
Implementation Steps	<ol style="list-style-type: none"> 1. Review existing strategies to support alignment with key programmes of work (e.g. Nature Recovery Strategy, Open Space Strategy, Place Making Strategy, Tree Planting Strategy, Canal & River Trust). 2. Review and build-on the public consultation of the Open Space Strategy to identify areas to improve/prioritise an appetite for potential initiatives (e.g. pocket parks, tree nursery). 3. Integrate consultation results into either the Open Space Strategy or the Nature Recovery Strategy to ensure a strategic approach for green corridors that connects existing open space, building on the network of priority restoration zones within the Black Country Nature Recovery Strategy. 4. Identify key multifunctional corridors that could promote transport, nature, physical activity and climate change (e.g. canal corridors). 5. Identify and secure funding (e.g. Green Recovery Challenge Fund). 6. Support implementation of Nature Recovery Strategy and Open Space Strategy Action Plan and other initiatives that promote nature recovery (e.g. community allotments, urban greening, wayfinding improvement, education programmes) building on existing successful schemes such as the Wolverhampton Tree Planting Initiative. 7. Continue to establish relationships with voluntary sector and nature-recovery organisations (e.g. Wildlife Trust) to secure buy-in and support enhancement of identified areas and register projects. 8. Work with landowners to develop a long-term maintenance plan for the improved open-space network. 9. Develop education programme to promote the importance of green and blue infrastructure across Wolverhampton. 	
Funding Requirements	Government funding schemes (e.g. Shared Prosperity Fund and the Tree Production Capital Grant); WMCA Community Grants and the Heritage Lottery Fund; Biodiversity Net Gain grants to support feasibility work.	

Cost Benefit	<p>Revenue Cost: Supporting the engagement process for the Open Strategy Action Plan could be done through the employment of a part time project manager costing ~ £25,000. Dependent on the size of sites to look after the natural capital we would suggest the employment for a skilled land management worker (cost would vary dependent on land size) of approximately £30,000-£60,000 (part-time/full time).</p> <p>Capital Cost: The capital cost depends highly on what strategic plans are developed in terms of corridor creation. Examples of natural capital costs are; the cost of planting trees per hectare is approximately £900-£2,000 per hectare (Woodland Trust , 2023), the cost of peatland restoration is £1,009 per hectare with a variation of £3,707 in cost from minimum to maximum (University of Leeds, 2019) and grassland restoration is approximately £1,000 (Environment Agency, 2015).</p> <p>Co-benefits: Green neighbourhoods; public health benefits from utilising green spaces; biodiversity enhancement; improved air quality; community recreation and cohesion.</p>
Carbon Impact	Carbon sequestration potential can only be determined once specific projects have been selected and completed.
Risks & Dependencies	Lack of staff (e.g. rangers) to monitor and enforce anti-social behaviour; safety and long-term cost of maintenance; development pressures on green space (e.g. housing and city centre growth).
KPIs	Number and scale of projects delivered per annum; amount of carbon sequestered by newly created and restored habitats.

Delivery Timescale: Medium-term		Theme: Green Infrastructure	
Action 6.2: Increase wildlife/biodiversity and plant coverage underused public and private-sector land			
Overview	The Council has recognised a pipeline of promising locations for biodiversity net gain initiatives throughout the city, as well as opportunities to support wider green infrastructure investment. These locations present significant potential for enhancing ecological diversity through strategic land management interventions. These could include former industrial sites, brownfield locations and unused parcels of council-owned land such as verges.		
Route Map Alignment	The Route Map acknowledges that some emission sources are difficult to decarbonise. In these cases, this action can support locally based carbon offsetting or in-setting of solutions as well as promoting a host of co-benefits.		
Governance	<p>Owner: The Council</p> <p>Champion(s): Local businesses, transport organisations, Council Highway Team and Environmental Services, Council Planning Team</p>		
Implementation Steps	<ol style="list-style-type: none"> 1. Engage with relevant stakeholders (e.g. large landowners) and Council officers to understand existing plans and policies (e.g. Nature Recovery Strategy and Open Space Strategy Update). 2. Build relationships across the private and public sector to foster collaboration and buy-in. 3. Identify potential assets via conducting a thorough mapping and inventory of the Council’s existing assets (e.g. green verges). 4. Engage with large, local landowners and community groups to identify potential sites, alongside understanding key opportunities and challenges. 		

	<ol style="list-style-type: none"> 5. Develop key measures to implement across locations (e.g. rain gardens) that align with and support current activities. 6. Begin feasibility work for projects on Council land, using pre-identified optimal Biodiversity Net Gain sites, to capture Biodiversity Net Gain funding. 7. Identify funding (e.g. WMCA Local Investment in Natural Capital Programme) and deliver schemes.
Funding Requirements	This action could be funded by investments from local businesses; the private sector; from Government sources (e.g. Commonwealth Games Legacy Enhancement Fund); or regional funding initiatives (e.g. WMCA Local Investment in Natural Capital Programme).
Cost Benefit	<p>Revenue Cost: Incentivising local landowners, marketing and carrying out feasibility work has a large variety of costs dependent on the deployment methods chosen. A land manager could be utilised across Actions 11 and 12.</p> <p>Capital Cost: The capital costs of Actions 11 and 12 are the same as they both involve the restoration of land and biodiversity.</p> <p>Co-benefits: Enhanced urban aesthetics contributing to vibrant spaces and increased biodiversity.</p>
Carbon Impact	Carbon sequestration potential can only be determined once specific projects have been selected and completed.
Risks & Dependencies	Lack of wayfinding to improve connectivity; ensuring design meet highway design specifications; health and safety regarding maintenance (e.g. accessing roundabouts); ongoing funding to deliver schemes and maintain them.
KPIs	Number of potential sites identified; number of sites repurposed.



6.4.6 Circular Economy

Delivery Timescale: Short-term		Theme: Sharing Hubs	
Action 4.3: Increase access to sharing or re-use hubs across the city			
Overview	Significant regeneration is planned across the city. Whilst our key focus is scope 1 and 2 emissions, we recognise the circular economy and sharing opportunities relating to construction activity. This action aims to align with key regional programmes such as the WMCA Circular Economy Roadmap and build on pipelines of work (e.g. the Reuse Hub) to limit the associated emissions from proposed construction activities.		
Route Map Alignment	Circular economy is a key cross-cutting theme underpinning Strategy and Action Plan development. This action has been included to ensure strong alignment with this foundational objective as well as wider goals (e.g. promoting collaboration, tackling embodied carbon and reducing waste).		
Governance	Owner: WMCA		
	Champion(s): The Council, Wood saints and Private Contractors		
Implementation Steps	<ol style="list-style-type: none"> 1. Identify and engage with existing sharing hubs to establish partnerships and embed key learnings from delivery models. 2. Define scope of services, ensuring integration with WMCA Circular Economy Roadmap principles and priorities. 3. Determine key focus for each site (e.g. construction) to develop targeted outreach to support uptake. 4. Identify suitable locations and engage with potential partner organisation. 		

	<ol style="list-style-type: none"> 5. Support deployment of the Zero Waste Construction Hub and monitor appetite for expansion. 6. Launch a comprehensive promotional campaign to raise awareness, including collaborating with local businesses to develop and host a series of workshops and events. 7. Identify and secure funding. 8. Explore opportunities for scaling up services and progress additional sites, leveraging the success of the Zero Waste Construction Hub. 9. Engage regularly with networks to monitor success of initiatives and implement user feedback.
Funding Requirements	Delivery of this action could be funded the private sector and local businesses as well as community funding (e.g. the People’s Postcode Lottery).
Cost Benefit	<p>Revenue Cost: Cost of hiring out the venue and employing full-time employees. The cost of venues for sharing depends on the agreement reached between the site manager/leaseholder and the Council.</p> <p>The engagement could either be carried by current staff capacity of through the hiring of a part time project manager ~£25,000. The sites will also need to be monitored so that the Zero Waste Construction Hubs are used appropriately the hiring of these staff members are likely to be approximately £25,000-£30,000 per member of staff.</p>
Carbon Impact	<p>Co-benefits: Supports community cohesion amongst the business community; reduced costs to businesses; reduced overall consumption; limiting waste to landfill and growth of circular economy.</p> <p>It is difficult to quantify the impact of the action. Circular economy initiatives will reduce embodied carbon emissions from reduced purchasing of new products.</p>
Risks & Dependencies	Uncertainty over long-term financial sustainability; community and business buy-in; securing technical knowledge and skills to run sites and workshops; and securing sites to progress schemes.
KPIs	Delivery of a zero-waste construction hub; number of businesses using the hub per annum; tonnes of waste diverted form landfill per annum.

Delivery Timescale: Medium-term		Theme: Procurement	
Action 4.4: Ensure council promotes sustainable practices through its supply chain (e.g. circular economy)			
Overview	This action seeks to leverage the influential procurement power of the public sector to advance overarching Route Map ambitions across sectors. In parallel, this will foster a robust foundation for achieving ambitious environmental goals whilst promoting net zero practices and reducing the carbon impact of the Council’s supply chain. Working collaboratively across the Anchor Network will not only maximise the impact of this action but presents cost saving opportunities via collective purchasing.		
Route Map Alignment	Supports alignment with the following 2031 Route Map sectoral emissions reduction requirements: <ul style="list-style-type: none"> ● -44% in transport emissions ● -36% in domestic emissions ● -54% in industrial emissions ● -64% in commercial emissions 		

Governance	Owner: Anchor Network Partner
	Champion(s): Anchor Network
Implementation Steps	<ol style="list-style-type: none"> 1. Review the Anchor Network partners’ existing procurement policies and guidelines. 2. Identify areas of best practice across the Anchor Network to cascade knowledge alongside identifying key areas where net zero carbon and circular economy principles can be incorporated. 3. Review and identify best practice across the UK. 4. Conduct an audit to identify high impact areas that the Anchor Network can collectively prioritise. 5. Develop and agree key activities, milestones and develop a collective Action Plan to provide clarity on action ownership. 6. Set key sustainability standards and policy requirements for large suppliers. 7. Gain internal and external feedback to ensure their feasibility. 8. Embed standards into procurement contracts. 9. Engage with the supply chain to communicate new requirements (e.g. via a suppliers’ forum). 10. Monitor the supply chain to ensure the requirements are being delivered.
Funding Requirements	This action may not require external funding and could be supported through existing processes and resources.
Cost Benefit	Revenue Cost: Explore utilising existing officer time to resource to engage and identify best practice. The auditing process could be contracted externally for anywhere between £2,000-£20,000 dependent on the volume of data they’re auditing.
	Co-benefits: Achieving cost savings and efficiency within projects; showcasing innovation; sharing best practice; supply chain resilience; and growth of circular economy.
Carbon Impact	Difficult to quantify impact of action. Circular economy initiatives will reduce embodied carbon emissions from reduced purchasing of new products.
Risks & Dependencies	The size and scale of the Council and the Anchor Network means that embedding change can take time. Due to resource constraints and political cycles, the public sector does not always have the luxury of making long-term procurement decisions. It will require a significant cultural change to embed this action
KPIs	Number of policies implemented per annum; outcomes of monitoring the supply chain for compliance.

6.4.7 Cross-Cutting



Delivery Timescale: Medium-term	Theme: New Builds
Action 3.2: Make sure every new development across the city meets the highest standards of energy efficiency and sustainability	
Overview	Large-scale regeneration is planned across the city, including 10,000 homes over the next 15 years. The Council can harness their power and influence as a commissioner of buildings (e.g. new homes, schools (e.g. St Peter's Collegiate CofE School)) to raise the standard of new builds by supporting net zero and climate resilient buildings; reducing embodied energy and incorporating nature-based solutions.

Route Map Alignment	Ensuring new builds exceed current guidance by incorporating energy-efficient technologies, promoting renewable energy generation and usage, integrating green infrastructure and circular economy construction principles and reducing private vehicle travel directly contributes to reducing emissions across all four key sectors. Alongside this, promoting these practices supports the minimisation of carbon emissions resulting from regeneration plans, contributing to sustainable growth.
Governance	Owner: The Council
	Champion(s): Wolverhampton Homes and WMCA
Implementation Steps	<ol style="list-style-type: none"> 1. Conduct a thorough review of existing Council policies related to new builds to identify key areas of improvement and support alignment with future policies (e.g. Local Plan, subject to development timeline, and Future Homes Standard (FHS)). 2. Conduct a best practice review into successful innovative new build projects across the UK to understand key learnings. 3. Clearly define sustainability criteria and principles for new builds (e.g. minimum energy efficiency standards, climate-resilient design principles and using materials with lower embodied carbon). 4. Work closely with internal colleagues to align sustainability standards with broader planning and climate action plans. 5. Integrate the sustainability criteria into the commissioning process for new builds. Develop clear guidelines and requirements that must be to receive approval and support from the Council. 6. Identify sites to set an exemplar standard and demonstrate feasibility of new standards. 7. Collaborate with and support education bodies and existing programmes (e.g. Springfield Building College) to provide training to meet new sustainability standards. 8. Monitor and track the performance of new builds against sustainability standards, ensuring enforcement is maintained. 9. Cascade any findings and lessons learnt to the Anchor Network.
Funding Requirements	This action may not require external funding and could be supported through existing processes and resources.
Cost Benefit	<p>Revenue Cost: The review and stakeholder engagement could be carried out in house, however, if further resource was needed to manage the additional processes, we can assume a project manager salary level at approximately £50,000 p.a.</p> <p>Capital Cost: The creation of a supplementary planning document for sustainability guidance could either be created in house or through hired contractors with the costs ranging from £150,000 - £250,000.</p> <p>Co-benefits: Supports resilience of the local energy network; safe and healthy homes for all; growth of low carbon economy; local upskilling; where affordable housing is being provided, addresses fuel poverty and support health benefits.</p>
Carbon Impact	It is anticipated that around 11,000 homes will be constructed by 2041. Should these homes adhere to the FHS rather than current standards, the potential reduction in carbon emissions could amount to approximately 8.5 KtCO _{2e} per year once they are built.
Risks & Dependencies	Any increased costs will impact the viability of embedding higher standards; availability of products; potential skill shortages within the Council and across the broader supply chain.

KPIs	Number of pilot schemes delivered per annum.
Delivery Timescale: Short-term Theme: Knowledge Sharing	
Action 1.2: Deliver a city-wide awareness and engagement programme for low-carbon heating solutions.	
Overview	It is anticipated that ASHP will play an instrumental role in the transition away from gas as a heating source. However, knowledge and technical expertise on ASHP is presently extremely limited – not only at the Council but across the UK. This action aims to address that gap by developing resources to support upskilling
Route Map Alignment	ASHP will play a vital role in decarbonising industrial and commercial processes. This action will support reaching Route Map 2031 ambitions of powering over 70% of new industrial buildings with ASHP and achieving a 15% emission reduction in existing industrial buildings through retrofit.
Governance	Owner: WMCA Champion(s): Anchor Network, city’s largest emitters
Implementation Steps	<ol style="list-style-type: none"> 1. Engage with industry and businesses to understand key knowledge gaps. 2. Develop an Action Plan to support prioritisation. 3. Develop a range of education materials such as: <ul style="list-style-type: none"> • How ASHP works and their benefits. • Case studies showcasing successful installations across the region. • Frequently asked questions and addressing common queries. • Signposting a diverse mixture of content (e.g. videos and webinars). 4. Engage with retrofit suppliers and secure funding to develop an interactive Sustainability Assessment Tool to support businesses with estimating potential energy savings and costs. 5. Disseminate communications and tools through established forums (e.g. forthcoming Business Sustainability Partnership Forum) and to local businesses to promote knowledge building. 6. Collate and host resources on a dedicated WMCA webpage.
Funding Requirements	This action could be funded through Government schemes that have been secured for the region such as the UK Shared Prosperity Fund.
Cost Benefit	Revenue Cost: Educational material creation and the running of the upskilling programmes this could be carried out in a number of ways, for instance; a bespoke course to a large group developed by a consultancy could cost approximately £2,000 to £10,000 dependent on the length of the course (one session versus a series of seminars), or individual courses for each applicant approximately £500-£2,000 per applicant. Communications of the tools and engagement could be carried out via the Council’s website and newsletters.
Carbon Impact	Co-benefits: Job creation and training opportunities in green economy; financial savings for end-users; foster knowledge sharing and enhanced stakeholder relationships across local businesses; and integration with wider city objectives. A property heated by an ASHP versus a gas boiler could save 1,800 kgCO _{2e} by 2030.
Risks & Dependencies	Key skills and knowledge gap; retrofit dependency for heat pumps; cost of heat pumps and the cost of running them without other retrofit measures.

KPIs	Development of a dedicated webpage; development of interactive Sustainability Assessment Tool; number of ASHP installed per annum.
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Delivery Timescale: Long-term	Theme: Heat Networks
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Action 2.3: Create a city-wide heating network	
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Overview	The Energy from Waste (EfW) Plant located in Dunstall Hill is a waste collection, treatment and disposal centre that is owned by the Council. This site presents one of several unique opportunities to explore low carbon technologies to support powering the city (e.g. utilising excess heat or producing electricity to power heat networks). This opportunity has been previously explored, but not progressed due to financing challenges. This action therefore involves building on previous insights and leveraging best practice from across the UK to successfully drive the initiative forward.
Route Map Alignment	By 2031, 4% of heating in existing commercial buildings is to be supplied by district heating.
Governance	Owner: The Council and Private Sector Partner Champion(s): WMCA, Anchor Network, Regeneration and Planning Team(s), EfW Operating Team
Implementation Steps	<ol style="list-style-type: none"> 1. Conduct heat demand analysis (e.g. existing energy consumption patterns and identifying areas with significant heat demand). Map potential waste heat sources across Wolverhampton. 2. Engage with key stakeholders (e.g. potential “off takers”, the Anchor Network) to understand key opportunities, requirements and challenges. 3. Collate and explore pre-existing heat network feasibility studies to integrate key learnings and align with future programmes of work. 4. Conduct analysis to identify potential locations to progress a pilot location (e.g. through mapping existing energy infrastructure, evaluating building density and assessing industrial zones). 5. Prioritise locations, exploring opportunities to model roll out within the Green Innovation Corridor. 6. Develop a comprehensive Network Plan and business case including detailed scheme design and phased implementation approaches. 7. Secure funding and investment. 8. Establish project team to monitor delivery. 9. Pilot network delivery. 10. Expand network to previously pre-identified areas.
Funding Requirements	Delivery of this action could be funded through Government sources (e.g. Green Heat Network Funding); private sector investments such as heat network operators and developments; community power purchase agreement options; and green finance grants.
Cost Benefit	Revenue Cost: Conducting heat analysis and feasibility requirements requires technical knowledge. We would estimate the required funding for this analysis to be £100,000 - £150,000 (Previous case study Andover- their feasibility study was approx. £100,000 (Council, 2023)). Capital Cost: Pilot network delivery- this depends greatly on the MW’s produced by the pilot scheme the UK government has reported that the capital costs of a district heat networks are approximately £150 per MWh with thermal stores costing £14 MWh (DECC, 2015).

	Co-benefits: Increased energy efficiency; job creation in low carbon sectors; reduction of heat island effects; demonstration of local government leadership; and enhanced resilience to energy price fluctuations.
Carbon Impacts	When compared to gas heating, powering the electrical and heating demand through district heating could save approximately 18 KtCO _{2e} from 2030 to 2040.
Risks & Dependencies	Funding to cover upfront infrastructure costs and variable energy pricing; uncertainty around heat source availability (e.g. future of energy from waste plant); delivery timescales and disruption to transport networks; route constraints such as suitability of district network operator infrastructure; and stakeholder buy-in and securing commercial interest.
KPIs	Delivery of a pilot site; percentage of heat supplied by district heating networks per annum.

Delivery Timescale: Medium Term		Theme: Upskilling	
Action 4.5: Develop a plan for growing green skills and jobs in the city			
Overview	To effectively realise proposed large-scale low carbon schemes (e.g. retrofit programmes), it is imperative to formulate a comprehensive action plan addressing the existing skills training gap. By strategically developing initiatives to bridge this gap, this action aims to maximise local green growth opportunities and ensure the city is equipped with and benefits from the necessary skills that will be essential for achieving the transition to net zero and driving low carbon growth.		
Route Map Alignment	Supports alignment with the following 2031 Route Map sectoral emissions reduction requirements: <ul style="list-style-type: none"> • -44% in transport emissions • -36% in domestic emissions • -53% in industrial emissions • -64% in commercial emissions 		
Governance	Owner: The Council		
	Champion(s): Education bodies, local renewable suppliers, WMCA		
Implementation Steps	<ol style="list-style-type: none"> 1. Conduct a baseline assessment of the existing labour market. 2. Map technological requirements against the net zero pathway to identify gaps between current capabilities and the skills required to achieve net zero. 3. Develop collaborations and partnerships with stakeholders such as: <ul style="list-style-type: none"> • Private sector: To identify pre-existing schemes to integrate with, key barriers and challenges. • Training providers: To enable the design and implementation of training programmes that align with industry needs. • Education bodies: To raise awareness and the importance of green skills training and deliver appropriate courses. 4. Develop a prioritised action plan for green skills with key monitoring targets and milestones and embed this within the existing Council’s Skills Strategy. 5. Facilitate the collaborative development of specific training packages tailored to address the identified opportunities and gaps in the region. 6. Establish a Green Skills Hub to promote available training and foster collaboration between education and industry. 7. Conduct regular action plan progress reviews to maintain progress 		

Funding Requirements	This action may not require external funding and could be supported through internal existing resources; however, some capital streams could be explored (e.g private company apprenticeship schemes or education facility investments).
Cost Benefit	Revenue Cost: In the initial year we could assume a part time project manager could lead the coordination with stakeholders and then a specialist support could be brought on board to deliver training. Project Manager: £25,000 (£50,000 pa at 0.5 FTE). To support training and delivery we estimate approximately £40,000 - £50,000 p.a. or this could be outsourced and charged on a per activity basis. It would be expected that this would include engaging with the supply chain to evidence skills need, assessment of local assets and delivery capacity, development of curriculum and supporting with funding options such as the Apprenticeship Levy.
Carbon Impacts	Co-benefits: Growth in low carbon and local economy and support creation of high-quality jobs; flexible and resilient skill system; and development of resilient retrofit supply chain. This action is difficult to quantify however will directly contribute to lowering emissions through the implementation of retrofit measures and low carbon technologies.
Risks & Dependencies	Unknown and emerging technologies create new skills requirements; availability of labour and ability for businesses to provide apprenticeships; delivery timeframes for introducing courses; and political and regulatory changes at a national and local level
KPIs	Development of a low carbon skills action plan; delivery of a Green Skills Hub; number of individuals enrolled on courses; number of individuals that secure job in low carbon industries

Delivery Timescale: Medium-term		Theme: Finance & Funding
Action 3.3: Develop a fund to support community-led initiatives to achieving Net Zero		
Overview	A key objective of the Net Zero Strategy and Action Plan is to maximise opportunities and benefits to the city’s residents and to support equity and social inclusion. Community-led schemes bring multiple benefits, creating unity, pride and can a play an important role in driving the behavioural change required to deliver the city’s net zero ambitions. This action will build on existing funding schemes such as the WMCA Community Green Grants and Community Environment Fund, to provide residents with the power to develop and deliver net zero schemes that align with their priorities whilst also helping showcase the benefits and co-benefits of net zero to the community.	
Route Map Alignment	Supports alignment with the following 2031 Route Map sectoral emissions reduction requirements: <ul style="list-style-type: none"> • -44% in transport emissions • -36% in domestic emissions • -53% in industrial emissions • -64% in commercial emissions 	
Governance	Owner: The Council	
	Champion(s): Local community groups	
Implementation Steps	1. Clearly define the objectives of the funding pot.	

	<ol style="list-style-type: none"> 2. Evaluate financial feasibility and possible funding sources/models (e.g. grants and loans). Explore partnerships with local businesses and government agencies to increase the funding pool. 3. Engage with existing available schemes (e.g. WMCA Community Green Grants) to understand lessons learnt and integrate best practice. 4. Establish criteria for eligibility, ensuring that projects align with community-led initiatives, place-based approaches and broader sustainability goals. 5. Develop an inclusive and accessible application process. 6. Launch a comprehensive promotional campaign to raise awareness. 7. Incorporate a community-driven decision-making process for selecting funded projects. Establish a review panel that includes representatives from the community, ensuring that decisions are made with a deep understanding of local priorities. 8. Implement a robust monitoring and evaluation system to track the progress and impact of funded projects. 9. Showcase successful projects and celebrate community achievements.
Funding Requirements	Alongside building on existing funding schemes such as the WMCA Community Green Grants and Community Environment Fund, additional opportunities include crowdfunding and investment from local businesses (e.g. sponsorship or Corporate Social Responsibility budgets). Additionally, the Council could consider setting up a Community Municipal Investment fund to implement green investment strategies.
Cost Benefit	<p>Revenue Cost: The costs of a fund will depend on the type of financial mechanism used to create the fund. For this example, we will consider a Community Municipal Investment Fund, this will require 1-2% interest paid per annum as the cost of borrowing. There will also be a fee to the regulated funding platform, this is likely to be in the region of 0.5% of capital raised and 0.5% the annual interest paid to investors. Please see the Financial Implementation Plan for further detail.</p> <p>Co-benefits: Community empowerment; social cohesion; local economic growth; opportunities for skills developed; improved public spaces; health and wellbeing benefits dependent on awarded projects.</p>
Carbon Impact	This action is difficult to quantify without knowledge of the specific projects and initiatives that will emerge from the initiative.
Risks & Dependencies	Limited funding pool potentially impacting the scale of the projects that can be implemented; low community engagement within the scheme results in limited awareness and difficulties in establishing a community-driven decision-making process; over-reliance on partnerships with local businesses and Government agencies may expose the funding pot to external factors, such as changes in policies or economic condition.
KPIs	Number of community schemes delivered.

Delivery Timescale: Short-term	Theme: Upskilling
Action 1.3: In partnership with stakeholders, provide access to information and training on achieving Net Zero.	
Overview	Building and expanding on previous successful internal carbon literacy training conducted by the Green Cities and Circular Economy Teams, this action looks to further upskill internal Council staff, the external supply chain and key

	<p>stakeholders by embedding training throughout procurement and onboarding processes, ensuring carbon is at the forefront of decision-making.</p>
<p>Route Map Alignment</p>	<p>Supports alignment with the following 2031 Route Map sectoral emissions reduction requirements:</p> <ul style="list-style-type: none"> • -44% in transport emissions • -36% in domestic emissions • -53% in industrial emissions • -64% in commercial emissions
<p>Governance</p>	<p>Owner: The Council</p>
	<p>Champion(s): Council’s largest suppliers, Anchor Network</p>
<p>Implementation Steps</p>	<ol style="list-style-type: none"> 1. Identify internal knowledge gaps. 2. Develop tailored carbon literacy training resources for Council teams, building on previous training materials. 3. Host dedicated training sessions across the Council to embed carbon literacy knowledge and awareness, aligned with roles and responsibilities. 4. Integrate and embed carbon literacy training within internal Council and supply chain onboarding processes. 5. Establish a platform for continuous learning, such as workshops, webinars or an online knowledge-sharing portal on the Council website. 6. Promote this webpage across social media platforms and with key partners (e.g. Anchor Network, city’s largest emitters) to engage local stakeholders with the carbon literacy process. 7. Continuously update and enhance training materials by including practical case studies that showcase successful carbon reduction initiatives within the Council. 8. Provide training annually to ensure knowledge is retained and to upskill new starters. 9. Once the programme is established, roll out the training programme to broader stakeholders (e.g. community organisations, SMEs).
<p>Funding Requirements</p>	<p>This action may not require external support and could be delivered through internal, existing resources.</p>
<p>Cost Benefit</p>	<p>Revenue Cost: Carbon literacy courses have a wide range of cost, as an example Carbon Literacy Project offers e-learning courses from £40 per person to £20 per person (both plus VAT). Therefore, if you have 100 people from both the local authority and wider stakeholders taking part in carbon literacy training this would cost approximately £3,500 (+VAT) (Carbon Literacy Project, 2023). This is one example there are other providers that can offer larger courses for multiple people or more bespoke courses to the Council’s needs.</p>
	<p>Co-benefits: Enhanced employee engagement; aligned decision-making; supply chain collaboration; sustainable procurement practices; and demonstration of corporate responsibility.</p>
<p>Carbon Impact</p>	<p>Difficult to quantify impact of action however it will contribute to the required shift in behaviour and decision making needed to realise net zero.</p>
<p>Risks & Dependencies</p>	<p>Ensuring the knowledge is embedded and that high impact areas are prioritised to maximise impact. Engaging with suitably qualified trainers and gaining their support and buy-in to extend the reach of the programme will also be vital.</p>
<p>KPIs</p>	<p>Internal and external carbon literacy training provided per annum (e.g. number of sessions; number of attendees; number of organisations engaged).</p>

6.5 Action Implementation

A recommend Action Owner is assigned to each action who is ultimately responsible for leading and delivering the action. They will be supported by Action Champions who will provide active support, helping to secure buy-in from key stakeholders and the wider community. To co-ordinate activities across the themes, we propose that delivery is underpinned by 'Action Plan Delivery Groups', which consist of relevant individuals and organisations that share a particular subject specialism (e.g. transport, energy supply or nature recovery) to support a holistic approach and to maximise efficiencies through collaboration. As the near-term actions are completed, the groups can evolve existing actions or select and develop new actions, based on any changes in context.

6.6 Action Governance

A strong governance process will be established using existing structures and boards (e.g. Climate Change Programme Board and Climate Action Advisory Group) to ensure accountability for action delivery and monitoring. This high-level governance will be complimented by Action Plan Delivery Groups who are the subject matter experts of specific themes (e.g. transport). Finally, the Action Owners are the leads identified for each action, who will provide direction and coordinate the necessary activities needed to successfully deliver the action.

6.7 Monitoring & Review

The Action Plan is a live document that sets out 20 priority actions identified to commence as swiftly as possible. KPIs are embedded into the actions to support regular monitoring and evaluation. A monitoring framework is outlined (see Appendix B: Route Map Monitoring Table) which will provide the Green City Partner Board with a clear means to assess progress. It will also support the Action Plan Delivery Groups to remain focused, motivated, and accurately track their progress. Capturing successes will also help maintain the buy-in required for successful delivery in the long-term.

The Action Plans should be reviewed annually to determine:

- Material changes to the political, economic, social, technological, legal or environmental background.
- Whether any actions have been sufficiently completed to be removed from the Action Plan.
- Whether there is sufficient capacity to add new Actions once the first 20 have been mobilised.
- Whether any new priorities have emerged in light of the latest evidence.

We recommend a full refresh of the Route Map and Action Plan in 2029 (in five years' time), to report on progress, identify remaining key gaps and to develop new actions.

7 Finance & Funding

Chapter at a Glance

This Chapter summarises potential financing and funding mechanisms that the Council could utilise to support delivery of the Action Plan.

7.1 Finance & Implementation Plan

Alongside this Net Zero Strategy and Action Plan, we have developed a supporting high-level Finance and Implementation Plan that reviewed the range of financing and funding mechanisms available to the Council to enable delivery of a 2041 net zero city (see Table 7-1).

Category	Funding Mechanism	Description
Energy Supply	Community Municipal Investment (CMI)	A form of debt finance raised by a council and administered by a regulated platform. Often local residents and the wider public invest in the CMI as it aims to deliver clear benefits to the local community, this investment is then paid off with interest (debt finance).
	Public Private Partnership	A partnership between a private company and a public body. They often operate as joint ventures - where a private company pairs with a public body to create a company, often to deploy low carbon infrastructure.
	National Renewable Incentives	A national scheme that encourages private investment in renewables.
Domestic Energy	National Grants	Grants provided by the National Government to help fund retrofit.
	Green Mortgages & Loans	Mortgages or loans that provide lower interest rates to environmentally preferably infrastructure. They require certain measurements of low carbon infrastructure, such as an EPC A or B.
	Integrating Carbon Credits in Retrofit	HACT retrofit credits are carbon credits that can be created through retrofitting social housing.
	Asset Bundling	Combining various assets and their financial return and risk to create a viable (long-term) investment.
	District Heat Networks	Financing for district heat, including the GHNF and public private partnerships.
Industry and Commercial	RE:FIT	RE:FIT is a procurement framework and support service that helps organisations deliver environmental retrofit projects with guaranteed financial savings.
	Requirements of Reporting	Large businesses and PLCs are required to report to certain standards, making them accountable for the emissions the produce and potentially influencing others further down their supply chain.

Category	Funding Mechanism	Description
Transport	Grants	Government grants provided to support EV infrastructure.
	Community Infrastructure Levy	A planning charge that helps local authorities support developments and infrastructure in their area.
	Parking Fees	Parking tariffs that relate to the car’s emission production. High emitting cars pay higher parking fees.
	Ultra Low Emission Zone	Implementing a fee charged for driving high emissions vehicles to improve air quality.
Nature	Offsets	Carbon credits created through the sequestration of carbon via nature, such as, trees and peatland. The credits can be sold to help repay the capital investment made to restore/ create the natural habitat.
	Biodiversity Credits	Credits sold to developers through the Biodiversity Net Gain Law. These credits take into account the nature and biodiversity of the site.
	Grants	Grants that support nature restoration/tree planting.
Upskilling	Apprentice Levy	Government funding towards apprenticeships (with the aim of reducing skills gaps)
	Free Training Resources	Training resources available to reduce low carbon skills gaps.

Table 7-1: Overview of Potential Funding Mechanisms

7.1.1 Grants and National Government Funding

There is a large amount of national funding available to support the delivery of net zero strategies, however, they often have finite availability and require applications to be submitted detailing what the grant funding would be used for. Through having a Net Zero Strategy and Action Plan, we anticipate that this will enable the Council to take full advantage of grants as they become available. The actions will provide the Council with a bank of pre-identified projects which can be put forward for grant funding at short notice. Ensuring there are resources allocated to monitoring grant opportunities and matching them with the Action Plan is critical to maximising funding opportunities.

7.1.2 Private Funding and Partnerships

Private funding and partnerships could provide the Council with access to significant amounts of capital; additionally, private companies tend to operate at an increased pace due to their for-profit nature. Private funding/partnerships should be considered carefully with thorough legal contracts to ensure each party understands where they stand in terms of risk and financial outcomes. Private partnerships are likely to require a financial return therefore, they are best placed in areas such as energy supply where a return on investment is greater. Areas such as domestic retrofit are harder to fund via private relationships due to their low return on investment and hard to manage nature.

7.1.2 Asset Bundling and Investment Opportunities

There is an opportunity to bundle several net zero deliverables together to create a fund and gain large scale capital with a long term investment. Investors into this fund will still expect significant returns, however, through bundling lower return items with higher return possibilities it is possible to obtain funding for several net zero actions through one fund. City Science and the Council spoke

with the West Midlands Pension Fund and there were significant possibilities for future investment in capital assets that could support the Council's pathway to net zero, however there is a need for financial return. To demonstrate strong financial returns the Council will need to carry out detailed finance analysis and create strong investment proposals for their net zero actions. This is not only applicable to the pension fund, but private investors are also more likely to consider investing in the Council's net zero Strategy if they can be guaranteed a financial return.

7.2 Recommendation

We recommend that the financial mechanisms and funding opportunities outlined here, are discussed in further detail (by the Council) to determine which opportunities require further exploration. Additionally, a more detailed financial and technical analysis could be considered for each of the 20 actions. This would help to provide a robust evidence base to attract inward public and private investment at the scale required to deliver a net zero city by 2041.

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8 Key Findings & Next Steps

Chapter at a Glance

This Chapter summarises the key Strategy findings, alongside risk and dependencies and next steps.

8.1 Key Findings

8.1.1 Scale of Challenge

In developing this Net Zero Strategy and Action Plan, we have identified a wide range of successes and projects that can be built upon. Decarbonisation success to date has largely been achieved through greening of the grid and energy efficiency improvements. Sustaining this level of carbon reductions over time remains a significant challenge given a range of factors including scalability, readiness of technological solutions, financing and funding and skill gaps.

As noted earlier in the Strategy, it is important to recognise that delivery of the priority actions set out in this programme will not meet the scale of change needed to deliver a net zero city but will sit within a wider programme being delivered through strategies, policies, action plans, guidance documents and projects already operating. For instance, strategies such as the WMCA Climate Change Adaptation Plan 2021 - 2026, Wolverhampton Local Plan and collaborative projects (such as the Reuse Hub) which draw on the skills of business, social enterprises and the broader public sector. Their successful delivery is both complemented by and dependent on a broad package of wider initiatives, as well as the co-operation and collaboration of Government, businesses and citizens.

8.1.2 Collaboration

Collaboration is an integral component to successfully delivering a net zero city. By co-developing a range of actions, with a breadth of action owners and champions, we are seeking to build on relevant expertise and maximise impact. Key partners include:

- **Public sector:** including the Anchor Network, WMCC and BCT.
- **Third sector:** including Local Nature Partnership, Canals & River Trust and Wildlife Trust.
- **Business community:** including i54, Marston's PLC and Wolverhampton Wanderers.

Through pooling resources, and encouraging knowledge transfer, active steps are being taken to cumulatively increase each organisation's sphere of influence whilst acting as a vital tool to mobilise action at every scale across the city.

8.2 Financing

Securing the appropriate funding to execute the priority actions set out above is an integral part of Wolverhampton's net zero journey, with finance acting as either a key enabler or barrier to success. Whilst a fundamental component, finance is historically difficult to secure, and will require ongoing attention.

8.3 Innovation

An innovative approach to delivering the actions will be needed. The approach should complement national funding (when available) with secure, sustainable and stand-alone programmes (such as for retrofit). It should also mitigate against external risks (such as national policy uncertainties) and ensure the required pace of delivery is maintained and insulated from 'stop-start' policies and funding which have been flagged as a key barrier. This includes sourcing and accessing alternative funding opportunities, supporting and bringing inventive technology into the mainstream and encouraging communities to adopt novel solutions to local problems. Learning from others through applying and tailoring best practice case studies from across the UK and internationally can be yet another innovative avenue to accelerate the decarbonisation progress within the city.

8.4 Risks & Dependencies

Successful delivery of the Route Map and Action Plan, and thereby Wolverhampton's vision to be net zero by 2041, is subject to a range of internal and external factors. The key risks are summarised overleaf (see Figure 8-1). During development of the Strategy, we have mitigated risks by prioritising changes that can be made at a local level, thereby supporting resilience that is independent of political shifts at a national, regional and local scale. The Route Map and Action Plan targets also aim to strike a balance between realism and ambition, ensuring that progress is tangible and actionable.

8.5 Next Steps: Monitoring and Review

Progress against the emissions reduction targets outlined in the Route Map (and summarised in Appendix B: Route Map Monitoring Table) and activities against all priority actions should be monitored and reported at regular intervals; Action Plan progress will be reported utilising KPIs outlined in Section 6.4.

Given that Wolverhampton aims to be net zero carbon by 2041, it is suggested that the monitoring and review process is utilised to help identify areas where more ambitious targets may be developed as delivery progresses to enable net zero (in certain sectors) by the earlier date. Progress updates will be provided to the Green Cities & Circular Economy Team. During the mobilisation phase we recommend that the status of all projects within the Action Plan are reviewed at least every six months.

The Action Plan focuses on the key activities needed over the next three to five years to accelerate Wolverhampton's transition to decarbonisation, particularly in relation to the key sectors. However, delivering net zero will require collective action over the next 17 years. The Route Map provide an insight into how further actions could be layered in future years to ensure maximum impact to 2041 and beyond. It is also recognised that the plan will be a flexible and living document. It will need to be reviewed and updated in response to changes in the policy and legislative climate, technological advancements, future opportunities and the results of annual monitoring.

We recommend that the sector trajectories (see Appendix B: Route Map Monitoring Table) are reviewed every three to five years to ensure they reflect recent activities, remain up to date and are aligned with the latest baseline evidence (based on the same agreed methodology as set out in the Route Map and Action Plan). This review will also inform future priority actions.

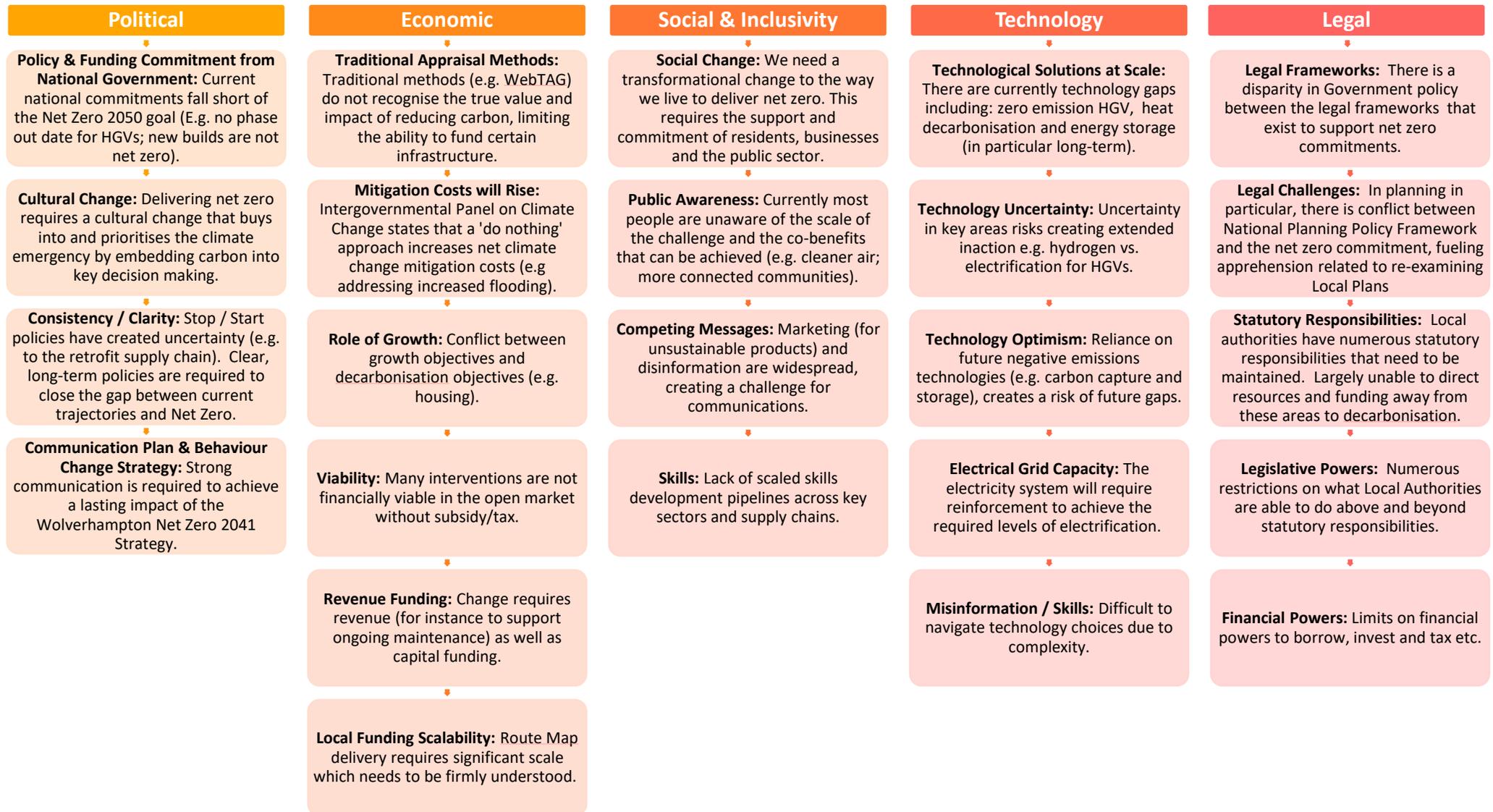


Figure 8-1: Risks & Dependencies across Key Areas

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10 Appendix

10.1 Appendix A: Pathway Model Assumptions

10.1.1 Domestic Buildings

Several assumptions have been made about the way new and existing buildings will be decarbonised. The number of new homes is estimated for each year based on the projection of 12,100 new homes by 2039 (Black Country Planning Authorities, 2022). The full set of inputs are detailed below.

	2021	2026	2031	2036	2041
New Builds					
Housing Standards for New Builds	Current Part L	Future Homes Standards			
Heating Fuel – Gas Boiler	100%	0%	0%	0%	0%
Heating Fuel – Heat Pumps	0%	100%	96%	100%	100%
Heating Fuel – Heat Network	0%	0%	4%	0%	0%
Existing Properties					
Proportion EPC B & Above	8%	22%	35%	48%	75%
Heating Fuel – Gas Boiler	83%	73%	67%	35%	0%
Heating Fuel – Oil Boiler	0.08%	0.07%	0.03%	0.00%	0.00%
Heating Fuel - Heat Pumps	4%	15%	25%	60%	96%
Heating Fuel – Direct Electric	4%	4%	4%	4%	4%
Heating Fuel – Other Fuel	9%	8%	3%	0%	0%
Proportion Retrofitted with Solar PV	2%	5%	15%	30%	35%

Table 10-1: Key Pathways Model Input Assumptions for Domestic Sector by Year

The government is introducing a FHS from 2025 to future-proof new homes and reduce carbon emissions from domestic buildings. These standards are being integrated from the second pathway modelling period (2026). Existing properties will also need to be decarbonised through energy efficient retrofit to at least EPC B (see Table 10-2), with 75% of existing homes meeting this standard by 2041. Retrofitting with heat pumps and solar PV is also required, with 96% of existing properties having heat pumps and 35% solar PV by 2041.

	2021 (Baseline)	2026	2031	2036	2041
Number of Homes Required to be Retrofitted (EPC B and above)	9,300	24,600	39,800	55,000	85,500

Table 10-2: Number of Homes Required to be Retrofitted by Each Year in the Route Map

10.1.3 Transport

Assumptions for transport decarbonisation comprise of reduction in demand (avoid), switching trips from private vehicle use (shift), and electrification of vehicular modes (improve). A summary of the key model inputs for the transport sector has been detailed in Table 10-3. Due to a lack of available data to support the distinction of trip purpose for LGV trips, it is assumed that all LGVs trips are freight trips only. Rail has not been considered due to its relatively small emissions (currently 1% of Wolverhampton's transport emissions).

	2021	2026	2031	2036	2041
Avoid & Shift					
Demand Reduction for Private Vehicles (Vehicle Miles Compared to Baseline)	N/A	12%	23%	24%	24%
Demand Increase for Public Bus Trips (Vehicle Miles Compared to Previous Period)	N/A	40%	43%	0% (no change)	0% (no change)
Freight Trip Efficiency Improvement	0%	2%	2%	2%	2%
Improve					
Cars: Electric	2%	6%	38%	83%	100%
Cars: Hybrid	1%	2%	5%	6%	0%
Motorcycles: Electric	0%	5%	29%	70%	100%
Buses & Coaches: Electric	2%	6%	29%	71%	100%
LGVs: Electric	1%	3%	17%	59%	100%
LGVs: Hybrid	2%	3%	17%	4%	0%
HGVs: Electric	0%	0%	12%	56%	100%

Table 10-3: Key Pathways Model Input Assumptions for Transport by Year

Baseline growth in transport demand has been modelled using the DfT's National Trip End Model. Demand reduction and modal shift assumptions have then been applied. Assumptions have been informed by literature from the Transport for the West Midlands including a 20% overall demand reduction, 25% reduction in private motor vehicle miles and a doubling of public transport use to 2035 (Transport for West Midlands, 2023).

All motor vehicle types achieve full electrification to 2041. It is assumed that hybrid vehicles do not play a significant role, but account for a small proportion of the overall road transport demand in the transition to full electrification. Electrification assumptions are based on the Future Energy Scenarios using the "System Transformation" scenario (ESO, 2023). As a freight consolidation hub is planned in the West Midlands (National Infrastructure Planning Inspectorate, 2023), LGV and HGV trip efficiency has been assumed to improve by 2% from 2026.

10.1.4 Industrial & Commercial

In contrast to the data on domestic buildings, the non-domestic building stock is less well documented and understood. Non-domestic EPC data provides some useful insight, as its coverage of the building stock is reasonable, but the contents of the data are less insightful than for domestic buildings. Non-domestic EPCs provide an indication of energy efficiency via an A to G scale like domestic EPCs, and they provide an estimate of primary energy usage (kWh/m²/year), but they do not provide a breakdown of energy by fuel type nor by end use (electricity, heating, hot water etc).

By assuming that the non-domestic EPC coverage is representative of the whole non-domestic building stock, we can make estimates of the split of energy between sub-sectors, end uses and fuel types. The national Building Energy Efficiency Survey (BEES) conducted in 2014-15 (DESNZ, 2016) provides mean energy intensities (kWh/m²) for sub-sectors of non-domestic buildings, broken down by end use (heating, hot water, lighting, catering etc). Using these average energy intensities and the

floor areas provided in the non-domestic EPC data, average energy intensities for electricity, heating and hot water and process loads were developed for commercial and industrial buildings.

The potential to reduce these energy intensities was informed by BEES which provided abatement factors for electricity and fuel consumption for sub-sectors of non-domestic buildings. These abatement factors are percentage energy reductions that could be achieved on electricity and fuel demands within each sub-sector. They represent the effect of replacing current equipment with the most efficient alternative; the abatement factors therefore reflect a total technical potential.

The abatement factors do not account for the likelihood of equipment being replaced or whether take-up would be limited due to barriers or site-specific factors. To account for this, the abatement factors were arbitrarily reduced by 25% to provide a more achievable abatement potential. The abatement potentials applied to industrial buildings are detailed below.

	Abatement Factor	Reduction Applied
Electrical Energy Demand	40%	25%
Non-Electrical Energy Demand	50%	25%

Table 10-4: Industrial Abatement Factors (DESNZ, 2016) & Model Assumptions

The full model inputs for the industry sector are also detailed in Table 10-5. Of the existing building stock, 50% is assumed to be retrofitted by 2041. Demand reduction is also a crucial element of the pathway for non-heating electrical energy (15% by 2041), and for energy used to process heating and hot water (37% by 2041). Existing buildings will be transitioned away from the use of other fuels by 2031 and gas as fuel by 2036, replacing boilers and other sources with ASHPs. Hydrogen will also be used within the fuel mix for existing buildings for process purposes (50% by 2036).

The assumptions are slightly different for new buildings. The model assumes a growth in industrial floor area of 325,000m (Black Country Planning Authorities, 2022). Potential reduction in demand for energy is higher in new builds as they can be built to a more efficient standard. This is also supported by a transition away from gas as a fuel source by 2031 rather than 2036. We have assumed that no hydrogen fuel will be used in the heating and hot water systems for new builds, rather this will be delivered by electricity (24%), ASHPs (71%) and Ground Source Heat Pumps (GSHPs – 5%). The transition to hydrogen for process loads will be faster than for existing building stocks, at 40% by 2031.

		2021	2026	2031	2036	2041
Existing Building Stock						
Abatement Factor for Retrofit		0%	0%	15%	30%	50%
Reduction in Non-Heating Electrical Energy		0%	0%	4%	9%	15%
Reduction in Heating, Hot Water & Process Energy		0%	0%	11%	22%	37%
Proportion of Heating & Hot Water Fuel Mix (DESNZb, 2023)	Gas Grid	53%	44%	36%	0%	0%
	Direct Electric	4%	7%	11%	24%	24%
	Electricity – ASHP	0%	12%	52%	71%	71%
	Electricity – GSHP	0%	1%	2%	5%	5%
	Other	43%	36%	0%	0%	0%
Proportion of Process Load (Cooking, Laundry, Industrial Processes) Fuel Mix	Gas Grid	39%	39%	39%	0%	0%
	Direct Electric	35%	39%	61%	50%	50%
	Hydrogen	0%	0%	0%	50%	50%
	Other	26%	21%	0%	0%	0%
New Building Stock						
Proportion Achieving Full Abatement Potential		50%	50%	50%	75%	100%

		2021	2026	2031	2036	2041
Reduction in Non-Heating Electrical Energy		15%	15%	24%	30%	30%
Reduction in Heating, Hot Water & Process Energy		19%	19%	21%	30%	37%
Proportion of Heating & Hot Water Fuel Mix	Gas Grid	59%	30%	0%	0%	0%
	Direct Electric	4%	14%	24%	24%	24%
	Electricity – ASHP	0%	36%	71%	71%	71%
	Electricity – GSHP	0%	3%	5%	5%	5%
	Other	37%	18%	0%	0%	0%
Proportion of Process Load (Cooking, Laundry, Industrial Processes) Fuel Mix	Gas Grid	30%	30%	0%	0%	0%
	Direct Electric	51%	60%	60%	60%	60%
	Hydrogen	0%	0%	40%	40%	40%
	Other	19%	10%	0%	0%	0%

Table 10-5: Key Pathways Model Input Assumptions for Industrial Sector by Year

By 2041, 30% of emission reductions in existing commercial buildings are assumed to be achieved through retrofit. ASHPs are assumed to play a significant role in providing hot water and heating, increasing from 20% of properties in 2026 to 71% in 2041. Direct electricity is expected to cover the demand for energy for process loads by 2036. For new buildings, direct electricity will replace the gas connection for process loads by 2031. ASHPs, GSHPs and direct electricity are expected to serve energy demand for all other purposes. Table 10-6 gives the abatement potential for the commercial pathway and Table 10-7 provide the full model inputs.

	Abatement Factor	Reduction Applied
Electrical Energy Demand	33%	25%
Non-Electrical Energy Demand	42%	25%

Table 10-6: Commercial Sector Abatement Factors (DESNZ, 2016) & Model Assumptions

		2021	2026	2031	2036	2041
Existing Building Stock						
Abatement Factor for Retrofit		0%	0%	10%	20%	30%
Reduction in Non-Heating Electrical Energy		0%	0%	5%	7%	7%
Reduction in Heating, Hot Water & Process Energy		0%	0%	6%	10%	10%
Proportion of Heating & Hot Water Fuel Mix (DESNZb, 2023)	Gas Grid	90%	68%	45%	23%	0%
	Direct Electric	9%	11%	14%	17%	20%
	Electricity – ASHP	0%	20%	31%	51%	71%
	Electricity – GSHP	0%	0%	5%	5%	5%
	District Heating	0%	0%	4%	4%	4%
	Other	1%	1%	0%	0%	0%
Proportion of Process Load Fuel Mix	Gas Grid	74%	62%	50%	0%	0%
	Direct Electric	25%	37%	50%	100%	100%
	Other	1%	1%	0%	0%	0%
New Building Stock						
Proportion Achieving Full Abatement Potential		50%	100%	100%	100%	100%
Reduction in Non-Heating Electrical Energy		12%	24%	24%	24%	24%
Reduction in Heating, Hot Water & Process Energy		16%	32%	32%	32%	32%
Proportion of Heating & Hot Water Fuel Mix	Gas Grid	90%	45%	0%	0%	0%
	Direct Electric	9%	14%	20%	20%	20%
	Electricity – ASHP	0%	38%	75%	75%	75%

		2021	2026	2031	2036	2041
	Electricity – GSHP	0%	3%	5%	5%	5%
	Other	1%	0%	0%	0%	0%
Proportion of Process Load Fuel Mix	Gas Grid	50%	25%	0%	0%	0%
	Direct Electric	50%	75%	100%	100%	100%

Table 10-7: Key Pathways Model Input Assumptions for Commercial Sector by Year

10.1.5 Energy Supply

Wolverhampton is heavily reliant on decarbonisation of the electricity grid to achieve net zero. Detailed assumptions are included in Table 10-8. Solar PV Generation inputs and assumptions were informed by a variety of source including Local Authority Renewable Statistics (DESNZa, 2023), Environmental Insights Explorer (Google, 2023) and datasets provided by the Council such as LAEP+ Solar Potential Advanced Infrastructure (2024).

	2021	2026	2031	2036	2041
Solar PV Generation					
Domestic (kWh/household)	44	420	800	1,170	1,550
Commercial (GWh)	5	46	87	128	170
Industrial (GWh)	5	13	20	28	36

Table 10-8: Key Pathways Model Input Assumptions for Energy Supply by Year

An increase in solar PV has been assumed in line with potential for rooftop solar in Wolverhampton. Significant increases in solar PV use by the commercial and industrial sectors has been assumed, increasing from 10 GWh to over 200 GWh by 2041 for both sectors combined. Ground-mount solar and other large-scale renewables (such as onshore wind) have not been modelled as they are considered unsuitable due to the built-up nature of the city. Note that solar PV is the only renewable energy source assumed to be generated in the future.

From modelling of the intermittency of solar energy, it's assumed that 50% of energy generated will be consumed directly by the building, the remaining 50% would be exported to the National Grid and therefore wouldn't contribute to reducing the carbon intensity of electricity consumption. This is a relatively optimistic value, which would reflect a slight uptake in battery storage technology to complement the use of solar. However, exact uptake in batteries has not been modelled.

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10.2 Appendix B: Route Map Monitoring Table

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Transport	228	221	213	206	199	192	179	166	153	140	127	111	95	79	63	47	38	29	20	11	2
Housing	348	351	341	340	311	286	269	258	248	231	223	199	176	153	128	109	109	109	108	98	11
Commercial	126	107	98	95	88	76	67	61	56	51	46	39	33	28	23	18	15	12	9	6	3
Industrial	172	160	147	139	122	99	91	88	84	82	79	65	51	38	28	19	18	18	17	16	16
Total	875	839	798	780	720	654	607	574	541	505	475	415	355	298	243	193	180	168	154	131	32

Table 10-9: Route Map Monitoring Table