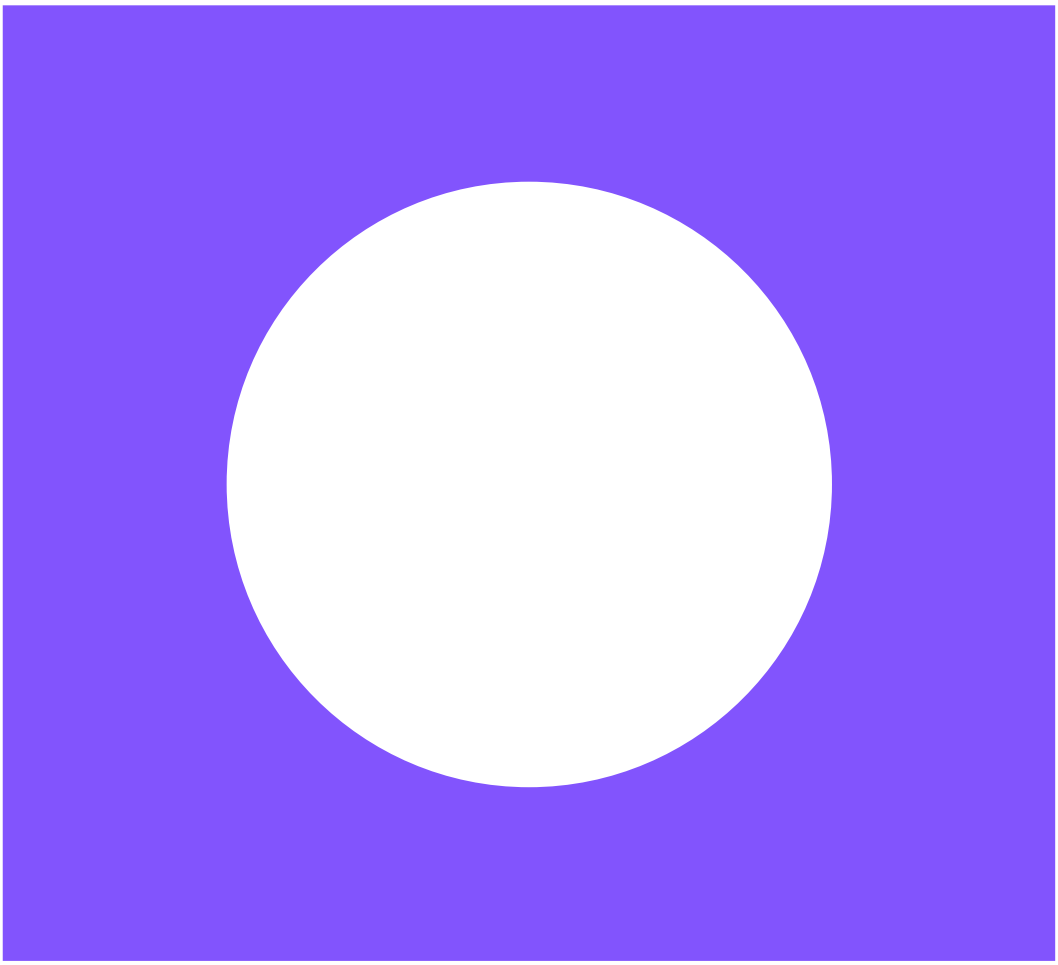
MOTT MACDONALD



Ashfield and Mansfield LAEP

EMCCA LAEP 1C - Final

July 2026

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Ashfield and Mansfield LAEP

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Executive summary

The Ashfield and Mansfield Local Area Energy Plan (LAEP) provides a comprehensive, data-driven roadmap for achieving a just, resilient, and affordable transition to net zero. Commissioned by the East Midlands Combined County Authority (EMCCA) and prepared by Mott MacDonald in partnership with IES, the plan integrates technical modelling, spatial analysis, economic appraisal, and stakeholder engagement to identify how the districts of Ashfield & Mansfield can most effectively decarbonise the local energy system while delivering wider social and economic benefits. The LAEP contributes to a joined-up regional approach that aligns local action with national policy objectives and the EMCCA's 2050 net zero ambition.

Purpose and Context

The UK has set a legally binding target to reach net zero greenhouse gas emissions by 2050. The Climate Change Committee's Seventh Carbon Budget (2025)[1] further reinforces the urgency of local delivery by estimating that approximately 82% of the UK's emissions are within the sphere of local authority influence.

In 2019, Ashfield District Council made a commitment to work to reach net zero, or close to it as possible for the Council's own operational direct and indirect (Scope 1 and 2) emissions by 2030, and work to minimise scope 3 emissions (outside the Council's direct control), and achieve net zero emissions across the local authority area by 2050, in line with national targets. Mansfield District Council declared a Climate Emergency for Mansfield in March 2019. The declaration includes a commitment to reducing carbon emissions by 40% by 2030 and making Mansfield Carbon Neutral by 2040.

This plan responds directly to the local challenges of high fuel poverty in some areas, dependence on fossil gas for heating, grid capacity constraints, and the need for economic regeneration that aligns with environmental sustainability.

Approach and Methodology

The LAEP was developed using the Energy Systems Catapult (ESC) methodology for place-based energy planning. It draws on a combination of:

- Digital Twin Modelling: IES's dynamic 3D model simulating energy demand, generation, and carbon emissions across Ashfield & Mansfield's building stock at the Middle Super Output Area (MSOA) level.
- Scenario Modelling: Quantitative comparison of three distinct decarbonisation pathways — Counterfactual (Do Nothing), Net Zero by 2050, and Accelerated Net Zero by 2040 — using logistic (S-curve) uptake functions for key technologies.
- Techno-Economic Analysis: Appraisal of capital investment, operating costs, system benefits, and bill savings under each pathway.
- Spatial Prioritisation: GIS-based identification of Focus Zones for targeted interventions where energy, social, and grid considerations converge.
- Stakeholder Collaboration: Engagement with local organisations and stakeholders including Ashfield & Mansfield Councils, utilities, large industries, housing providers, and community groups.

This approach ensures that the LAEP is evidence-based, spatially specific, and co-created with those who will be instrumental in its delivery.

[1] The Seventh Carbon Budget - Climate Change Committee

The UK government is currently undertaking a reorganisation of England's local government with the intention to establish new single-tier unitary councils in areas where two-tier systems exist, such as across Nottinghamshire. If implemented, this would see "unitary authorities" assume full legal powers in April 2028. It is acknowledged that this local government reorganisation (LGR) has the potential to impact how and/or who delivers the recommendations outlined in this report. However, the analysis which underpins this LAEP report was intentionally undertaken on an MSOA level such that following a potential local government reorganisation, the data can be re-shaped at the MSOA level to continue to provide an evidence-based decarbonisation pathway for Local Authorities. Whilst the UK LGR may require reallocation of roles and responsibilities to deliver the projects specified in this LAEP report, the restructure is intended to deliver long-term simplification, stronger strategic leadership, and more effective cross-area collaboration, ultimately with the intention to quicker, more efficient delivery of projects.

Scope

The LAEP focuses on the parts of the energy system where a local authority and its partners can exert meaningful influence. This includes homes and non-domestic buildings, private vehicles and charging infrastructure, locally influenced generation such as rooftop solar, and the decarbonisation choices facing local industry that connect into local networks. Nationally controlled systems that are better addressed through central government or national operators, for example strategic rail, aviation and utility-scale electricity generation, sit outside the scope for emissions accounting and intervention planning. Maintaining this focus helps Ashfield & Mansfield concentrate resources on deliverable local actions.

The LAEP models three scenarios, with the preferred scenario for Ashfield & Mansfield being 2050 Net Zero.

DO NOTHING

Only decarbonisation activities between now and 2050 that are already legislated to happen

2050 NET ZERO

In line with national targets and guidelines including 6th Carbon Budget to 2035 and Distributed Future Energy Scenarios

2040 NET ZERO

Bespoke for D2N2 programme, set by EMCCA. Based on stakeholder preference and suitability of solutions.

Current Energy and Emissions Baseline

In 2023, Ashfield and Mansfield recorded total territorial emissions of approximately 990 $ktCO_2e$ — 399 $ktCO_2e$ in Mansfield and 590 $ktCO_2e$ in Ashfield. The emissions profile for the area is dominated by three key sectors: transport (35%), domestic energy use (31%), and industry (14%).

Mansfield's total energy demand in 2023 was 885 GWh, with space heating accounting for the largest share at 60%, followed by lighting (14%), equipment (12%), domestic hot water (12%), and auxiliary systems (2%).

Ashfield's total energy demand reached 1,146 GWh in 2023. Space heating was again the dominant use, representing 57% of consumption, followed by lighting (16%), equipment (12%), domestic hot water (12%), and auxiliary systems (3%). Natural gas remains the primary fuel source, contributing most of the emissions associated with heating.

Energy efficiency and Buildings Retrofit

Across Ashfield and Mansfield, approximately 74,000 buildings require some level of retrofit to achieve the net zero scenarios. Modelling shows that around 30,355 homes (39% of the housing stock) require light retrofit, while around 33,468 homes (43%) need deep retrofit.

Light retrofit typically offers shorter payback periods and is well-suited for rapid scaling, particularly in owner-occupied homes. In contrast, deep retrofit is essential for older, solid-wall properties to enable efficient heat pump operation and address fuel poverty hotspots. The recommended approach is to concentrate deep retrofit in a first wave of priority MSOAs (Middle Super Output Area) where solid wall prevalence, fuel poverty and low EPC (Energy Performance Certificate) ratings coincide.

Low-carbon heat

Heat decarbonisation in existing homes relies primarily on air source heat pumps installed alongside targeted fabric upgrades and appropriate hot water storage. Of the identified 96,000 suitable properties, early installations should be focussed in areas where electricity network capacity coincides with existing funding eligibility. In parallel, heat network zoning should be pursued in the identified areas and leveraging the central government zoning programme.

Transport Electrification

The modelling shows the number of EV cars rising to about 60,747 and 53,075 vehicles by 2050 in Ashfield and Mansfield respectively, with a planning assumption of one public charger for roughly 20 EVs and the remainder of charging met by private and workplace provision. Siting of public chargers should begin with public car parks and areas that lack off-street parking, then expand to workplace and destination hubs that can host rapid and ultra-rapid chargers.

Local generation and flexibility

Expanding local renewable energy generation is key to enhancing energy resilience and managing grid load. The analysis identifies significant potential for rooftop solar PV, with the capacity to generate over 394 GWh annually across domestic and non-domestic buildings. When paired with battery storage and Demand Side Response (DSR) measures, this local generation can reduce peak demand, provide flexibility to the grid, and lower consumer bills.

Industrial decarbonisation

The plan prioritises the electrification of low-temperature industrial processes first, while high-temperature processes prepare for a potential transition to low-carbon hydrogen, contingent on the development of a credible supply chain and supporting infrastructure.

Analysis suggests that industrial gas use for process heating can be substantially reduced by 2050, with associated emissions falling by around 91% in Ashfield and 89% in Mansfield under the assumed fuel-switch scenarios across the highest non-domestic gas consumers. To make these achievable, large industrial sites should be encouraged to develop time-phased decarbonisation plans detailing what changes will occur, when they will occur, and what new energy vectors and network capacities will be needed.

Networks, storage and headroom

The plan highlights that several primary substations and MSOAs have limited spare capacity, making timely reinforcement, connection planning, and flexibility critical to keeping electrification on track. There is a strong case for proactive investment in distribution network upgrades, as any net zero-compliant scenario is projected to add approximately 467 MW and 402 MW of After Diversity Maximum Demand (ADMD) in Ashfield and Mansfield respectively, which would exceed the capacity of the current infrastructure.

Close collaboration with the local distribution network operator (NGED) will be necessary to appropriately phase the scale roll-out of PV (Photovoltaics), ASHP (Air Source Heat Pump) and EVs (Electric Vehicles).

Economics and value for money

The additional undiscounted capital expenditure for the 2040 and 2050 scenarios is estimated at £3.7 billion in today's prices. Although the required investment is substantial and the pace of transition will depend on sustained policy and grant support, it is expected to generate benefits through lower energy bills, carbon reduction, improved air quality, and employment stimulation in the local economy.

Prioritisation and focus zones

Spatial mapping identified Focus Zones where targeted interventions deliver maximum benefit. These include areas with high fuel poverty risk, poor EPC ratings, and high grid utilisation.

Quick Win Projects:

- Retrofit of social housing and public estates.
- Deployment of rooftop solar on public sector buildings and schools.
- Rollout of public EV charging in high-demand residential zones.
- Pilot district heating networks in high heat-density clusters.

Next Steps

To ensure the timely and effective delivery of the LAEP, three actions are recommended:

1. Establish a Ashfield & Mansfield LAEP Delivery Partnership led by the councils and supported by EMCCA, the Distribution Network Operator, local businesses, and other stakeholders to coordinate the programme and identify funding;
2. Launch a public engagement initiative, with an online 'hub' to build confidence and promote low-carbon technologies and behaviours, prioritising pilot projects that demonstrate best practice;
3. Develop a comprehensive delivery roadmap and investment plan that prioritises short-, medium-, and long-term interventions as outlined in the report.

1 Introduction

Mott MacDonald, in partnership with IES, has been appointed by the East Midlands Combined County Authority (EMCCA) and its local authority partners to lead the development of the Local Area Energy Plan (LAEP) for Ashfield and Mansfield, supporting their journey toward achieving net zero carbon emissions. In response to escalating impacts of climate change and the global push towards sustainable energy solutions, the development of a LAEP has been identified as a crucial step in supporting climate ambitions across Derbyshire and Nottinghamshire.

This LAEP forms part of a wider Regional Local Area Energy Plan commissioned by EMCCA. The East Midlands regional plan comprises of eight local area plans, of which Ashfield and Mansfield is one. This LAEP has therefore been prepared to be comparable to the other local plans, and to contribute to the wider regional plan. This report presents the outcomes of Ashfield and Mansfield LAEP, following a comprehensive process of data acquisition, scenario modelling, stakeholder collaboration, and spatial analysis.

1.1 Purpose of the LAEP

A LAEP is a long-term, evidence-based plan that sets out the most effective and efficient pathway for an area to transition to a low-carbon, smart, and flexible energy system. It provides a strategic framework to coordinate investment in energy infrastructure, shape local policies, and guide decision-making across stakeholders. By aligning spatial, technical, and socio-economic considerations, LAEPs ensure that local authorities, businesses, network operators, and communities can collectively plan for a cost-effective and just transition to net zero.

Local authorities have a pivotal role to play in enabling the UK's net zero transition. An estimated 82% of the UK's carbon emissions fall within local authorities' scope of influence[2]. There is a growing need for place-based energy strategies that align national goals with local opportunities, priorities, and constraints.

A LAEP is a bottom-up, data-driven, whole-system approach that integrates technical evidence, stakeholder engagement, and non-technical factors to create a comprehensive net zero plan tailored to Ashfield and Mansfield's unique characteristics.

The LAEP considers energy supply and demand, transport, buildings, local industry, and the environment. It looks at current energy use and future decarbonisation opportunities for electricity, heat, and gas networks, the built environment (industrial, domestic, and commercial), and the potential for hydrogen and other low carbon fuels. The plan will involve collaboration with various stakeholders to develop a realistic, data-driven action plan.

The primary goal of the Ashfield and Mansfield LAEP is to identify the most cost-effective ways to decarbonise the councils, aligning local plans and priorities with broader national policies and strategies. It will provide a roadmap for each local authority area to achieve net zero emissions at the local level. Additionally, the LAEP will be coordinated alongside other areas within the wider EMCCA region to ensure a consistent and joined-up approach between Derby City, Derbyshire, Nottingham, and Nottinghamshire (D2N2).

[2] HM Government. Net Zero Strategy: Build Back Greener. Department for Business, Energy & Industrial Strategy, October 2021. Available at GOV.UK

Our standardised approach will ensure alignment in outputs, which will significantly increase the ability for projects across areas to scale up through similar enabling mechanisms such as training programmes, funding allocations and aligned priorities.

1.2 Geographical Boundary of the LAEP

1.2.1 Geographical Boundary

Figure 1.1: LAEP Geographical Boundaries in relation to the Nottinghamshire County



Ashfield is a local authority in the Nottinghamshire County, with a population of 126,000[3] over an area of 110km^2. It borders the northwest edge of Nottingham City. Ashfield has a significant coal mining history and historically had several collieries. Today, Ashfield's main sources of employment are in human health and social work activities, and retail. There is still some light manufacturing, predominantly in the distribution, construction, motor vehicle and food and drink industries.

Mansfield is also a local authority in Nottinghamshire County in the East Midlands region of England. With a population of just over 113,000[4], it covers an area of 78km^2. Mansfield lies on the western edge of Sherwood Forest and also has a significant coal mining history, with key industries now being manufacturing, construction, retail, and health and social care.

It should be noted that ongoing Local Government Reorganisation may alter the existing local authority boundaries in Nottinghamshire in the coming years. As part of the D2N2 programme, LAEPs have been created for the neighbouring authorities. This should minimise the amount of disruption to this plan caused by re-organisation.

1.3 LAEP Scope

The LAEP considers energy supply and demand, transport, buildings, local industry, and the environment. It examines current energy use and future decarbonisation opportunities for electricity, heat, and gas networks, the built environment (industrial, domestic, and commercial), and the potential for hydrogen and other low-carbon fuels. The plan involves collaboration with various stakeholders to develop a realistic, data-driven action plan.

[3] Ashfield population change, Census 2021 – ONS
[4] Local indicators for Mansfield (E07000174) - ONS

Table 1.1: LAEP Scope

Energy Source Category	Description
Buildings	**Identifying priority areas for retrofitting of domestic homes and public buildings to improve energy efficiency** Identifying priority areas for heat pump installation or other types of low-carbon sources of heating. Encouraging the installation of rooftop solar panels and low-carbon, flexible energy technologies, such as batteries, to reduce demand at peak times
Transport	**Identifying priority locations for the installation of electric vehicle (EV) charge points based on projected EV use, particularly around dwellings without off-street parking.**
Energy	**Identifying suitable sites for large-scale, low-carbon energy developments such as onshore wind, Solar Energy Farms, and District Heat Networks** Work in conjunction with local electricity distribution network operators (DNOs) to ensure the electricity network can handle expected extra capacity and grid connections. Reducing peak energy demand via 'smart' or flexible electricity systems
Local industry	**Understanding the energy requirements and decarbonisation options for local industry**

1.4 Emission Boundary

The LAEP is focused on areas where local authorities can exert meaningful influence, including buildings, personal transport, local energy generation and industrial emissions within the distribution network footprint.

While the Ashfield and Mansfield LAEP provides a strategic framework for guiding their area's transition to net zero, it is essential to define the boundaries of its scope. In line with the Energy Systems Catapult LAEP methodology and the practical remit of local authorities, Table 1.2 lists the emissions out of scope for emissions accounting and intervention planning.

Table 1.2: Emissions Scope

Emission Source	Justification
National and Strategic Transport Infrastructure	Emissions from vehicles transiting through Ashfield and Mansfield on national motorways are excluded as these journeys are not locally generated and fall outside the remit of local transport planning.
Rail electrification	Emissions from diesel-powered rail services and the potential electrification of rail infrastructure are excluded, as these are governed by national transport policy and infrastructure investment decisions.
Aviation	Emissions from domestic and international aviation are excluded, as flight operations and airport infrastructure are governed by national and international regulatory frameworks beyond local authority control.

Emission Source	Justification
Large-scale energy generation	Emissions from large-scale distributed generation connected at the Grid Supply Point (GSP) level have been excluded from this analysis, as these assets contribute to national energy supply and their associated emissions are already captured within the carbon intensity factors used for electricity consumption. The LAEP focuses on distribution-connected and locally influenced generation, such as rooftop solar and community-scale renewables.
Land use change and peatland emissions	Although significant in the regional carbon balance, emissions from land use change and peatland degradation are excluded. These are typically addressed through broader land management and agricultural strategies.
Agricultural emissions	Emissions from agricultural activities, including methane and nitrous oxide from livestock and fertiliser use, are excluded due to limited local authority control and the need for sector-specific national strategies.
Embodied emissions from construction	Embodied emissions (sometimes referred to as capital carbon) includes the emissions emitted in fabricating goods (construction or consumer goods), transporting them to their point of use, and in the case of construction the emissions emitted during construction. These emissions, and any interventions to reduce them, are excluded from the LAEP.

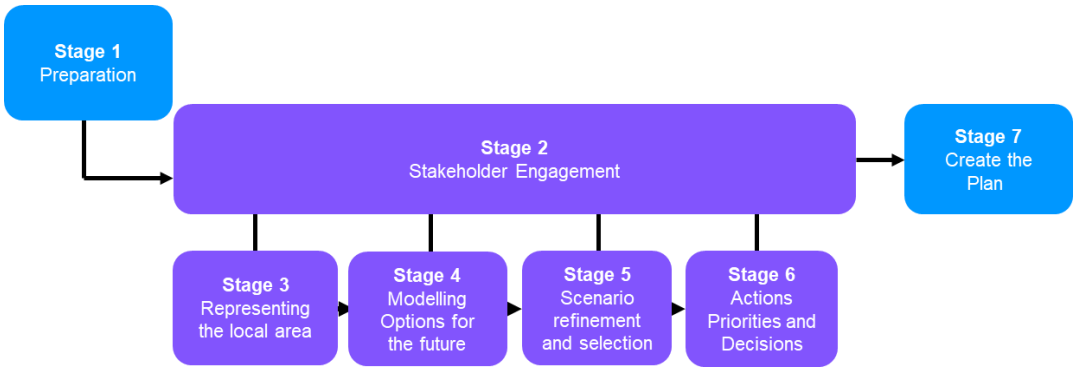
Note: other exclusions may exist, which will be presented in the technology intervention areas, and associated appendices.

These exclusions reflect the standard practice in LAEP development, which typically omits non-energy sources of greenhouse gas emissions and aspects of the energy system expected to be overseen by central government. This approach supports targeted, actionable planning while maintaining alignment with national decarbonisation strategies.

1.5 LAEP Structure

This plan is structured into themed chapters that enable stakeholders to quickly locate and engage with the information most relevant to their interests and responsibilities. It is designed to be both comprehensive and accessible, supporting a wide range of users in understanding and applying the evidence-based roadmap for Ashfield and Mansfield's targets to reach net zero. This LAEP models net zero by 2040 and 2050 scenarios to align with the broader D2N2 regional LAEP. Ashfield's climate change strategy aim to achieve carbon neutrality by 2050, and Mansfield's by 2040. Figure 1.2 below presents the summary approach of the LAEP, structured by Energy Systems Catapult guidance.

Figure 1.2: LAEP Structure Diagram



2 Policy Context

This section presents an overview of key national, regional and local policies influencing Ashfield and Mansfield's emissions levels and resulting net zero progress. This has enabled a context-driven approach as far as possible for quantification of positive and negative influences on future pathways to net zero specific to Ashfield and Mansfield.

2.1 National Policies

2.1.1 Overview of National Climate Targets and Strategic Direction

The UK's climate policy is anchored in the UK Climate Change Act 2008[5], as amended in 2019 to set a legally binding target of net zero greenhouse gas emissions by 2050. Interim targets include a 68% reduction by 2030 and 78% by 2035, compared to 1990 levels. These targets are territorial, excluding emissions embedded in imports. The Net Zero Strategy: Build Back Greener [6] outlines sector-wide decarbonisation, with a key emphasis on clean electricity by 2035 and recognition that 82% of emissions fall within local authority influence, making LAEPs a critical delivery mechanism.

In 2024, the Climate Change Committee (CCC) updated its recommendations to accelerate progress toward the 2030 targets[7]. These include tripling offshore wind, doubling onshore wind, and increasing solar capacity fivefold. The CCC also called for 10% of UK homes to be heated by heat pumps and for nearly all new cars sold to be electric. These recommendations are reinforced by the Seventh Carbon Budget (2025), which proposes a cap of 535 $MtCO_2e$ for 2038–2042 and an 87% emissions reduction by 2040. Sector-specific targets include an 86% reduction in surface transport emissions and major contributions from electrification and land use change.

2.1.2 Energy Infrastructure, Market Reform and Planning Policies

The UK Government has introduced several legislative and strategic reforms to modernise energy infrastructure and accelerate clean power deployment. The Great British Energy Act (2025)[8], establishes Great British Energy (GBE), a publicly owned company tasked with investing in and operating low-carbon energy infrastructure. Backed by £8.3 billion in public capital, GBE will co-invest with the private sector, support community energy schemes, and help deliver the government's target of a fully clean electricity system by 2030.

The proposed Energy Independence Act aims to phase out new oil and gas exploration licences, improve home energy efficiency, and expand support for insulation and low-carbon heating. Ofgem has approved a £24 billion investment programme to upgrade electricity and gas networks, expand grid capacity to connect 126 GW of clean power by 2030, and deploy flexible technologies such as storage and smart grids. The Clean Power 2030 Action Plan[9] sets regional caps for solar and battery storage, including 2.1 GW of transmission-connected solar PV and 500 MW of battery storage in Central England, guiding local connection priorities.

[5] The Climate Change Act 2008 (2050 Target Amendment) Order 2019
[6] Net Zero Strategy: Build Back Greener - GOV.UK 2021
[7] Progress in reducing emissions 2024 Report to Parliament - Climate Change Committee
[8] Great British Energy Bill 2024-25
[9] Clean Power 2030 Action Plan - GOV.UK

To support delivery, the Planning and Infrastructure Bill (2025)[10] proposes reforms to streamline consenting for critical infrastructure, introduce strategic nature recovery mechanisms, and enable cross-boundary spatial planning. Ofgem's Connections Reform replaces the "first come, first served" grid queue with a strategic prioritisation process, favouring projects with planning progress and alignment to national decarbonisation pathways. This may affect the sequencing and viability of local solar and storage projects.

Furthermore, Great British Energy's Local Power Plan[11], announced in February 2026, sets out a vision for transforming the UK's local and community energy sector so that, by 2030, every community has the opportunity to benefit from and own a local energy project. Through up to £1bn investment in a combination of grants, loans, advice, expert help and more, this plan will support more than 1,000 projects, increase shared ownership, and catalyse the development of scalable, self-sustaining business models for community energy organisations. GBE already have a formalised agreement with the East Midlands Combined County Authority to support the region to access the benefits of local and community energy.

2.1.3 Buildings, Heat and Local Delivery Mechanisms Policies

Buildings account for around 25% of UK emissions, making them a key focus of decarbonisation efforts. The Heat and Buildings Strategy (2021)[12], sets out plans to phase out new gas boilers by 2035, scale heat pump installations to 600,000 per year by 2028, and ensure all new buildings are net zero-ready. The Future Homes and Buildings Standard (FHBS, 2025)[13] will require all new homes and non-domestic buildings to be built to high energy efficiency standards, with low-carbon heating systems and improved ventilation, from 2027 onwards. Homes built under the new standard are expected to produce 75–80% fewer emissions than those built under current regulations.

The Warm Homes Plan (2025)[14] complements these efforts by targeting fuel poverty, aiming to lift over one million households out of fuel poverty by 2030 while accelerating the shift to clean, homegrown energy. Together, these policies provide a robust framework for local authorities to deliver decarbonisation through LAEPs, with clear national targets, funding mechanisms, infrastructure upgrades, and building standards to support local action.

2.1.4 Transport and Industrial Strategy Policies

The Integrated National Transport Strategy (INTS, 2024)[15], is developing a unified vision for England's transport system, aiming to improve integration across modes, support decarbonisation, and enhance accessibility. It promotes the use of data and technology to improve journey planning and system efficiency and will guide transport policy and investment decisions over the next decade.

The UK Transport Decarbonisation Plan (2021)[16] outlines measures to achieve net zero transport emissions by 2050. Key actions include ending the sale of petrol and diesel cars by 2030, requiring all new vehicles to be zero-emission by 2035, and investing in public transport, walking, cycling, and sustainable aviation and maritime fuels. Supporting infrastructure includes

[10] Guide to the Planning and Infrastructure Bill - GOV.UK
[11] Local Power Plan | Great British Energy
[12] Heat and buildings strategy
[13] Future Homes and Buildings Standard
[14] Warm Homes Plan
[15] Integrated National Transport Strategy for England
[16] Transport decarbonisation plan

EV charging points and hydrogen refuelling stations. Recent updates include the Zero Emission Vehicle mandate and Sustainable Aviation Fuel mandate from 2025.

The UK Modern Industrial Strategy (2025)[17] provides long-term policy certainty for high-growth sectors, including clean energy industries. It supports investment in regional clusters, supply chain development, and skills for the energy transition. The Clean Energy Industries Sector Plan[18], part of the strategy, is particularly relevant to LAEPs, focusing on enabling local delivery of low-carbon infrastructure and workforce development.

2.1.5 Plans for Neighbourhoods UK programme

The government announced £1.5 billion in funding for 75 selected communities across the UK through the Plan for Neighbourhoods, of which areas in Ashfield and Mansfield are included. This will provide up to £20 million in support and funding for each area.

The purpose of the fund is to invest in local people's priorities, with the funding split between capital of 75% and revenue of 25%. The funding is aligned to several themes, including regeneration, transport and connectivity. Transformation aims to be holistic, long-term, and sustainable to deliver meaningful change in the day-to-day lives of local people.

Ashfield was awarded £62.6 million in June 2021 as part of the government's Towns Fund programme. Together with investment from the Towns Fund Accelerator Grant, the Future High Streets Fund, and co-funding, this brings more than £100 million into the area to enhance the lives of residents.

Similarly, Mansfield Place Board's submission to central Government generated funding from the UK Government's Towns Fund, where the district received Towns Fund allocations totalling £12.3m for 13 projects that seek to collectively tackle the economic challenges the district faces including skills, employment, job creation and making physical improvements and changes as part of a place shaping agenda.

2.2 Regional Policies

2.2.1 East Midlands Combined County Authority Ambition for Greener Environment

The East Midlands Combined County Authority (EMCCA) has set ambitious goals[19] to create a greener, more sustainable environment. In alignment with national targets, EMCCA aims to be carbon neutral by 2050. To realise this ambition, some of opportunities have been identified which include building new low-carbon homes, retrofitting existing homes, in line with the 2025 EMCCA Retrofit Strategy[20], promoting renewable energy, protecting and enhancing green spaces, exploring the establishment of heat network zoning to decarbonise heating and hot water, and potentially increasing the region's electricity network capacity.

2.2.2 D2N2 LEP Energy Strategy 2019-2030

The D2N2 Local Enterprise Partnership (covering Derby, Derbyshire, Nottingham, and Nottinghamshire) set out a regional energy strategy[21] for 2019-2030 to support economic growth while reducing carbon emissions. It targets a 60% reduction in emissions from 1990 levels, with

[17] The UK's Modern Industrial Strategy 2025 - GOV.UK
[18] The UK's Modern INDUSTRIAL STRATEGY - Clean Energy Industries - Sector Plan
[19] The East Midlands Growth Plan - East Midlands Combined County Authority
[20] 3997_EMCCA RETROFIT STRATEGY_1.pdf
[21] Energy Strategy 2019-2030

ambitions for 100% low-carbon energy supply, of which 60% should come from renewables. The strategy also promotes smart transport, aiming for 70% of vehicle miles to be ultra-low emission, and supports community energy generation with a goal of 15 MW installed capacity. It encourages upgrading buildings to EPC C or above, expanding electricity storage by 180 MW, and investing in energy efficiency to reduce regional energy bills by over £1 billion annually.

2.2.3 Nottinghamshire County Council Carbon Reduction Plan

The Nottinghamshire County Council Carbon Reduction Plan (2022–2032)[22] sets out a roadmap for the council to achieve carbon neutrality by 2030 for its own operations. The plan focuses on reducing greenhouse gas emissions from activities related to energy use in buildings, highways assets (mainly street lighting), and work-related travel and transport. It provides a framework for action and defines the scope of emissions to be measured and reported, ensuring that progress towards the 2030 goal is transparent and accountable. The plan demonstrates the council's commitment to leading by example in the transition to a low-carbon future within Nottinghamshire.

The roadmap projects a bold transition for Nottingham and the wider region towards a low-carbon, sustainable future, aiming for significant emissions reductions, widespread adoption of renewable energy, and major improvements in energy efficiency by 2030. By 2030, the vision is for Nottingham to have upgraded most buildings to high energy performance standards, shifted a large share of transport to ultra-low emission vehicles, expanded heat networks, and achieved substantial progress towards carbon neutrality, in line with both local and regional targets. Key takeaways include the importance of coordinated action across electricity, heat, and transport sectors, the need to address challenges like population growth and economic expansion, and the value of aligning local initiatives with regional and national strategies to ensure an effective and resilient energy transition.

2.2.4 The Nottinghamshire Plan

The Nottinghamshire Plan [23] covering the period from 2021 to 2031, sets out the long-term vision of creating a healthy, prosperous and green future for all residents. The key objectives focus on bringing improvements to health, wellbeing and living standards as well as growing the economy while achieving net zero carbon targets by 2030 through;

- Reducing emissions across transport fleets, properties and highways
- Support and improve biodiversity
- Reduce waste and increase recycling
- Improve air quality
- Promote greener travel

2.2.5 Nottinghamshire's Electric Vehicle (EV) Charge Point Framework

The Nottinghamshire EV Strategy[24] sets out a clear vision and approach to expanding EV infrastructure by developing a comprehensive, accessible, and future-ready charging infrastructure across the county. It supports Nottinghamshire's broader climate goals by aiming to reduce transport-related emissions and improve air quality. The strategy focuses on equitable access, ensuring that both urban and rural communities—especially those without off-street parking—can benefit from the shift to electric vehicles. It also emphasises collaboration with

[22] Nottinghamshire County Council - Carbon Reduction Plan 2022-2032

[23] Nottinghamshire County Council, *The Nottinghamshire Plan: Our Plan for a Healthy, Prosperous and Greener Nottinghamshire 2021–2031* (Nottinghamshire County Council, 2021)

[24] Nottinghamshire County Council, *Electric Vehicle Charging Frameworks and Strategies* (Nottinghamshire County Council, 2025)

local authorities and private partners to deliver infrastructure that meets current and future demand.

2.2.6 Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas Across the East Midlands: Final Report

The Low Carbon Energy Opportunities and Heat Mapping for Local Planning Areas Across the East Midlands: Final Report[25] was produced in 2011 but still provides a useful starting point on the suitability of areas for renewable energy. Mansfield District Council have also recently commissioned an update to this for their district as part of their Local Plan Review evidence base.

2.3 Local Policies

2.3.1 Ashfield District Council Climate Change Strategy

In 2019, Ashfield District Council made a commitment to work to reach net zero, or as close to it as possible for the Council's direct and indirect (Scope 1 and 2) emissions by 2030, and work to minimise scope 3 emissions (outside the Council's direct control) as mentioned in Section 1 of this report[26], which is in line with UK national targets. Alongside reducing the Council's own emissions, Ashfield District Council recognises the importance of supporting the decarbonisation of the whole Ashfield District, in line with the UK Government targets of achieving net zero by 2050 and the international target of keeping global temperature rise well below 2ºC.

The strategy sets out a road map for reducing carbon emissions across Ashfield District Council's operations and services.

2.3.2 Ashfield District Council Carbon Management Plan

The plan[27] outlines Ashfield District Council's commitment to reducing greenhouse gas emissions and achieving net zero emissions. The plan includes a full greenhouse gas analysis of the Council's operational emissions and sets out key actions to reduce them. Since 2015/16, the Council has already reduced its emissions by 25% through various projects, such as installing solar PV on council-owned buildings and implementing smarter working practices.

The plan follows the Greenhouse Gas (GHG) Protocol, reporting emissions across three scopes: direct emissions from Council-controlled sources (Scope 1), indirect emissions from purchased energy (Scope 2), and indirect emissions associated with the Council's value chain (Scope 3).

2.3.3 Ashfield District Council Local Plan

Ashfield District Council's Local Plan[28] includes a commitment to build 1,000 extra homes in Ashfield over the next 15 years, in addition to the previous houses requested. This is now in the process of moving to public consultation.

2.3.4 Ashfield District Council Corporate Plan 2023-2027

Ashfield District Council's Corporate Plan[29] has five key strategic priorities of housing development, economic initiatives, health programmes, environmental projects and digital

[25] Microsoft Word - EM Report RE Final_31.03.11.doc
[26] Climate change strategy - Ashfield District Council
[27] Carbon management plan - Ashfield District Council
[28] Local Plan (2023-2040) - Ashfield District Council
[29] Ashfield District Council Corporate Plan 2023 to 2027

transformation. It commits to district-wide reduction in carbon emissions with reduced carbon footprint from Council operations.

2.3.5 Ashfield District Council's Strategic Direction 2022-2027

Ashfield District Council's Strategic Direction[30] seeks to respond to climate change by ensuring buildings, vehicles and other assets are 100% environmentally friendly.

2.3.6 Mansfield District Council Climate Change Strategy and Delivery Plan (2022)

Mansfield District Council declared a Climate Emergency for Mansfield. The declaration includes reducing carbon emissions by 40% by 2030 and making Mansfield Carbon Neutral by 2040. The vision for the district is to 'grow an ambitious, vibrant and confident place' and the overarching strategy focuses on four cross-cutting themes: Growth, Aspiration, Wellbeing and Place. The Mansfield District Council's Climate Change Strategy[31] outlines how Mansfield District Council will work towards achieving the Carbon Neutral 2040 target.

2.3.7 Mansfield District Council Local Plan 2013-2033

Mansfield District Council's Local Plan[32] includes reference to council planning for at least 6500 new homes to be built between 2013 and 2033.

2.3.8 Mansfield District Council Local Plan Review

The council undertook a review of its existing local plan[33] in 2025 to ensure that it reflects changes to the district's housing requirements along with new legislation and guidance introduced by the government. Included in the consultation were revisions to a number of policies and a long list of potential sites which could come forward for new development. One policy example is the council now needs to plan for at least 495 new homes a year, which equates to 10,395 homes over the plan period.

2.3.9 Towards 2030 – A Strategy for Mansfield – Our Plan Refresh 2024

This strategy[34] sets out how Mansfield District Council will respond to uncertainties and challenges it faces, whilst also setting out MDC's renewed vision, ambitions and the priorities the council will focus on going forward.

Since the adoption of the strategy in 2019 MDC have delivered on and supported several key projects across the district including:

- Adopted the Town Centre Master Plan and Design code that sets the framework for encouraging high quality development.
- Secured £20m from the Levelling Up Fund (LUF) for the Mansfield Connect project – a new civic and community hub.
- Developed a Climate Change Strategy and delivery plan aimed at reducing carbon emissions across the district.
- Developed four Passivhaus family homes.

[30] Ashfield District Council's Strategic Direction
[31] Mansfield Climate Change Strategy and Delivery Plan February 2022
[32] Local Plan 2013-2033 – Mansfield District Council
[33] Mansfield District Council Local Plan Review
[34] Towards 2030 - A Strategy for Mansfield

3 Current Emissions and Energy Use

This section presents an overview of the existing emissions and energy in Ashfield and Mansfield. This is intended to establish the starting point for the change required to achieve net zero.

3.1 The energy baseline definition

The Local Area Energy Plan (LAEP) energy baseline for both local authorities is a simulation of energy supply and demand across all buildings within each Council's boundary for the year 2023.

It includes both domestic and non-domestic buildings, although confidence in the input data for non-domestic buildings is lower, and emissions from industrial activities beyond building energy use are not available at this stage. Engagement with large energy users was undertaken to qualitatively understand their current energy use, technologies employed and future decarbonisation plans.

The baseline covers approximately 107,000 buildings for Ashfield and Mansfield (50,199 in Mansfield, 57,099 in Ashfield), each with a rich set of attributes. Simulated energy consumption and associated carbon emissions are available at annual, and monthly intervals and can be broken down by heating, domestic hot water (DHW), total electrical loads (that includes lighting, auxiliary and equipment). These results can be aggregated at Middle Super Output Area (MSOA) and Local Authority levels and are accessible via IES' 3D digital twin energy model, which visualises all buildings and energy assets across the two areas. Note that this resource will be accessible to the local authorities and it not publicly accessible.

This baseline provides a robust representation of the current local energy system, forming a strong foundation for future energy interventions and decarbonisation pathways.

3.2 Creation of the energy baseline

Each local authority's baseline was developed using IES' Digital Twin software, which integrates geographic information system (GIS) and building data to simulate energy use and carbon emissions across the building stock. The key datasets utilised are set out below.

- **The Ordnance Survey National Geographic Database** (OS NGD) Buildings dataset was used to generate 2D building geometries.
- **Energy Saving Trust's Home Analytics** datasets for domestic and non-domestic buildings provided information on building characteristics such as fabric, heating systems, and fuel types.

These datasets include EPC data and predictive modelling for homes without EPCs. For non-domestic buildings, data availability was more limited, restricting the scope of analysis for interventions like fabric improvements. Where data gaps existed, assumptions were made to enable all buildings to be included in the analysis.

A list of attributes available from Energy Savings Trust data for domestic and non-domestic buildings is included in Appendix B.

A baseline energy profile was created using IES' technology, resulting in a dynamic 3D digital map of the two areas. The modelling was organised by Middle Super Output Areas (MSOAs), which each contain around 5,000 buildings. These zones represent the smallest geographical

units with sufficient government energy data (electricity and gas) for comparison, and each has its own masterplan-scale energy model.

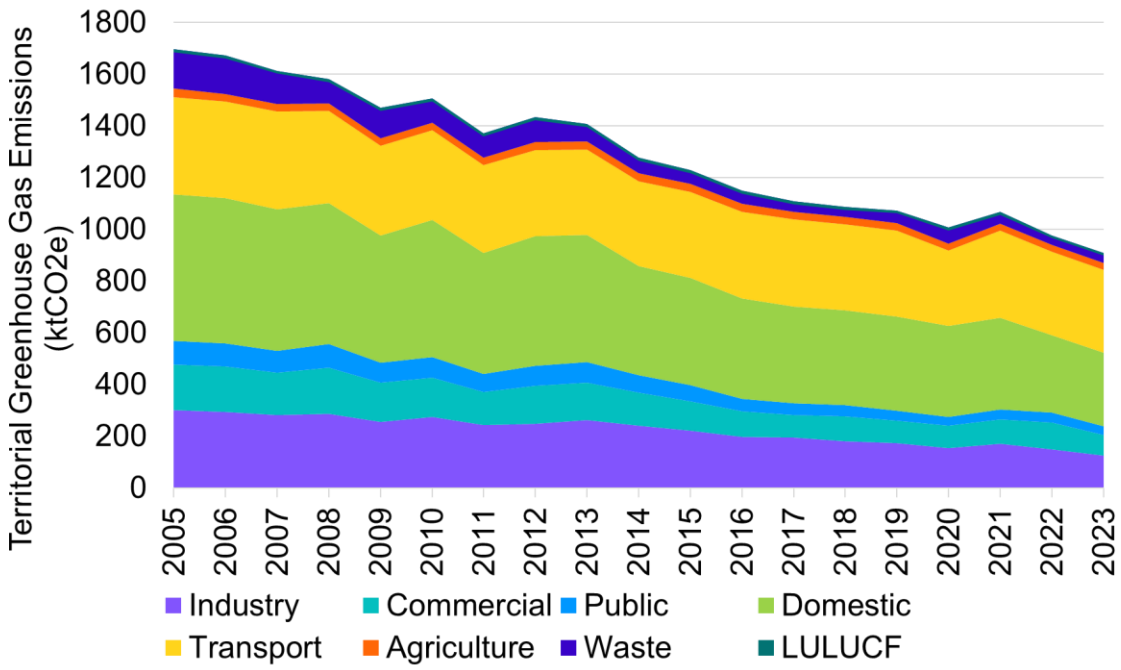
3.3 Historic Emissions and Energy Use

The total emissions directly generated in Ashfield and Mansfield combined is approximately 990.5 kt CO2e (399.2 ktCO2e in Mansfield, 590.3 ktCO2e for Ashfield) (from UK Government data for 2023).

Figure 3.1: Combined Total Historic Emissions for Ashfield and Mansfield (ktCO2e) illustrates the historical emissions of Ashfield and Mansfield from 2005 to 2023 split by sector, based on UK Government data. Over this period, the area has experienced a gradual reduction in carbon emissions across industry, transport, domestic and commercial properties and waste, largely driven by the decarbonisation of the national electricity grid.

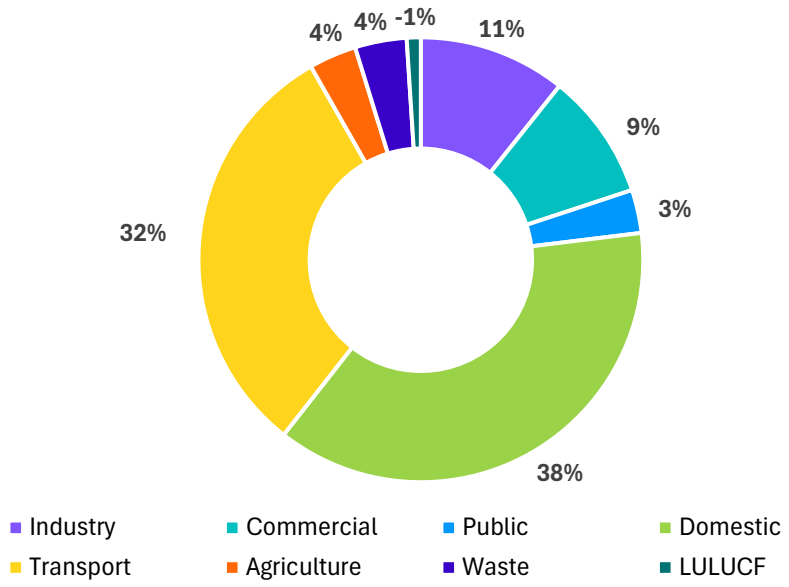
Ashfield and Mansfield's transport sector represents the largest emissions contributor, accounting for 35% of total emissions, followed by the domestic sector at 31%, industry at 14%, and commercial at 9%. The LAEP scope includes emissions from industry, commerce, public, and domestic sectors, targeting 63% of Ashfield and Mansfield's total carbon emissions. The LAEP also looks at the projected EV charging requirement to shift away from ICE (Internal Combustion Engine) vehicles, which will help to reduce the transport emissions in both districts. LULUCF (Land Use Land Use Change and Forestry) emissions are currently net negative across both districts, although are out of scope for the LAEP anyway.

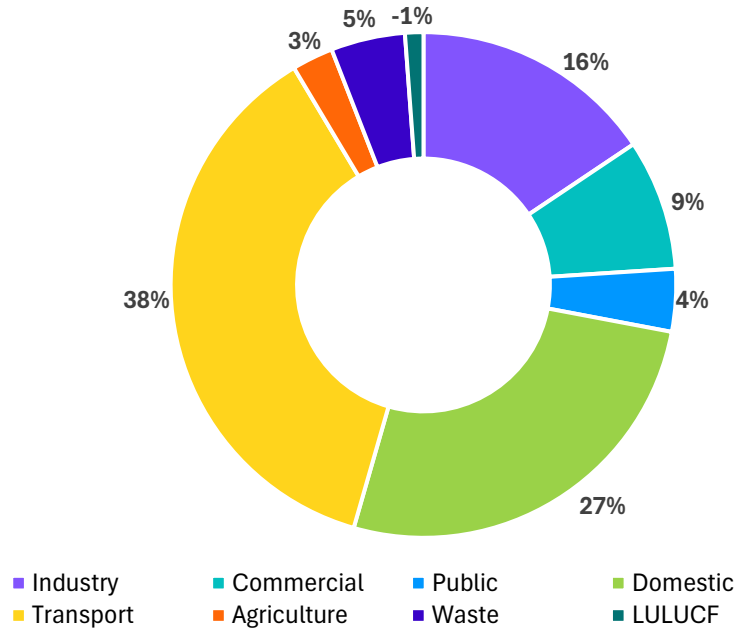
Figure 3.1: Combined Total Historic Emissions for Ashfield and Mansfield (ktCO2e)



Source: UK local authority and regional greenhouse gas emissions statistics - GOV.UK

Figure 3.2: Mansfield (Upper) and Ashfield (Lower) % emissions breakdown (2023)





Source: UK local authority and regional greenhouse gas emissions statistics - GOV.UK

Figure 3.3 : Ashfield buildings energy use breakdown (GWh) (2023)

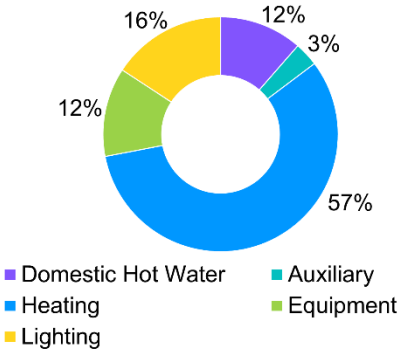
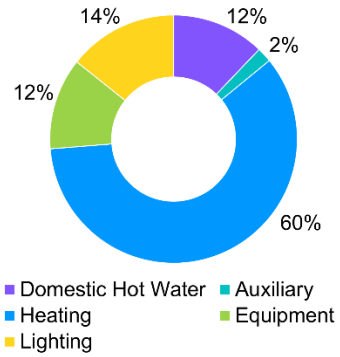


Figure 3.4 : Mansfield buildings energy use breakdown (GWh) (2023)



Total energy demand in Ashfield totalled 1146.1GWh in 2023. Space heating was the dominant energy use representing 57% of all consumption, followed by lighting (16%), equipment (12%) and domestic hot water (12%) and then auxiliary systems (3%).

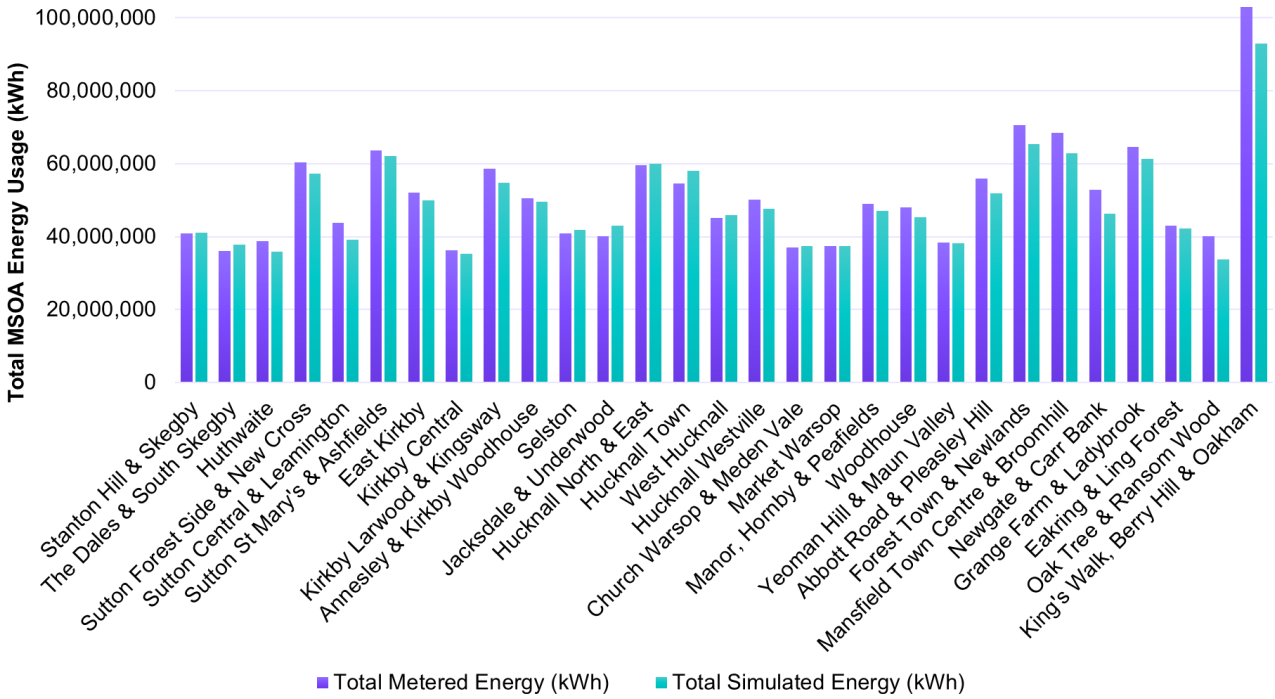
Total energy demand in Mansfield totalled 885.9GWh in 2023. Space heating was the dominant energy use at 60%, followed by lighting (14%), equipment (12%) and domestic hot water (12%) and then auxiliary systems (2%).

3.4 Energy baseline validation

Having utilised data from the Energy Savings trust to model energy use in the Digital Twin, results from the Digital Twin were validated against UK Government data, which includes only electricity and gas metered consumption. In terms of data accuracy therefore, this means fuels such as oil, LPG, and biomass were excluded, leading to skewed results in rural areas where these fuels are more commonly used. This is not anticipated to be material in the case of Ashfield and Mansfield, due to the vast majority of domestic and non-domestic properties using gas and electricity for heating.

Below are the energy simulation results for electricity and gas consumption compared to government data at MSOA level for Ashfield and Mansfield's domestic buildings.

Figure 3.5: Energy simulation results at MSOA level for Ashfield and Mansfield's domestic buildings



For both domestic and non-domestic buildings, a floor area correction was applied. This adjustment accounts for the simulation software's assumption that the entire building footprint is thermally conditioned, including spaces such as cupboards, internal voids, and wall thickness. Where high-confidence conditioned floor area values were available from the Energy Saving Trust, these were compared to modelled areas to derive scaling factors used across the building stock.

To enable a like-for-like comparison, oil, LPG, and biomass consumption were removed from the simulation results, aligning with the scope of the government dataset. Given the limitations of the available data, the results are considered acceptable. A tolerance range of ±20% was set, and all MSOA results fall within this range.

4 Stakeholder Engagement Approach

Stakeholder engagement has been the foundation for the overall progress of the project, with frequent interaction with stakeholders undertaken at every stage. A diverse set of stakeholders have been engaged, from commercial and community backgrounds, which enabled efficient review and feedback at different points of the project.

4.1 Engagement Objectives

Stakeholder engagement provided the project team with feedback which informed the preferred pathway chosen for this LAEP. Stakeholders assisted in developing a sequenced plan of proposed actions for achieving Ashfield and Mansfield's net zero goals.

The original stakeholder engagement aims tied into the wider LAEP programme as well as project specific aims. These were:

The original stakeholder engagement aims tied into the wider LAEP programme are:

- Identify the critical stakeholders needed to deliver the priority projects.
- Increase stakeholders' understanding of energy systems and the LAEP process.
- Develop stakeholder trust and buy-in to the proposals of the LAEP.
- Encourage a wide range of views and insights to refine the LAEP, identifying opportunities and constraints that will improve the deliverability.
- Increase stakeholders' understanding and the LAEP process and how it feeds into the net zero goals of Ashfield and Mansfield District Councils.
- Establish a sound foundation for effective and sustained local action to reduce carbon emissions in line with the councils' net zero goals.

4.2 Stakeholder Mapping

A desk-based stakeholder mapping exercise was undertaken, to produce a register of names and contact details for each area. These included Group 1, Primary and Secondary stakeholders. This created the stakeholder register, with contact details and a tracker for all touchpoint contacts held in a secure SharePoint site. Further stakeholders were added to the register as relevant throughout the course of the project.

4.3 Stakeholder Management

The interest and position of stakeholders relevant to the project was considered throughout and informed the appropriate methods of communication with each stakeholder group, whether through group stakeholder engagement sessions or organising 1:1 calls or discussions where appropriate. The grouping of stakeholders into the following categories ensured that each stakeholder group received tailored engagement and information regarding the scheme and its proposals.

Table 4.1: Stakeholder Prioritisation

Category	Influence	Interest	Ranking
Steering Group	High	High	High
Group 1 Stakeholders	High	Medium	High

Category	Influence	Interest	Ranking
Primary Stakeholders	High	Medium	High
Secondary Stakeholder	Medium	Medium	Medium

Steering Group (SG)

A small group of individuals who represent the local authorities, working closely with the project team to advise on engagement, decision making and assist with further stakeholder mapping, along with EMCCA, Mott MacDonald and IES.

Group 1 Stakeholders (G1)

These stakeholders were categorised due to their influence over all LAEP's included in the D2N2 programme, primarily network operations and the universities. These stakeholders were engaged separately at programme level. Meetings consisted of one-to-one sessions which were held with Cadent Gas and National Grid Electricity Distribution on what data could feed into the digital twin, and energy modelling analysis.

Group 2: Primary Stakeholders (PS)

Primary stakeholders were directly involved in the LAEP process and had significant influence over its outcomes. They provided local insights, priorities, and data inputs, shaping the content and direction of the LAEP, including modelled scenarios and optimised pathways. These stakeholders included key council representatives, and relevant community groups.

Group 2: Secondary Stakeholders (SS)

Secondary stakeholders were not directly involved in the LAEP's core activities. They provided local insights, priorities, and data inputs. These stakeholders included large industry and/or commercial organisations such as the NHS, utility providers, and residents' groups.

Primary and secondary stakeholders were invited to workshops at key stages of the development process. Insights gathered at stakeholder meetings were fed to the project team and IES to influence the modelling.

Table 4.2 summarises the stakeholders engaged throughout the LAEP development process.

Table 4.2: Summary Stakeholder Register

Stakeholder Category	Organisations Engaged
Steering Group	Ashfield and Mansfield District Councils, D2N2/EMCCA representatives, Mott MacDonald, IES
Group 1 Stakeholders	National Grid, Cadent Gas, Local NHS boards, University of Nottingham and Nottingham Trent University, Nottinghamshire and Derbyshire County Councils
Primary and Secondary Stakeholders	• Employees from other teams within Ashfield and Mansfield councils • Local residents and resident groups (e.g. Mansfield CVS) • Local government organisations (e.g. Warsop Parish Council, Selston Parish Council) • Large industry commercial organisations (e.g. Aldi, National Grid, Amazon, process loading manufacturers) • Community energy organisations (e.g. Nottinghamshire Community Energy) • Net zero hub/local enterprise partnership (e.g. LEP) • Social housing providers and local council housing teams (Nottingham Community Housing Association, EMH Homes, Pinnacle Group) • Local organisations with energy/decarbonisation expertise (e.g. Community Energy England, Nottinghamshire Community Energy) • Utility Providers (Cadent Gas, National Grid) • Local planners and developers • Public sector estates organisation (leisure centres, tourism organisations)

4.4 Stakeholder Engagements

The engagement process was designed to be iterative and two-way. Insights gathered during stakeholder meetings were fed back into the project team, and any resulting changes or refinements to the LAEP were communicated transparently to contributors. This feedback loop fostered trust, built consensus, and encouraged stakeholders to become advocates for the plan.

The Steering Group met fortnightly throughout the project, to steer the day-to-day work of the delivery team and shape other stakeholder engagements.

Group 1 stakeholder engagement consisted of one-to-one sessions which were held with Cadent Gas, National Grid and UK Power Network on what data is available that could feed into the digital twin, and energy modelling analysis.

Group 2 stakeholders were invited to workshops and stakeholder engagement sessions, taking place aligned with the relevant LAEP Stage. Group 2 stakeholders were further categorised into priority and non-priority groups as identified by the steering group, in order to target their engagement in all future sessions and workshops, to streamline the outputs received and appropriately manage our time spent with the most relevant Group 2 stakeholders.

Insights gathered at stakeholder meetings were shared and discussed amongst the wider EMCCA LAEP delivery team and agreed inputs were reflected into the energy modelling or intervention modelling, with changes then made as a result.

This commits Mott MacDonald and IES to meaningful, genuine stakeholder engagement, ensuring our stakeholders are heard and will likely continue to be engaged beyond the publication of this LAEP. Additional engagement was sought from using MS forms to expand on discussions taking place during the stakeholder engagement sessions and allowed participants to re-summarise their points in writing, or the opportunity to offer more detailed and written answers to specific topics discussed such as intervention proposals and scenarios.

Table 4.3: Key Stakeholder Engagements

Communication channel	Frequency	Description
Workshops	Six were carried out, for each of the main stages of the LAEP. Work with primary and secondary stakeholders to gather insights on the LAEP and help refine future plans.	Virtual and/or in person. Comprised of a presentation of data or information, followed by specific questions to stakeholders to inform the next phase of work. Stakeholders were given the opportunity to ask questions with regards to the information presented. Other tools, such as MS Form surveys or polls, were used for additional input where relevant.
Email	Weekly. Briefing information ahead of workshops. Allowing for two-way engagement if any questions arise	Use of emails prepares stakeholders for the workshops by providing aims and objectives of the session, as well as key themes to encourage streamlined sessions. Email communication allowed people to contact Mott MacDonald and the Steering Group with any ad-hoc requirements or feedback.

4.5 Key Stakeholder Insights

Table 4.4: Summary of Key Stakeholder Insights

Stakeholder	Insight
Utility provider	Provided context for how the LAEP needs work alongside utility systems, influencing the phased pathway. Shared knowledge and expectations on the forward development of both electricity and gas networks, including the future potential of hydrogen in the local area. Queried and added depth to the consideration of infrastructure impacts of scale roll-out of interventions.

Stakeholder	Insight
Hydrogen network representative	Support offered to engage industry partners. This engagement was used to support the LAEP and wider consideration of hydrogen uptake.
Community energy groups	Technical knowledge on the feasibility of interventions has proved useful to determine uptake rates. Firsthand experience of working with communities has also offered up new opportunities and actions included in the phased pathway. Additionally, the groups were able to offer considerable local knowledge and examples of best practice, to further inform several areas of the plan.
College	Sharing their approach to tackling their listed buildings offered useful insights for localised and bespoke approaches for retrofit.
NHS	Useful insights to how they are finding use of a range of low carbon technologies - issues faced include Ground Source Heat Pump (GSHP) borehole leakage, high ASHP running costs, and aging Combined Heat and Power (CHP) systems. Their fabric-first approach is standard, but capital and operational constraints limit deep retrofit potential.
Local authorities	Current data available to the local authorities has been inputted into the modelling. An overview of the priorities of both districts and local knowledge is also used to help develop the prioritisation section as well as expand the modelling (e.g. floating solar, mine water heat, water source heat pumps, food waste generation).
Local residents	Highlighted individual opportunities and concerns regarding interventions, including local insight on challenges to uptake across a range of interventions. Shared prior local analyses on different technologies and their potential in the local energy system.
Local Business Owner	Flagged that the cost to SMEs and homeowners for heat pump installations compared to gas boilers is too high, in terms of both capital expenditure (Capex) and operational expenditure (Opex). This highlights a key risk and uncertainty in the LAEP, emphasising that a cost re-balancing between electricity and gas prices may be required at national level to encourage uptake. Grid constraints were also flagged as an issue that currently blocks business owners from installing PV panels in the area. This highlights the need to engage with the DNO early on projects, and the importance of lobbying for national funding of grid upgrades to allow local low carbon generation to be installed.
County Council Representatives	Highlighted that the impacts on health of retrofit need to be considered and are often undervalued. Also highlighted the gap in the funding market for vulnerable people who do not qualify as fuel poor and therefore have limited access to funding for retrofit improvements, however they are often at most risk of winter death due to being unable to properly heat their homes.

Stakeholder	Insight
	Also highlighted the benefit of place based improvements when undergoing significant retrofit across a whole neighbourhood. These can be difficult to quantify directly, however have proven social impacts in terms of reduced crime and improved health outcomes. This strengthens the argument for widespread deep retrofit, even when costly and disruptive. A key blocker in terms of grid upgrades was also highlighted, where Ofgem require proof of demand before releasing funds for i.e. a new substation, however they don't have permission to create the demand if the possibility to connect to the grid is not there, creating a loop which is difficult to break out of when planning new electrical loads for i.e. a new housing development of all electrically heated homes.

5 Assessing Options for the Future

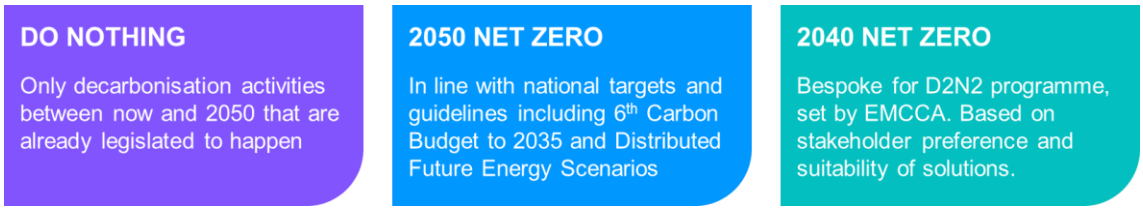
This section sets out the scenario constraints which frame the LAEP, and the approach to deciding which interventions underpin the fundamentals of the transition to net zero for Ashfield and Mansfield.

5.1 Overview of Scenarios

Scenarios are a powerful tool in energy planning, letting us explore different futures, understand the impacts of our choices, and prepare for uncertainties. Three scenarios were used as part of this LAEP to explore potential decarbonisation pathways for Ashfield and Mansfield.

These scenarios reflect varying levels of ambition and policy contexts, from minimal intervention to accelerated decarbonisation aligned with regional targets. To ensure comparability, key economic parameters such as intervention costs, energy prices, and discount rates were held constant across all scenarios. This supports sensitivity analysis and isolates the effects of policy ambition and technology uptake.

Figure 5.1: Scenarios for the LAEP modelling



5.1.1 Do Nothing

This ‘Do Nothing’ scenario represents what will happen without additional policy (beyond what is already legislated) or without additional infrastructure investment identified in this LAEP. In this way, the ‘Do Nothing’ scenario represents the most probable outcome, if nothing additional was done beyond what is already committed to. The ‘Do Nothing’ acts as the baseline, from which carbon reductions and the cost of the LAEP can be calculated.

This could be characterised as a small amount of consumer engagement in decarbonisation in addition to slow system changes. In the ‘Do Nothing’ scenario, the energy system emissions are reduced, but the scenario does not result in reaching net zero. It aligns with the “Falling Short” pathway from the National Grid/Regen Distributed Future Energy Scenarios (DFES).

Each intervention area in the subsequent sections, provides specific detailed counterfactual assumptions and exclusions relevant to the technological solution. The high-level Do Nothing assumptions are listed in Table 5.1.

Table 5.1: Do Nothing modelling assumptions

Technology Area	Policy landscape and Market Trends
Heating Decarbonisation	As there is currently no legislated mandate for heat pumps, we have assumed no further uptake of low-carbon technologies and a like-for-like replacement of heating systems at the end of their operational life
Building Thermal Energy Efficiency (Fabric Improvements)	We have assumed that all privately rented and social housing currently rated EPC C or below will undergo some form of fabric retrofit in order to meet the Minimum Energy Efficiency Standard (MEES) target.
Energy Generation	As with air source heat pumps, we have assumed no further uptake of solar PV due to the absence of mandated legislation

5.1.2 2050 Net-Zero

Aligned with the UK Government's legally binding target, this scenario reflects a pathway to net zero greenhouse gas emissions by 2050. It is similar to the "Leading the Way" DFES pathway however includes assumptions from the Climate Change Committee (CCC) on retrofit rates and policy impacts. Hydrogen use is considered for industrial clusters, consistent with National Grid's Future Energy Scenarios (FES 2024)[35]. This scenario provides a nationally consistent benchmark for evaluating local contributions to UK climate commitments.

5.1.3 2040 Net Zero

This regionally defined scenario targets net zero by 2040, positioned between the national 2050 target and the 7th carbon budget. It allows for bespoke modelling of retrofit rates, hydrogen deployment, and other interventions tailored to local opportunities and constraints. The scenario assesses the feasibility, impacts, and benefits of accelerating the energy transition to meet a 2040 target.

5.2 Scenario Modelling Approach

Scenario modelling for a LAEP can follow two main approaches:

- **Standardised Scenarios aligned with regional planning (Top-Down):** LAEPs can adopt industry-standard scenarios, such as the Distribution Network Operator's Distributed Future Energy Scenarios (DFES), which are derived from the National Energy System Operator's Future Energy Scenarios Pathways (FESP). This approach ensures consistency with regional and national planning frameworks.
- **Bespoke Local Scenarios informed by stakeholder input (Bottom-Up**): Alternatively, scenarios can be developed through engagement with local stakeholders, reflecting local priorities and ambitions. This includes input from local authorities, large energy users, community organisations, and businesses. Such collaboration helps identify unique local drivers and constraints that may not be captured in standardised scenarios.

[35] Future Energy Scenarios (FES) | National Energy System Operator

Following discussions at the programme level, a bottom-up modelling approach was adopted to estimate the uptake of interventions, informed by local stakeholder input and priorities. Input is also taken from the UK Climate Change Committee's (CCC) Seventh Carbon Budget, which targets a 75% reduction in UK territorial emissions by 2040, achieving net zero emissions by 2050. While DFES projections for the East Midlands follow similar trends, the data can rely on LAEPs for their modelling. Therefore, national projections are used as a scalable proxy for local totals.

To model uptake of interventions, a logistic growth (S-curve) function was applied. This reflects slow initial growth due to barriers such as upfront costs, followed by acceleration in the mid-phase driven by policy support, and eventual saturation near 100%. Uptake is normalised to 100% of the total required installations by the target year, assuming a low starting point in 2026.

During modelling, curve midpoints and growth rates were anchored to concrete national and regional policy signals, and adjusted around these in discussion with stakeholders. Peak annual delivery was capped at realistic levels to reflect workforce and supply chain ramp-up constraints. Annual percentages represent the incremental increase in installations for each year, while cumulative uptake reaches 100% by the target year.

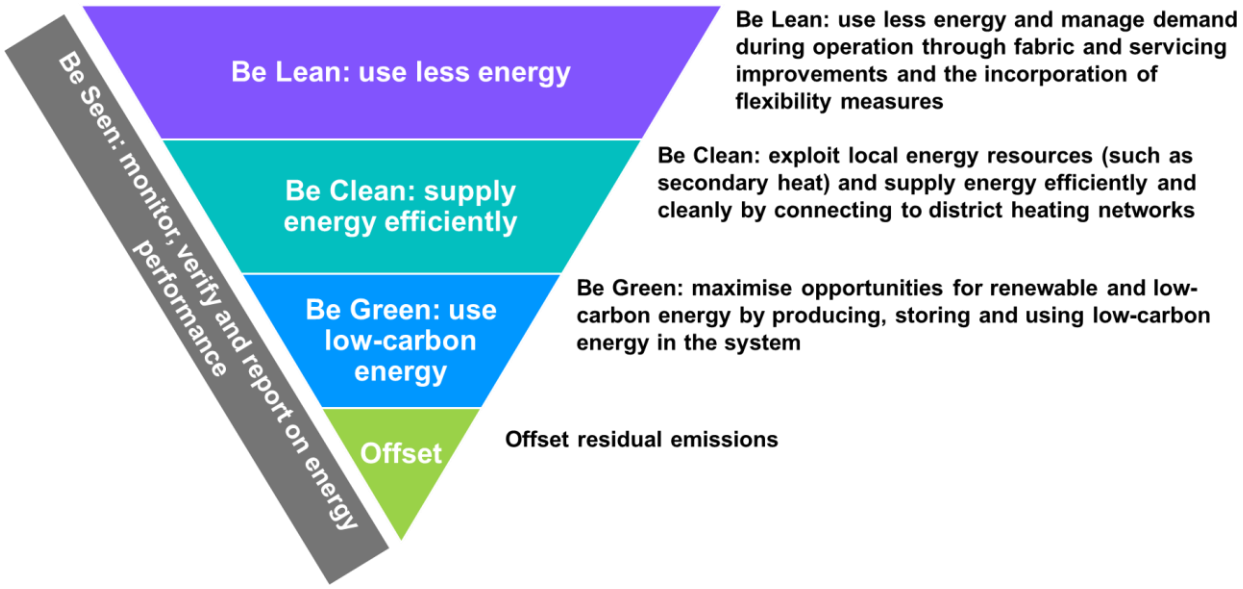
- For the **Net Zero by 2050 scenario**, the timeline follows the CCC's Balanced Pathway, with local adjustments.
- For the more ambitious **Net Zero by 2040 scenario**, the timeline is compressed by a factor of approximately 1.67 (25 years to 2050 vs. 15 years to 2040). This shifts data points earlier while preserving the S-curve shape.

5.3 Intervention Prioritisation Approach

The idealised approach to achieving net zero emissions is to follow the energy hierarchy as represented in Figure 5.2. It offers a common-sense, cost-effective, sustainable energy policy that aims to reduce energy use before seeking to meet remaining demand by investing in 'be clean' technologies in advance of 'be green' and offset incentives.

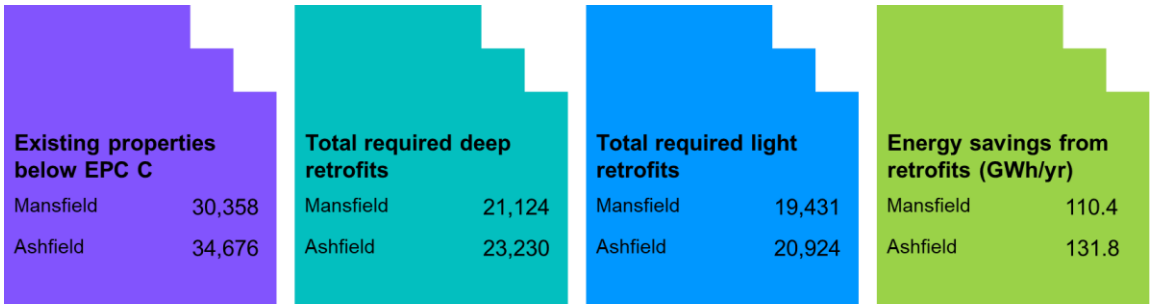
The Hierarchy offers an effective framework to guide sustainable energy policy and decision-making. The Interventions identified for Ashfield and Mansfield will therefore follow this hierarchy, starting with energy efficiency measures and then followed by low carbon heating alternatives, then following this with installation of local renewables and battery storage.

Figure 5.2: The Energy Hierarchy



6 Energy efficiency in buildings

Buildings account for nearly 40% of energy consumption in the UK across all sectors, and this equates to almost a quarter of total emissions UK wide.[36] This section deals with energy efficiency in buildings associated with the upgrade and retrofit of fabric improvement measures. This spans both domestic and non-domestic properties.



The primary focus of retrofit of building fabric improvements is to bring down the “U-Value”, the thermal transmittance measure, of different components of a building to increase its ability to retain heat and ultimately support environmental sustainability. Increased fabric performance and energy efficiency of a buildings can be linked to many direct benefits such as reduced energy bills, reduced fuel poverty, warmer homes and reduced carbon emissions. There are also many indirect co-benefits that can be realised through energy efficiency or fabric retrofit, the better example being resilience on the energy (gas and electricity) grids through the reduced energy demand from homes and businesses.

Additionally, implementing fabric retrofit will reduce the overall thermal heat demand of properties. This reduction will be pivotal when transitioning to electric heating systems. This is because it will lower the required heating capacity of properties, which in turn will significantly cut the total capital costs associated with heat pump and electrical grid upgrades. Further details are provided in Section 7.

Building fabric retrofit is crucial to tackling climate change. It also contributes to the growth of local economies through the creation of jobs and is ultimately linked to the increased health and well-being of the population.

6.1 Existing Building Stock

6.1.1 Domestic Housing Stock

Across Ashfield and Mansfield, domestic housing accounts for 96% of all buildings, split between social housing, private rented and owner-occupied tenure types. With the right information and insights influencing policy decisions, a significant impact on the energy transition and carbon reduction can be made through addressing this sector.

Most of the existing housing in these districts was shaped by the Nottinghamshire coal industry, with rapid construction to accommodate workers resulting in large, uniform estates. In Ashfield, traditional brick terraces and semis remain dominant in older mining towns such as Sutton-in-Ashfield and Kirkby, while Mansfield’s stock reflects its industrial past through Victorian terraces near the town centre, extensive interwar council estates, and its significant

[36] The CCC Sixth Carbon Budget

post-war expansion.[37] From the 1970s to the 1990s, both districts saw the growth of large private suburban estates, typically built with brick cavity walls and tiled roofs, adding to the varied mix of housing types across the area.

Going forward the majority of these houses will continue to be occupied, highlighting the importance of future proofing these properties. A key aspect of futureproofing is reducing both the thermal and electrical demand. This can be achieved by improving fabric performance and implementing other energy efficiency measures, which in turn lowers energy consumption and reduces associated carbon emissions.

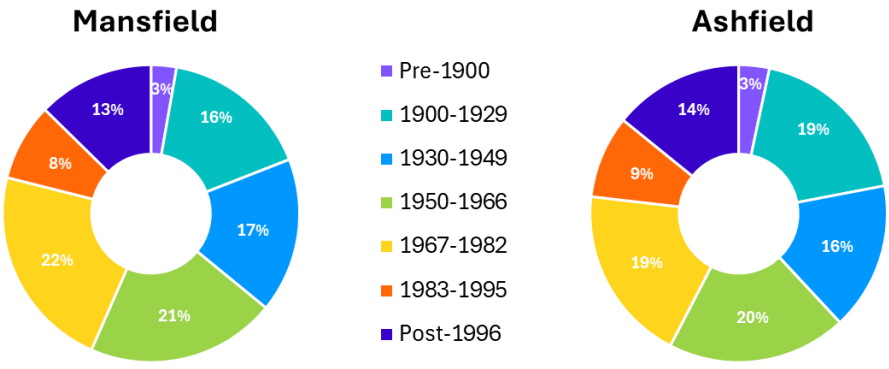
Energy efficiency and energy retrofit in buildings is a fundamental for achieving net zero. Through following the first step of the Energy Hierarchy, “Be Lean”, it is possible to bring wider benefits such as creating warmer homes, improving internal air quality and thermal comfort, reducing energy use, all giving occupants more certainty over their energy bills, and a reduction in the risk of fuel poverty.

In the context of EMCCA, Ashfield and Mansfield and this Local Area Energy Plan, energy efficiency will play a critical role in demand reduction and heat decarbonisation across the area.

To address the energy transition needs of the local area is it pertinent first to understand the emissions context of the area (see Figure 3.1) and the “tools” that each local authority might have at their disposal by way of energy interventions. Emissions associated with domestic sector has decreased in line with Ashfield and Mansfield’s historic emissions and this is mainly due to decarbonisation of the electricity grid.

While grid decarbonisation has driven much of the reduction in domestic emissions to date, the characteristics of Ashfield and Mansfield’s housing stock remain a critical factor in determining future energy demand and retrofit potential. Figure 6.1 shows the varying construction dates of Ashfield and Mansfield’s domestic properties which helps indicate the level of pre-existing energy efficiency measures the home may already be equipped with, and lead to an understanding of the scale of retrofit needed.

Figure 6.1: Breakdown of Properties by Age band across both districts



Ashfield and Mansfield’s housing stock presents a significant challenge for energy efficiency, with 75% of homes built before 1983. These properties were constructed under standards far below today’s requirements, resulting in high heat loss and poor baseline performance. Figure 6.1 shows that 34% of homes were built before 1950, and only 13% were constructed after 1996 under modern regulations.

[37] nottinghamshire-coalfields_book.pdf

The oldest homes, Pre-1900 (3%) and 1900–1929 (18%), typically feature solid brick or stone walls with lime mortar and no cavity, giving estimated U-values above 2.1 W/m²K, roughly eight times worse than current standards.[38] These buildings can be durable and architecturally significant, they normally require more complex retrofit solutions, which is likely dependent on factors such as statutory planning protection. Both districts include various building of historic value as listed buildings, non-designated heritage assets, or buildings in conservation areas. These factors can limit the energy efficiency measures that can be implemented, and create additional costs. The technical challenge of applying external or internal wall insulation is a significant technical barrier, while cost and affordability represent financial barriers. The disruptiveness of the work is also likely to be a major consideration, particularly for internal wall insulation.[39]

The largest share of properties, 21%, consists of homes built between 1967 and 1982, followed by those built between 1950 and 1966 (20%) and 1930 and 1949 (16%). The two earlier periods reflect the post war expansion when demand for quick, affordable housing was high. Construction methods in these decades often prioritised scale rather than thermal performance. Walls were usually solid or uninsulated cavity types, loft insulation was minimal or absent, and glazing standards were basic.

The 1930–1949 band marks the architectural transition to cavity wall construction. While these walls offer slightly better conductive performance (typically around 1.5 W/m²K) because of the air gap, they introduced new vulnerabilities. These early cavities were built for moisture prevention rather than thermal retention and were left uninsulated. Additionally, the move to suspended timber floors in this era often makes this cohort significantly prone to higher air infiltration rates compared to their solid-walled predecessors. As a result, these homes tend to have poor baseline efficiency and higher heat loss without targeted retrofit measures. It should be noted that the EPC data will reflect where changes have occurred to the properties since the year built, i.e., the installation of double glazing or addition of loft insulation. This has therefore been captured in our assessment and in the digital twin.

The 1983–1995 (9%) and post-1996 (13%) segments coincide with the introduction and progressive tightening of Approved Document L within the Building Regulations. First introduced in 1985 and updated significantly in 1995, 2002, and 2006, these regulations mandated strict limits on air permeability, thermal bridging, and U-values. The 8% of stock built post-1996 likely benefits from mandatory double glazing, floor insulation, and high-performance loft insulation, achieving an EPC rating of C or higher by design. While these newer properties require minimal fabric intervention, they represent the minority of Ashfield and Mansfield's infrastructure. This implies that to achieve district-wide decarbonisation, the primary focus must remain on the 75% of buildings constructed before 1983, where the gap between original performance and modern standards is widest.

The UK's Energy Performance Certificate (EPC) data provides insight into the thermal efficiency of dwellings across the country. EPC ratings are the most widely used indicator of a building's energy efficiency level and are based on data points collects across building fabrics (insulation, windows, construction type, age), heating and hot water system and electrical demand (lighting, electric heating and appliances).

Figure 6.2 and Figure 6.3 presents the EPC rating distribution across Ashfield and Mansfield's domestic building stock.

[38] Conservation of fuel and power: Approved Document L - GOV.UK

[39] Retrofit Internal Wall Insulation: guide to best practice

Figure 6.2: Proportion of EPC Ratings Across Mansfield MSOAs

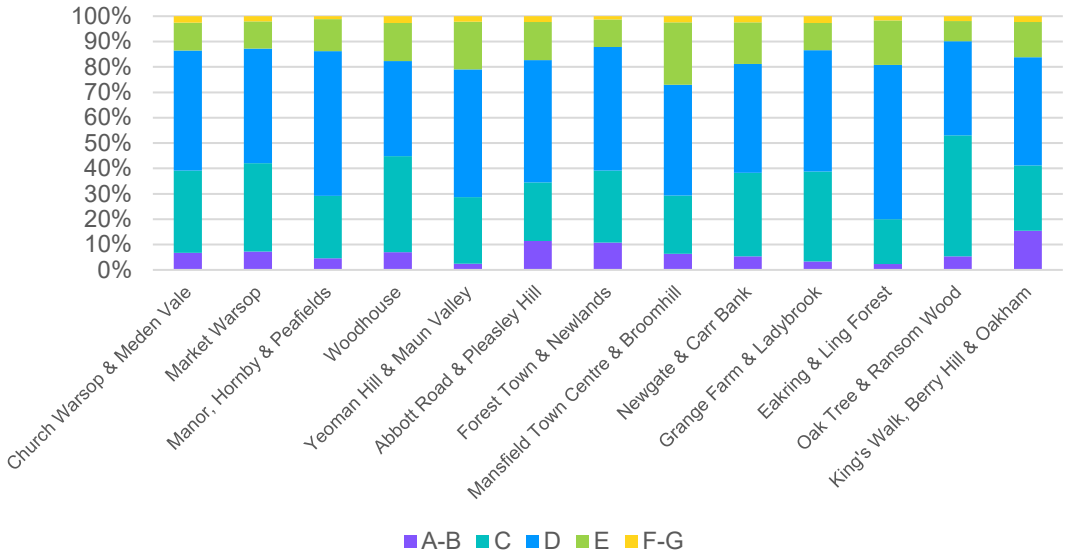
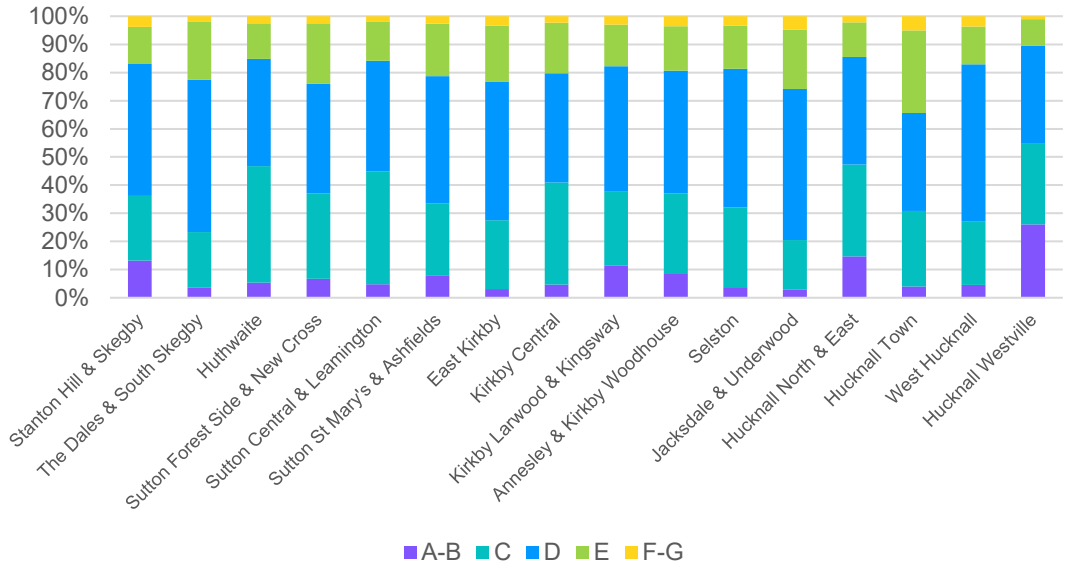


Figure 6.3: Proportion of EPC Ratings Across Ashfield MSOAs



Given Ashfield and Mansfield's large proportion of pre 1996 buildings, it is unsurprising to see a substantial proportion of homes falling below the UK Government's current recommended EPC rating of C. 63% of homes are rated D or lower, indicating high energy demand and poor insulation. This further raises the importance of fabric retrofit and energy efficiency as a priority in the area.

Homes constructed after the year 2000 may only require minimal upgrades to reach EPC rating C and above, if they aren't already achieving these levels based on as built and installed fabric and systems. It may, however, be difficult to achieve EPC rating C for Ashfield and Mansfield's

older properties given the increased complexity in delivering full fabric and energy retrofit improvements, as well as the high costs associated with deep retrofit.

It is likely that this challenge will continue to influence the level of fuel poverty experienced in Ashfield and Mansfield, with both areas reporting a slightly higher rate of fuel poverty (12.3% and 12.4%) compared to the East Midlands regional average (11.7%).[40] How this can be addressed through targeted intervention is addressed in Chapter 13.

The Low-Income Low Energy Efficiency (LILEE) definition of fuel poverty was introduced in 2019. Before this, a home was classified as fuel poor if it spent more than 10% of its annual income on space heating and energy services.[41]

This is far more likely in a home rated EPC E or below due to lack of insulation and poor thermal retention capability. Fuel poverty currently contributes to around 155 excess winter deaths across EMCCA annually. Retrofitting homes can have a huge impact on reducing this alongside reducing health inequalities and reducing absences from school and work arising from damp and cold air related illnesses.[42]

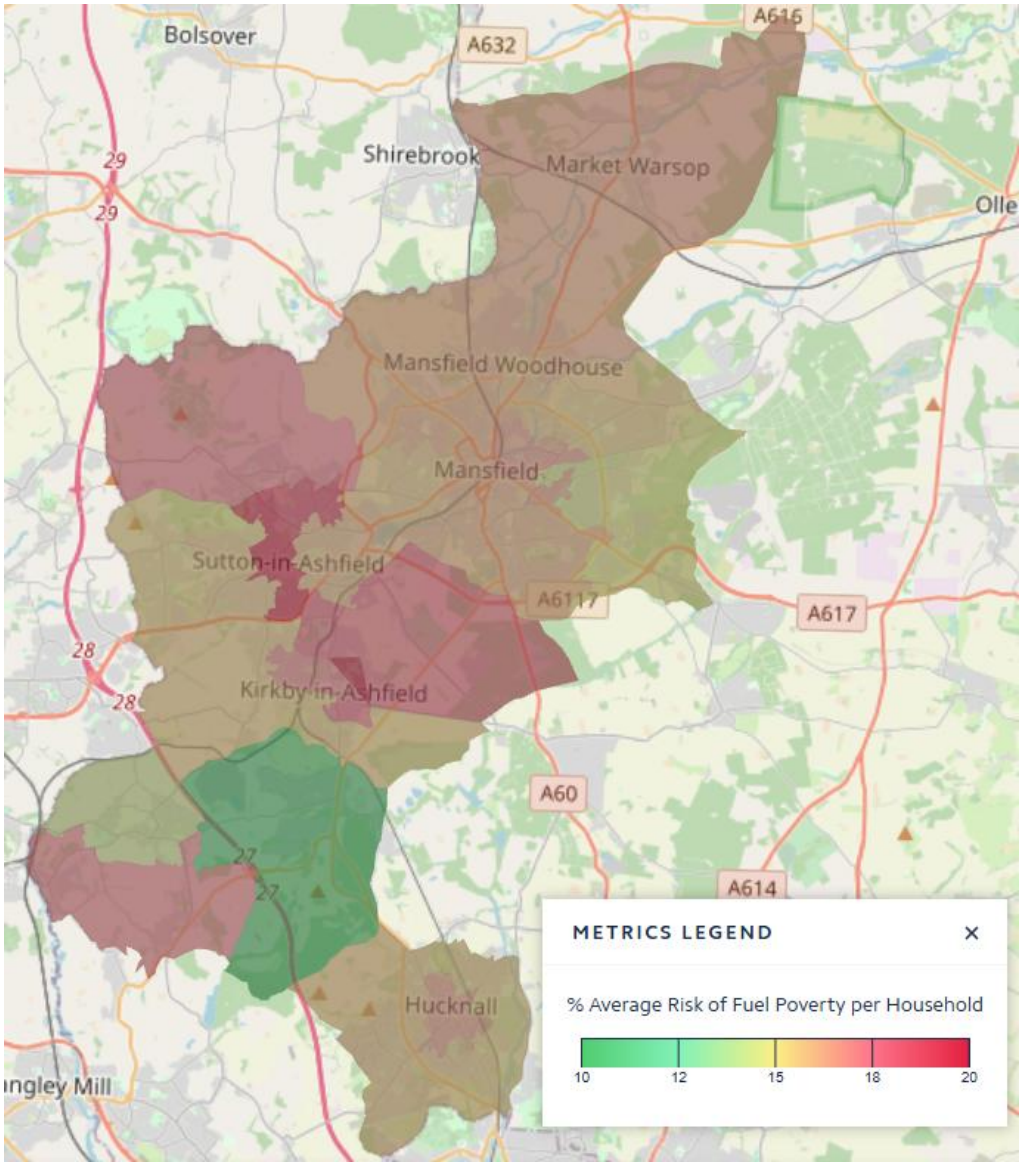
Figure 6.4 gives an overview of the areas in Ashfield and Mansfield which are at higher risk of fuel poverty occurring (based on the 2024 release of the UK Government's 2022 data). The orange and red areas on IES' digital twin map illustrates that fuel poverty is even more pronounced in Ashfield and Mansfield's densely populated inner city specifically in Sutton Central & Leamington and The Dales & South Skegby in Ashfield. Lower proportions of fuel poor households are identified by the yellow and green areas, which are evident in the south of Ashfield in Annesley & Kirkby Woodhouse, as well as Eakring & Ling Forest and Oak Tree & Ransom Wood in Mansfield.

[40] Sub-regional fuel poverty data 2024 (2022 data) - GOV.UK

[41] Fuel poverty methodology handbook 2025: Low Income Low Energy Efficiency (LILEE)

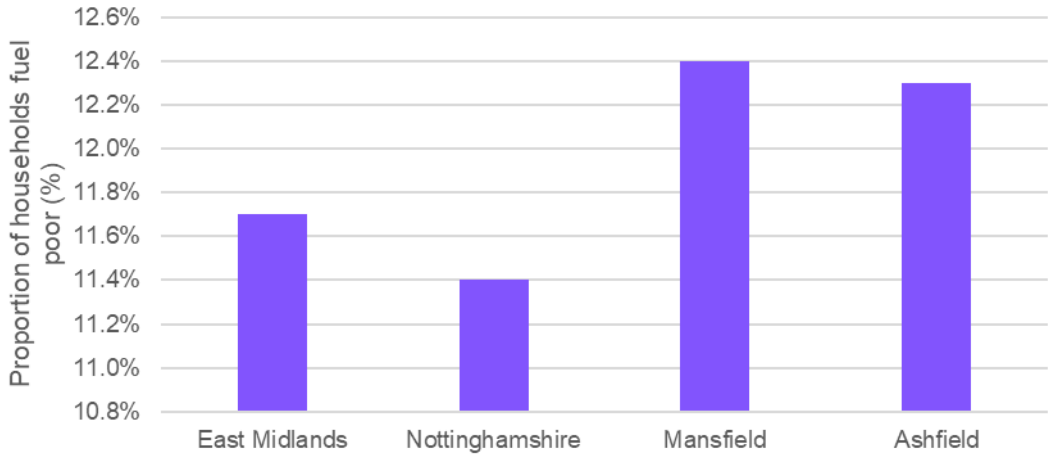
[42] 3997_EMCCA RETROFIT STRATEGY_1.pdf

Figure 6.4: Average Risk of Fuel Poverty per Household across Ashfield and Mansfield



The proportion of fuel-poor households in Ashfield and Mansfield is higher than both the East Midlands and Nottinghamshire averages, as illustrated in Figure 6.5. This measure of fuel poverty is based on the condition of the housing fabric, identifying homes that require more energy to maintain comfortable living conditions. Consequently, it can be inferred that the average energy efficiency of Ashfield and Mansfield's housing stock is below the regional standard, reinforcing the need for targeted retrofit interventions to improve overall energy performance. It should be noted that the y axis in Figure 6.5 does not start at 0%, to allow for clearer distinction between the fuel poverty rate comparisons.

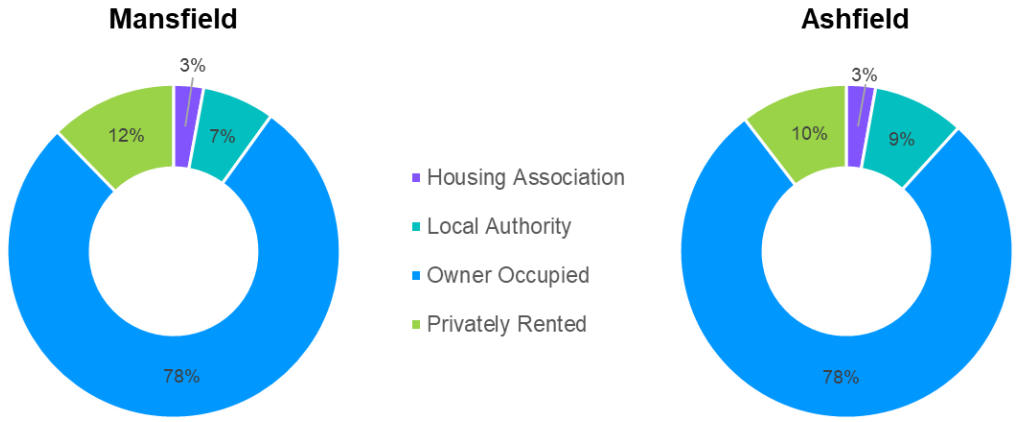
Figure 6.5: Proportion of Fuel Poor Households in Ashfield and Mansfield



Source: Sub-regional fuel poverty data 2024 (2022 data) - GOV.UK

Addressing this below-average efficiency requires an understanding not only of the housing fabric but also of who owns and manages these homes, since tenure strongly influences the feasibility of retrofit interventions. Figure 6.6 shows the tenure breakdown across both districts. Of the homes within Ashfield and Mansfield, 78% of homes are owner-occupied, 11% are privately rented, and 11% are social housing. Of the homes within Ashfield and Mansfield, most are owner occupied, indicating a strong level of control of occupiers over the implementation of building fabric changes.

Figure 6.6: Proportion of Tenure Types across Ashfield and Mansfield



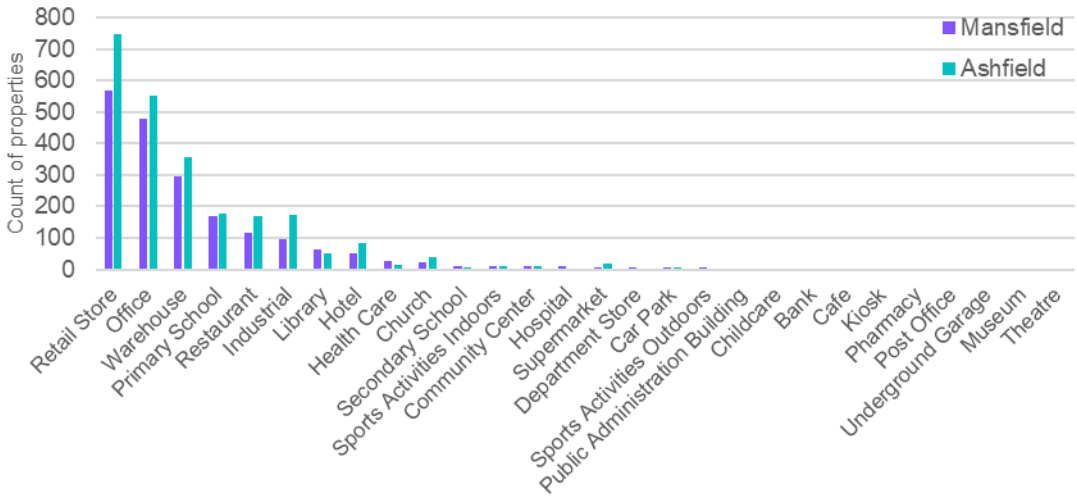
Across all tenure types, lighter retrofit measures will understandably be more affordable and have a shorter payback than deep retrofit. With typical payback periods of approximately 5-10 years, light retrofit is more likely to be affordable for homeowners especially those in the owner-occupied bracket. Deep retrofit does provide higher energy, and therefore carbon savings, compared to light retrofit measures. However, the cost and payback are much less favourable to the homeowner for deep retrofit. Currently, minimal incentives to upgrade fabrics exist for private landlords to raise the rating of their properties above an EPC E, however legislation may come into place which requires all privately rented properties to be EPC C. Social housing providers have the ability to buy fabric upgrade measures in bulk and can manage procurement more effectively for their own energy efficiency programmes, which are often part or fully funded

through public sector grant funding. For analysis on domestic retrofit modelling see section 6.3 and 6.4.

6.1.2 Non-Domestic and Commercial Building Stock

The non-domestic sector accounts for 4% of the buildings across Ashfield and Mansfield. These buildings span the public and commercial sectors and are utilised for a variety of primary uses, as listed in Figure 6.7. Detailed in this figure is the total number of non-domestic buildings split by primary use case varying from churches to retail stores. Currently, the non-domestic building stock is predominantly made up of commercial buildings, with office and retail buildings accounting for the majority.

Figure 6.7: Total non-domestic buildings, split by primary use



While the EPC values of non-domestic properties are evaluated to identify priority areas across the districts, a significant proportion of the non-domestic building stock in Ashfield and Mansfield lacks surveyed EPC data, meaning that the ratings of many properties are not captured. This data gap reflects broader issues with the methodology for undertaking and reporting non-domestic EPCs, where the current policy landscape has less strict drivers regarding the uptake of ongoing energy assessments. Currently, one of the only policies in place in this sector is all rented commercial properties in the UK must have a minimum EPC rating of E. To progress energy efficiency in non-domestic building stock requires further energy studies on non-domestic buildings to provide more available data to aid in identifying and implementing energy efficiency measures across the properties.

The total simulated thermal demand of the varying non-domestic buildings was also assessed, as shown in Figure 6.8, which gives a further indication of the key building archetypes in need of energy efficiency improvements. The office and primary school properties exhibit significantly higher thermal demand than the other building types, primarily due to the large volume of the properties across Ashfield and Mansfield, identifying these building types as a priority to retrofit. Ashfield also had significant demand from industrial buildings and warehouses.

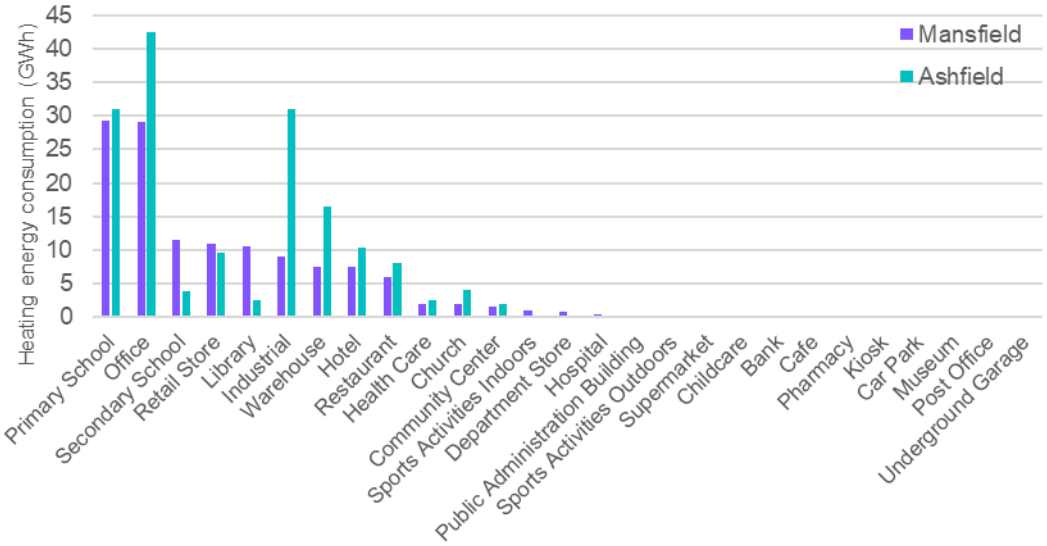
Office buildings tend to share similar characteristics, such as building envelopes, room layouts, and energy systems, presenting an opportunity for standardised retrofit approaches. Implementing retrofits at scale across these properties is likely to be more straightforward compared to other non-domestic building types, which tend to be more varied in design and

function. For these building types, more bespoke retrofit approaches may need to be undertaken, which could incur additional complexity and costs.[43]

It should be noted that the EPC dataset used in this assessment was limited and did not contain any information on specific fabric condition and construction types. Therefore, it's unclear whether the increased demand in these building types is driven by operational systems and activities specific to each use, or by poor thermal efficiency of the buildings themselves.

One challenge within the commercial buildings sector however is the commercial ownership and rental model, where large office or retail buildings are owned by large commercial asset owners and rented to those utilising the spaces. This means that the ability of the local business or organisation within the space to effect energy efficiency change within their environment is relatively minimal compared to the domestic sector. However, by the same principle, increased energy efficiency and fabric standards applied to commercial buildings could impact those large asset owners encouraging their engagement in retrofitting their assets prior to rental or sale.

Figure 6.8: Total Thermal Demand of Non-domestic properties in Ashfield and Mansfield Split by Building use



Within the scope of this LAEP, the opportunity to accurately represent the decarbonisation required within the non-domestic sector, depends on data availability. The fabric and energy efficiency measures most appropriate for each non-domestic building will depend heavily on the primary use of the building. Different uses like offices and industrial building will have significantly different building fabrics, equipment type and profiles, and occupancy patterns which will affect which measures are most suitable for each building.

Different primary uses also have varying funding mechanisms for how to implement improvements; public sector buildings are more likely to receive more UK Government grant funding than private office buildings, the former Public Sector Decarbonisation Scheme (PSDS) is a good example of this type of funding support. In the absence of available funding for commercials buildings it is important other incentives or regulations for private building be developed by the UK Government to support the implementation of energy efficiency and fabric upgrade measures.

During the LAEP development and through the stakeholder engagement with non-domestic stakeholders and estate managers, ongoing retrofit programmes amongst non-domestic

[43] Challenges and Opportunities in Commercial Retrofit | UKGBC

buildings, such as schools, colleges and the NHS, where highlighted. All programmes mentioned were following fabric first approaches despite funding limitations. To ensure continued operation of such buildings out of hours periods (e.g. end of term) were being used to implement such measures or complete upgrades.

6.2 Intervention Methodology

6.2.1 Energy Interventions

To meet the legally binding decarbonisation targets for the UK, significant levels of energy efficiency improvements need to be undertaken across the country. For Ashfield and Mansfield's diverse domestic and non-domestic sectors to reach the levels of uptake needed for net zero compliance the two chosen scenarios - a 2040 and 2050 net zero scenario, as well as a counterfactual "Do Nothing" scenario – have been modelled following two energy efficiency approaches.

The specific fabric upgrades that were modelled into Ashfield and Mansfield's LAEP were split into the following Retrofit categories shown in Table 6.1.

Table 6.1: Light and Deep Retrofit Definitions

Light Retrofit Criteria	Deep Retrofit Criteria
Cavity Wall Insulation: Applied to properties identified as having cavity walls that are currently uninsulated.	**Window Upgrades**: All single-glazed windows being proposed to be upgraded to double glazing.
Full Loft Insulation: Targeted to properties where the predicted loft insulation depth is between 0–50mm.	**Solid Wall Insulation**: Applied to properties with solid brick or stone walls that are currently uninsulated.
Loft Top-Up Insulation: Applied to homes with an existing insulation depth of 50–150mm, where it was assumed the loft would be 'topped up' with an additional 200mm of insulation.	**Floor Insulation**: Based on Home Analytics data, we targeted buildings with either suspended floors or those with an unheated space below, provided these floors were not already insulated.

There are just over 13,000 buildings requiring some degree of retrofit across these light and deep retrofit categories in order to meet MEES compliance as a minimum.

Due to limitations in the available data on fabric conditions and construction types of non-domestic properties, the modelled retrofit upgrades are limited to domestic buildings and do not include non-domestic stock.

6.2.2 Building Fabric – Do Nothing

This scenario takes into account the current pathway, based on currently mandated legislation at the time of completion of this LAEP. It assumes that all existing national legislation is implemented in relation to energy efficiency, which includes the following policies:

The UK Governments Minimum Energy Efficiency Standards (**MEES**) **regulations**[44], which applies to private-rented properties not owner-occupied, currently states that a property cannot be rented unless it has an EPC rating of E or higher. This is anticipated to increase to EPC C or higher by 2030.

The Future Homes and Buildings Standard (2025) is assumed to be implemented and will mandate that all new builds are constructed as 'net zero ready', future proofed for low carbon heating and with 'world leading' levels of energy efficiency. This bill aims to have all new builds at an EPC rating of C or higher, however 85% of new build properties in England are already achieving a minimum EPC rating of B. We therefore assume that all houses constructed after 2025 will be to an EPC B or higher, and will not require fabric retrofit intervention.

The UK Government is encouraging the improvement of housing stock via these policies and incentives, the impact of which have been incorporated into our modelling of the "Do Nothing" scenario.

6.3 Light Retrofit

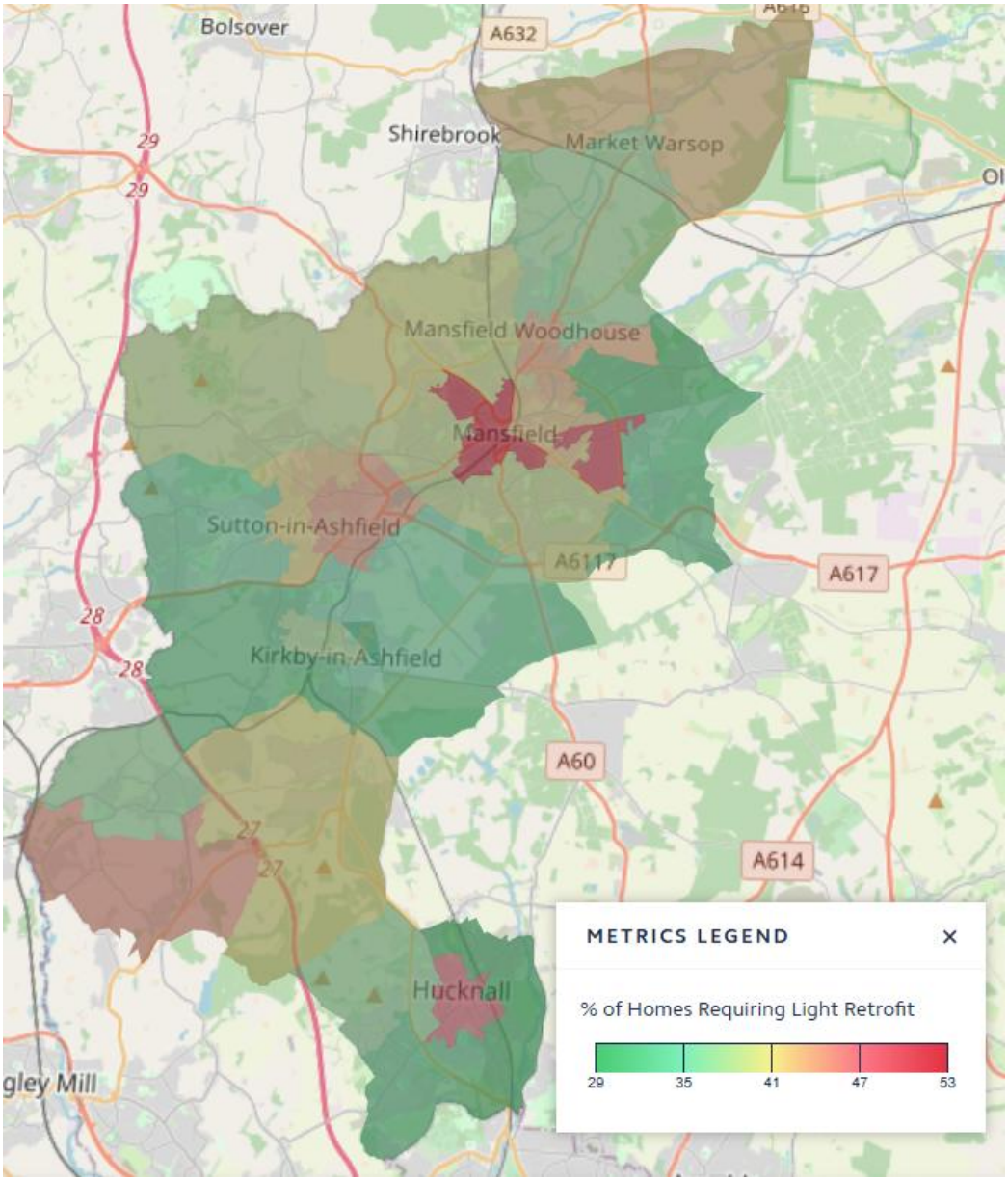
The light retrofit option represents the cheaper retrofit option, focusing on less intrusive insulation improvements. This option is targeted for homes requiring less expensive and disruptive thermal efficiency improvements.

Light retrofit measures such as cavity wall insulation and loft insulation are lower cost than internal and external solid wall insulation and have been identified to have a significantly reduced payback compared with deep retrofit approaches. To find which homes require light retrofits, the existing fabric levels were analysed to find where improvements are needed. The extent of the improvements required was compared against the criteria for light and deep retrofit, described in Table 6.1. With this analysis across the districts, it was then possible to quantify the extent of light retrofit needed across Ashfield and Mansfield.

Figure 6.9 identifies the intensity of light retrofit installations required across Ashfield and Mansfield, showcasing Mansfield Town Centre & Broomhill and King's Walk, Berry Hill & Oakham in Mansfield and Hucknall in Ashfield have the highest concentration for light retrofit installations. The concentrations across the rest of the figure vary by location, highlighting the need for widespread uptake across the districts.

[44] Improving the energy performance of privately rented homes: 2025 update

Figure 6.9: Number of homes requiring light retrofit, by MSOA



The 2040 and 2050 scenario uptake growth rates are informed by mandated national and regional policies, including the UK Government's Warm Homes Plan, which seeks to front-load retrofit measures with a particular emphasis on social housing, representing 11% of Ashfield and Mansfield's total housing stock.[45] Uptake rates are also aligned with the CCC's Seventh Carbon Budget net zero pathway, which prioritises the rapid deployment of energy efficiency measures ahead of low-carbon heating installations.[46] The uptake rates for the 2050 and 2040 Net Zero scenarios are set out in Figure 6.11.

Additionally, the uptake profile assumes a slower rate of delivery between 2025 and 2030, reflecting current workforce and supply chain capacity. From 2030 onwards, however, retrofit

[45] Warm Homes: Local Grant policy guidance

[46] The Seventh Carbon Budget - Climate Change Committee

demand is expected to drive significant growth in both workforce skills and supply chain capability, enabling a sharper acceleration in uptake.

Figure 6.10: Annual light retrofit installations for 2040 and 2050 scenarios

Year	2050		2040	
	Annual uptake	Cumulative uptake	Annual uptake	Cumulative uptake
2025	**0.0%**	**0%**	0.0%	0%
2026	5.0%	5%	6.0%	6%
2027	5.0%	10%	6.0%	12%
2028	6.0%	16%	8.0%	20%
2029	6.0%	22%	8.0%	28%
2030	**8.0%**	**30%**	**12.0%**	**40%**
2031	8.0%	38%	12.0%	52%
2032	7.0%	45%	12.0%	64%
2033	6.0%	51%	10.0%	74%
2034	6.0%	57%	10.0%	84%
2035	**6.0%**	**63%**	**9.2%**	**93%**
2036	6.0%	69%	4.2%	97%
2037	6.0%	75%	2.0%	99%
2038	5.0%	80%	0.4%	100%
2039	5.0%	85%	0.2%	100%
2040	**5.0%**	**90%**	**0.0%**	**100%**
2041	2.7%	93%		
2042	2.6%	95%		
2043	1.5%	97%		
2044	1.1%	98%		
2045	**0.9%**	**99%**		
2046	0.5%	99%		
2047	0.4%	100%		
2048	0.2%	100%		
2049	0.1%	100%		
2050	**0.0%**	**100%**		

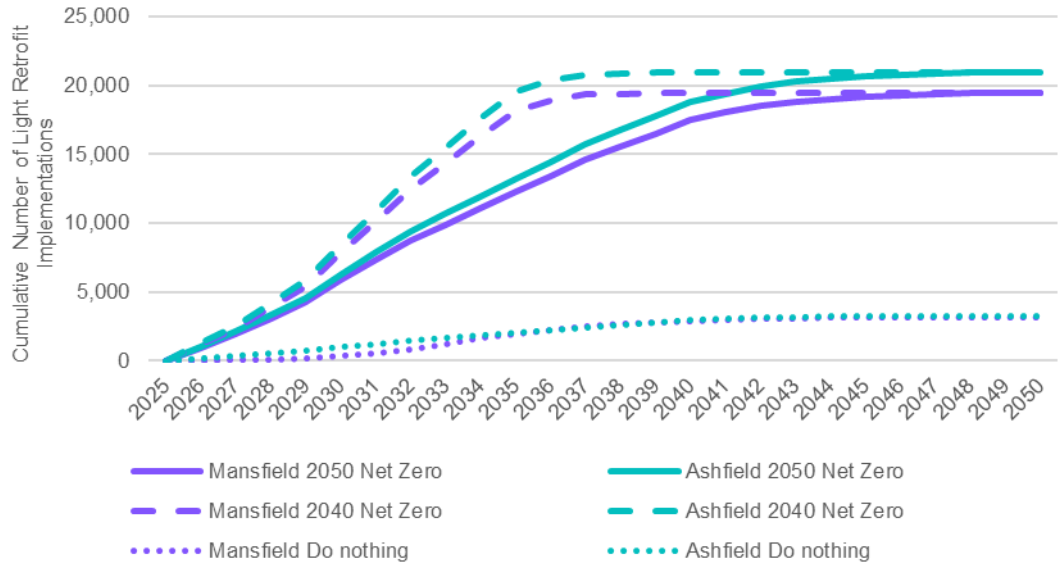
When implementing these retrofits, it is important to consider initially prioritising retrofits to vulnerable individuals, as the opportunity to complete light retrofit could result in long-term benefits such as warmer homes and reduced energy bills for residents, resulting in reduction in fuel poverty rates across both districts.

Figure 6.11, underlines the estimated year on year uptake for required light retrofit measures for the 2040 and 2050 scenarios.

In both the 2040 and 2050 scenarios, a total of 40,355 homes are required to have light retrofit upgrades, representing 39% of the total housing.

However, to meet the pathway targets of the local area in each scenario, light retrofit upgrades alone may not always be sufficient. While heat pumps can be oversized for less thermally efficient properties, this can lead to reduced efficiency and higher running costs over the system's lifetime. Therefore, for some properties, further thermal efficiency improvements are recommended to optimise performance, reduce operational costs, and achieve long-term carbon savings.

Figure 6.11: Annual uptake of light retrofit required per scenario



6.4 Deep Retrofit

The deep retrofit option represents the more expensive approach, requiring more intrusive insulation improvements. It is intended for homes that need significant enhancements in thermal efficiency. As described in Table 6.1, the deep retrofit encompasses fabric upgrades for solid wall insulation, glazing upgrades and floor insulation. These retrofit measures are tailored to older housing stock, which often feature building envelopes that benefit most from these fabric upgrades, such as solid stone walls, single glazing and suspended floors.

Similarly to the light retrofit, the home analytics dataset within the digital twin of Ashfield and Mansfield was used to identify where deep retrofit measures would be suitable for each property, based on building fabric and construction type. The aim of this approach was to ensure that every property achieved adequate insulation levels, with a dual purpose of reducing the risk of fuel poverty and enabling the efficient installation and operation of a low-carbon heat source. This is discussed further in section 7.

Figure 6.12 emphasises where in Ashfield and Mansfield is most in need of deep retrofit. Again, these areas are concentrated around the urban zones of Ashfield and Mansfield, including Hucknall in Ashfield and Mansfield Town Centre & Broomhill, showing the highest concentration of homes suitable for deep retrofit measures.

Figure 6.12: Homes Requiring Deep Retrofit by MSOA

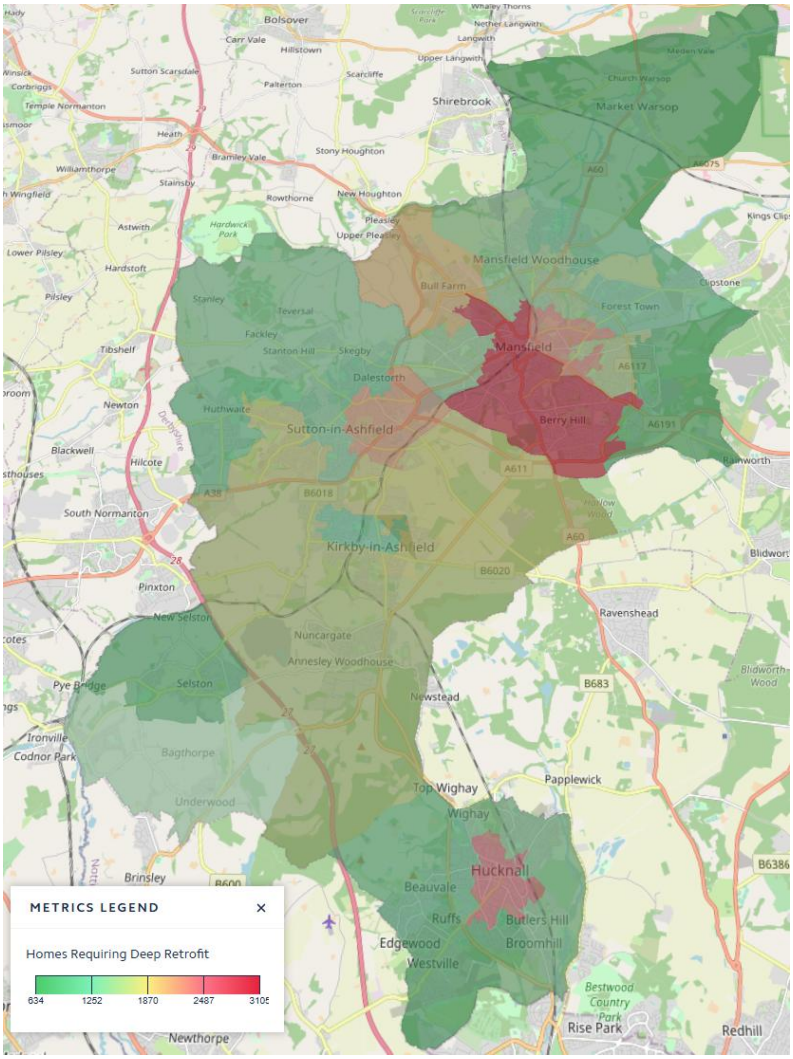


Figure 6.13: Annual deep retrofit installations for 2040 and 2050 scenarios

Year	2050		2040	
	Annual uptake	Cumulative uptake	Annual uptake	Cumulative uptake
2025	**0.0%**	**0%**	0.0%	0%
2026	5.0%	5%	6.0%	6%
2027	5.0%	10%	6.0%	12%
2028	6.0%	16%	8.0%	20%
2029	6.0%	22%	8.0%	28%
2030	**8.0%**	**30%**	**12.0%**	**40%**
2031	8.0%	38%	12.0%	52%
2032	7.0%	45%	12.0%	64%
2033	6.0%	51%	10.0%	74%
2034	6.0%	57%	10.0%	84%
2035	**6.0%**	**63%**	**9.2%**	**93%**
2036	6.0%	69%	4.2%	97%
2037	6.0%	75%	2.0%	99%
2038	5.0%	80%	0.4%	100%
2039	5.0%	85%	0.2%	100%
2040	**5.0%**	**90%**	**0.0%**	**100%**
2041	2.7%	93%		
2042	2.6%	95%		
2043	1.5%	97%		
2044	1.1%	98%		
2045	**0.9%**	**99%**		
2046	0.5%	99%		
2047	0.4%	100%		
2048	0.2%	100%		
2049	0.1%	100%		
2050	**0.0%**	**100%**		

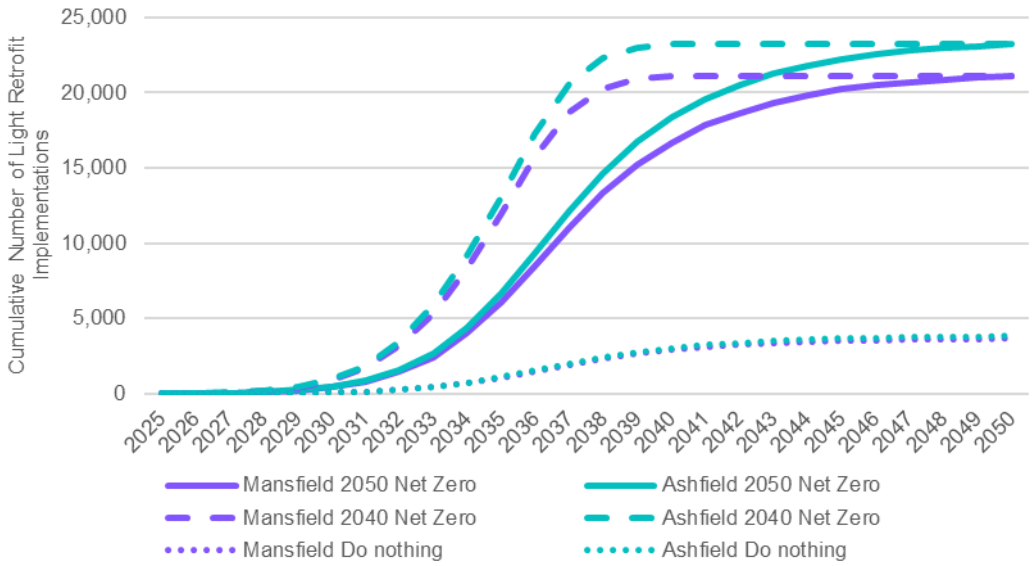
Mansfield Town Centre & Broomhill and Hucknall both have a large concentration of building stock built pre-1930, where these properties are typically constructed from solid masonry and are therefore challenging to insulate.

It is vital to target these older building types as they are most at risk of poor thermal comfort and associated health risks such as damp and mould growth, often driven by excess moisture and inadequate ventilation. Deep retrofit fabric measures supplemented by suitable energy efficient ventilation in these properties, can provide additional benefits by reducing risks of condensation, damp, and mould through improved insulation, airtightness, controlled ventilation, while maintaining thermal comfort.

Figure 6.13 and Figure 6.14, underline the required annual uptake retrofit uptake rate for the 2050, 2040 and Do Nothing scenarios. The Do Nothing represents the expected retrofit of private rented properties as part of MEES regulations. Similar to light retrofits, the 2040 and 2050 scenario uptake growth rates were informed by mandated national and regional policies alongside considering the growth of the supply chain to limit the uptake to realistic levels. However, the uptake rates have been delayed compared to light retrofit, to account for the increased scope and costs associated with deep retrofit upgrades, and assuming that the majority of installations would be in homes which are late adopters of heat pumps, and require significant fabric upgrades before installation.

In both the 2040 and 2050 scenarios, a total of 44,354 homes are required to have deep retrofit upgrades, representing 43% of the total housing. It should be noted that this represents the maximum possible amounts of deep retrofit that could be implemented in Ashfield and Mansfield, in practise many homeowners and landlords will choose to forego these works due to high costs and disruption.

Figure 6.14: Annual Uptake Projection of Deep Retrofit



6.5 Impacts

Displayed in Figure 6.15 and Figure 6.16, is the total number of retrofit installations required across Ashfield and Mansfield, specifying the number of properties requiring either light, deep or no retrofit. Additionally, there is a separate category for the housing stock requiring both light and deep retrofits. Analysis from the home analytics data, indicated that a certain proportion of housing will require a combination of light and deep retrofits to reach sufficient energy efficiency levels.

Figure 6.15: Mansfield Number of Buildings requiring fabric retrofit, per MSOA

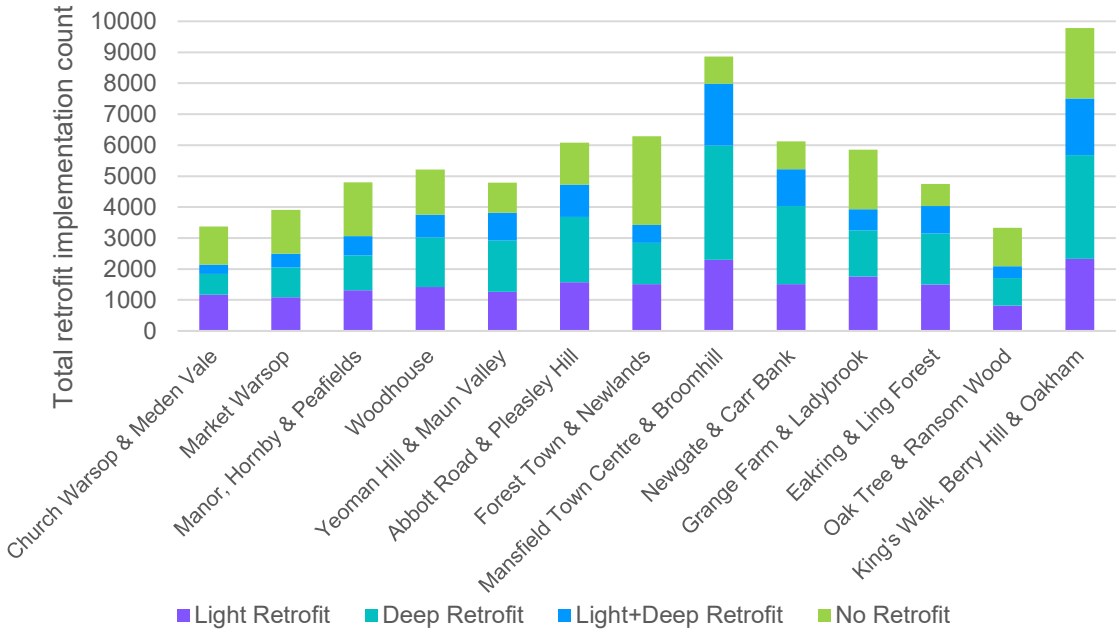
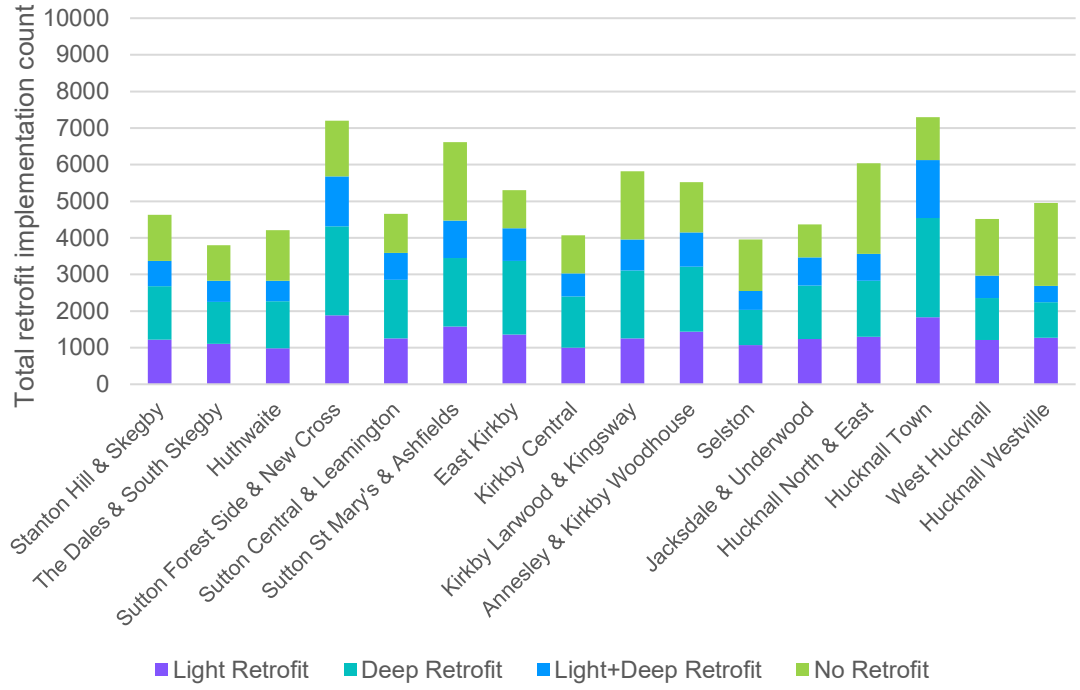


Figure 6.16: Ashfield Number of Buildings requiring fabric retrofit, per MSOA



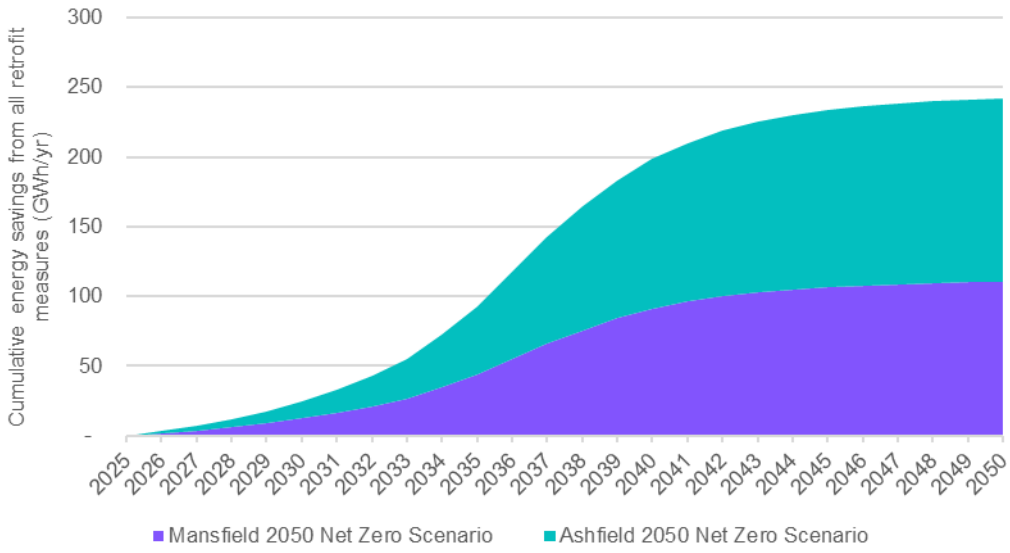
Retrofit installations are expected to be widespread across both districts, necessitating installations across all tenure types. This will require coordinated engagement from both the public and private sectors, including the development of incentives and potential funding mechanisms to support the transition. As the capital expenditure will be the main hurdle for the implementation of retrofits, these funding mechanisms would aid in ensuring the retrofit upgrades are accessible to all properties.

Households with lower income levels will be the least likely to undertake and pay for the high cost of deep retrofit measures, so appropriate support must be given in such circumstances to ensure a just transition towards net zero by 2040 or 2050. Retrofit programmes must be designed with support mechanisms for landlords and incentives for low-income households.

Additional targeting may be required in areas of high fuel poverty that have a large proportion of privately rented homes. Owner-occupied homes may have greater autonomy to invest in upgrades, while rented properties particularly in the private sector, face challenges due to split incentives and regulatory constraints. Refer to Section 12 - Economic Appraisal for further analysis and in depth technoeconomic discussion on costs of each intervention across each net zero scenario.

The successful implementation of these retrofits will introduce significant energy savings across both districts while satisfying thermal comfort levels within each property. Figure 6.17 displays the projected annual thermal energy savings from domestic retrofits, driven by the reduced heat demand resulting from fabric upgrades. This identifies the significant increase in energy efficiency of homes, resulting from light and deep retrofits.

Figure 6.17: Annual Projected Combined Energy Savings of Deep and Light Retrofit



The energy savings will provide vast benefits both to residents and Ashfield and Mansfield local authorities, providing cost and carbon savings leading to a host of other benefits. These include alleviating fuel poverty, as households that were previously thermally inefficient would be able to heat their homes more affordably.

Additionally, these benefits will be extended as and when low-carbon heating technologies are deployed. As, the retrofit measures will act as a foundational step allowing the low carbon technologies to efficiently operate, allowing for further savings. This will not only lead to immediate energy savings and lower utility bills for residents but also contributes to the reduction of carbon emissions associated with gas use. In addition, the resulting decrease in thermal demand will help mitigate the anticipated strain on the local grid as both districts transition to electrified heating systems in the future. For more information on the impacts of the installation of low carbon heating systems, please refer to section 7.

7 Low Carbon Heating

This section examines how low-carbon space heating technologies can be deployed to help Ashfield and Mansfield achieve net zero carbon emissions. At present, most domestic and non-domestic buildings in the districts rely on fossil fuels for space heating and hot water, creating a significant decarbonisation challenge. To address this, the majority of buildings will need to transition to low-carbon heating solutions, primarily those powered by electricity, such as heat pumps, supported by complementary technologies where appropriate.

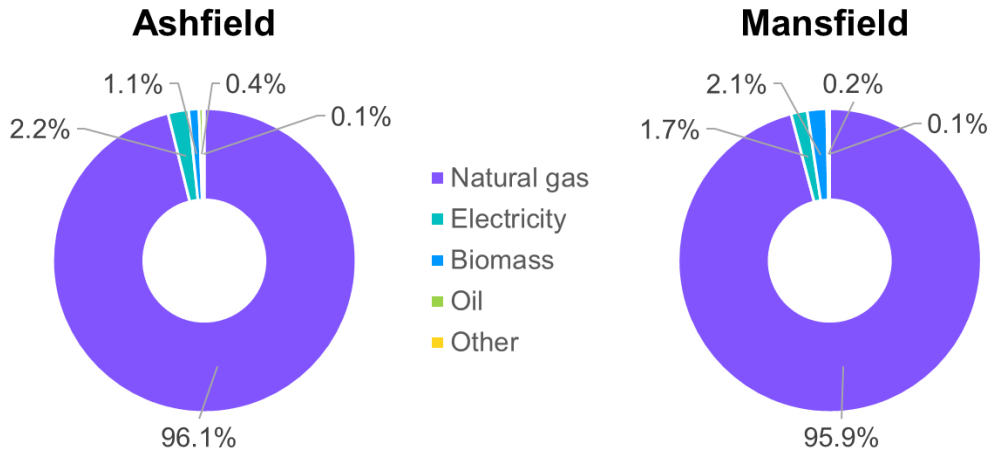


7.1 Domestic Sector

7.1.1 Existing System

Achieving net zero in Ashfield and Mansfield will require a significant uptake of low-carbon heating technologies across the domestic sector to decarbonise emissions associated with space heating. At present, natural gas is the dominant fuel type used in both districts as shown in Figure 7.1.

Figure 7.1: Ashfield and Mansfield Domestic Heating split by Fuel Type (%)



Natural gas remains the dominant heating source in both districts, supplying space and water heating to approximately 96% of homes in both Ashfield and Mansfield, primarily through gas-fired boilers. This high dependency reflects extensive gas network coverage and the prevalence of older housing stock connected to mains gas.

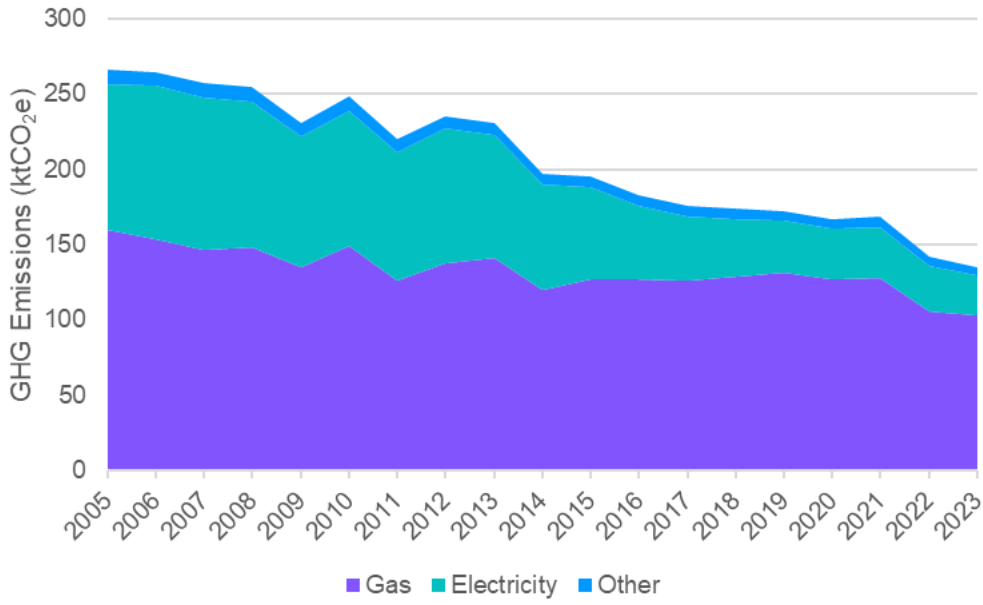
Electric heating uptake remains low in both districts, reflecting limited penetration of heat pumps and resistive electric systems. This is likely due to the dominance of older housing stock and fewer new-build properties where heat pumps are increasingly specified. There is limited use of other fossil fuels for space heating in both districts, with Ashfield having 0.4% of homes using oil, and Mansfield 0.2%. The predominant fuel type in the “other” category is LPG, of which both districts have 0.1%.

Ashfield and Mansfield have engaged with retrofit programmes such as the Home Upgrade Grant Phase 2 (HUG2), which delivered loft and wall insulation, solar PV, and over 50 air-source heat pumps. Previous schemes like the Sustainable Warmth Competition and ongoing ECO-funded upgrades have supported low-income households, but uptake has been relatively modest.

Ashfield exhibits a slightly higher share of biomass heating (2%) compared to Mansfield (1%), which is consistent with its slightly more rural geography and dispersed settlements, where accessibility to natural gas is reduced. Most of these households likely previously had LPG or oil boilers, where the replacement of these with a biomass counterpart provides a lower-carbon alternative.

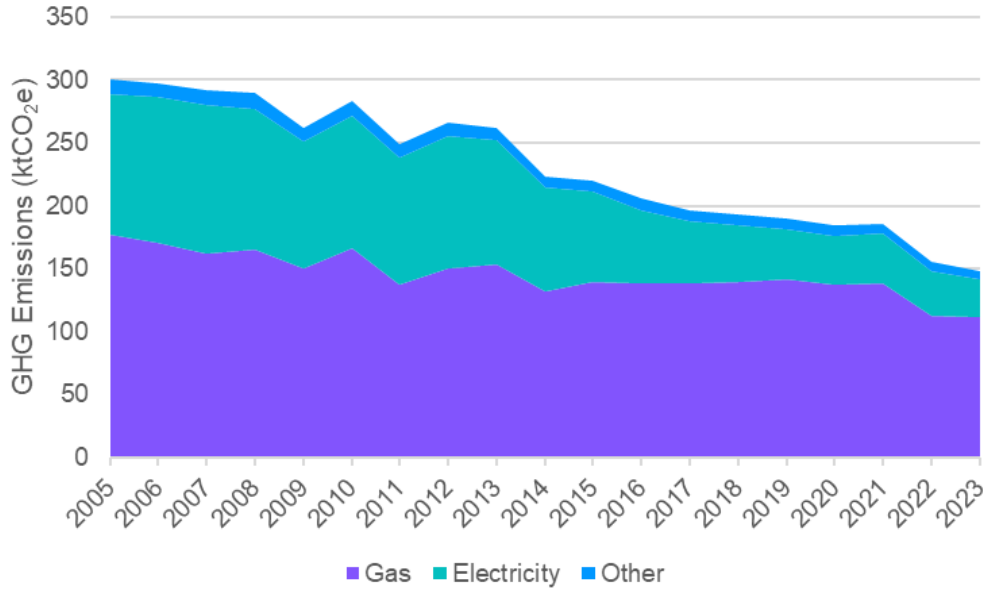
Overall, both districts share a common baseline of high gas dependency and limited early adoption of low-carbon heating technologies. Coordinated initiatives such as heat pump incentives, fabric retrofit schemes, and local network upgrades, will be critical to accelerate the transition across both councils.

Figure 7.2: Historical Domestic Carbon Emissions in Mansfield ($ktCO_2e$)



Source: UK local authority and regional greenhouse gas emissions statistics - GOV.UK

Figure 7.3: Historical Domestic Carbon Emissions in Ashfield ($ktCO_2e$)



Source: UK local authority and regional greenhouse gas emissions statistics - GOV.UK

Figure 7.2 and Figure 7.3 present the historical carbon emissions associated with domestic fuel use across Ashfield and Mansfield. In Mansfield, domestic buildings using natural gas contribute 103 $ktCO_2e$ of emissions, followed by 27 $ktCO_2e$ from electricity-based heating systems and 5 $ktCO_2e$ from the remaining sources. In Ashfield, the contributions from natural gas and electricity heating systems are 111 ktCO2e, 31 $ktCO_2e$ and 6 $ktCO_2e$ respectively. There have been significant emissions reductions across all fuel types since 2005, predominantly from electricity use. This is in large part due to the decarbonisation of the grid as well as efficiency measures. Local retrofit programmes such as the Home Upgrade Grant (HUG) and Sustainable Warmth schemes have supported these reductions, particularly in hard-to-heat homes.

National retrofit schemes such as HUG2 and ECO4 have targeted off-gas homes with insulation and heat pump installations. However, the complexity of retrofitting mean that progress has been incremental rather than transformative. These initiatives have achieved greater impact in semi-urban areas and social housing, where improvements to building fabric and early adoption of low-carbon heating technologies have been more readily accelerated.

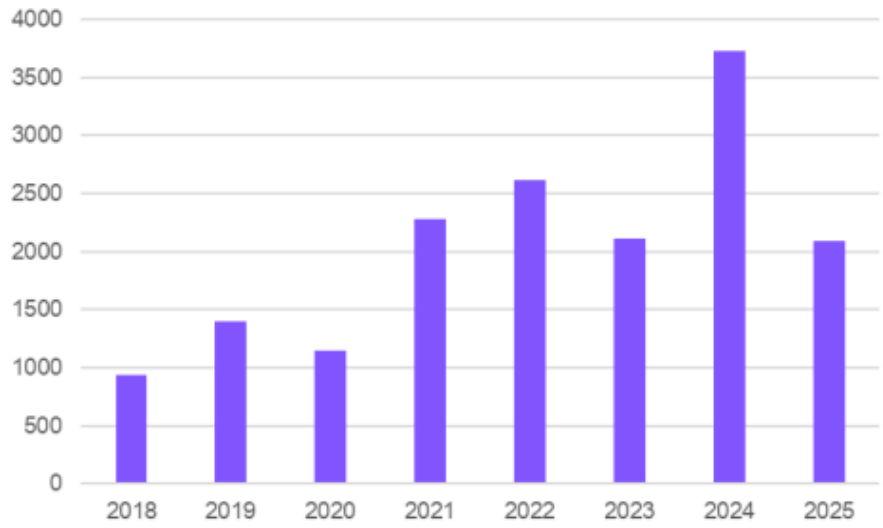
Despite these gains, the challenge of transitioning to low-carbon heating and improving building fabric performance at scale remains. Coordinated interventions (e.g. heat pump incentives, fabric retrofit schemes, and local network upgrades) will be critical to achieving net zero targets.

7.1.2 Low-carbon Heating System Installations

It has been assumed for the LAEP that air source heat pumps will be the primary alternative to natural gas fuelled heating systems in order to meet its net zero goals. Historic heat pump uptake in the East Midlands is illustrated in Figure 7.4. There is a steadily growing uptake of heat pumps since 2018 in the East Midlands with 3,726 installations recorded in 2024. While this upward trend is encouraging, heat pumps still represent a small fraction of space heating compared to the total housing stock.

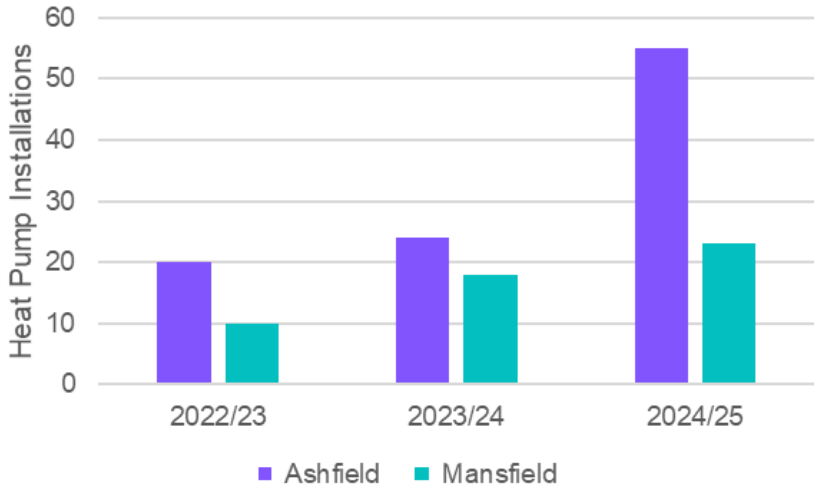
Government data also tracks heat pump installations at the local authority level through the Boiler Upgrade Scheme. Figure 7.5 shows that both Local Authorities follows the regional trend, with an increasing trend in installation numbers.

Figure 7.4: East Midlands historical heat pump uptake



Source: Heat pump deployment statistics: June 2025 - GOV.UK

Figure 7.5: Boiler Upgrade Scheme Heat Pump Installations in Ashfield and Mansfield



Source: Boiler Upgrade Scheme statistics: August 2025 - GOV.UK

In the 2024/25 financial year, the two districts recorded a combined total of 78 heat pump installations under the scheme. With more than 96,000 homes across both districts using natural gas and an average boiler lifespan of 15 years, approximately 6,400 gas boilers are replaced annually. However, around only 1% of these replacements currently switch to heat pumps, largely due to high upfront installation costs, technical complexity, and the need for

additional insulation upgrades, measures that are often expensive and disruptive, as discussed in Section 6.

To decarbonise domestic heating in Ashfield and Mansfield, this percentage must rise sharply. Even if boiler replacements are banned in the 2030s, proactive measures are needed now to accelerate uptake in the short term, particularly if net zero is to be achieved before the national 2050 target.

7.1.3 Do Nothing

The Do Nothing scenario assumes minimal policy intervention for heat decarbonisation. The only measure considered is the ban on fossil fuel heating systems in new-build properties from 2030[47], with no additional policies targeting the removal of fossil fuel systems from existing buildings.

While there is noticeable growth in heat pumps, most of these installations are assumed to be from the fossil fuel boiler ban in new builds, with only a small percentage occurring from existing gas boilers changing systems. Heat pump uptake is expected to be very low due to the lack of policy incentives and grant funding available. However, after 2035, gas boiler to heat pump conversions are expected to pick up slightly as per the planned phase-out of fossil fuel boilers.

7.1.4 Intervention Methodology

The analysis considers the feasible installation of heat pumps in all building types currently using any fuel source other than electricity or biomass. A digital twin model was applied to simulate changes in energy use and carbon emissions resulting from the replacement of fossil fuel boiler systems with heat pumps. The additional peak electrical demand and annual electricity consumption associated with heat pump operation were incorporated into the projections for carbon reduction and grid impact. Consequently, each building's total electricity consumption after heat electrification equals its existing electricity use plus the demand from the air-source heat pump. For buildings already heated by electricity, it is assumed that their systems will remain unchanged.

7.1.5 Scenarios Overview

The two net zero-compliant scenarios developed for this LAEP assume a full electrification of space heating, with no hybrid heat pump installations. This scenario assumes a relatively consistent, steady uptake of heat pumps, which accelerates slightly in the mid-2030s in all three scenarios. The annual uptake rates for the 2040 and 2050 Net Zero scenario are set out in Figure 7.6 and Figure 7.7.

[47] Note that the new Future Homes Standard, summarised in Section 2.1.9 now legislates for no fossil fuel heating in new builds from 2025, at the time of the DFES publication this date was still set to be 2030

Figure 7.6: Annual domestic ASHP installations in 2040 and 2050 scenarios

Year	2050		2040	
	Annual uptake	Cumulative uptake	Annual uptake	Cumulative uptake
2025	**0.0%**	**0%**	0.0%	0%
2026	0.2%	0%	0.7%	1%
2027	0.3%	1%	1.1%	2%
2028	0.5%	1%	1.6%	3%
2029	0.6%	2%	2.5%	6%
2030	**0.9%**	**3%**	**3.6%**	**9%**
2031	1.2%	4%	5.2%	15%
2032	1.7%	5%	7.2%	22%
2033	2.3%	8%	9.3%	31%
2034	3.1%	11%	11.2%	42%
2035	**4.0%**	**15%**	12.4%	**55%**
2036	5.2%	20%	12.5%	67%
2037	6.4%	26%	11.1%	78%
2038	7.5%	34%	9.3%	88%
2039	8.5%	42%	7.2%	95%
2040	**9.0%**	**51%**	**5.2%**	**100%**
2041	9.0%	60%		
2042	8.5%	69%		
2043	7.5%	76%		
2044	6.4%	83%		
2045	**5.0%**	**88%**		
2046	4.2%	92%		
2047	3.1%	95%		
2048	2.3%	97%		
2049	1.7%	99%		
2050	**1.2%**	**100%**		

Uptake is projected to grow steadily, accelerating in the mid-2030s as policy measures take effect. Figure 7.7 reflects this trend, showing increased installations driven by the Boiler Upgrade Scheme and its £7,500 grants, alongside regulatory changes such as the removal of the one-metre boundary rule for air-source heat pumps. These measures, combined with the planned phase-out of new fossil fuel boiler installations by 2035, are expected to significantly boost adoption rates

All new-build properties are assumed to comply with the Future Homes Standard, incorporating low-carbon heating systems from the outset. The main challenge lies with existing housing stock, where space constraints and the need for fabric upgrades, particularly in older homes, pose significant barriers. Heat pumps operate less efficiently in poorly insulated buildings, leading to higher running costs and difficulty maintaining thermal comfort in colder conditions. Early investment in fabric retrofit measures is therefore essential to achieve the necessary performance and cost-effectiveness.

Overall, 97,655 installations are modelled across both districts by the net zero target year. This is expected to offset a total of around 700 GWh of natural gas consumption across both local authorities, as shown in Figure 7.8.

Figure 7.7: Mansfield and Ashfield Domestic Heat Pump Uptake Projections for 2040 and 2050

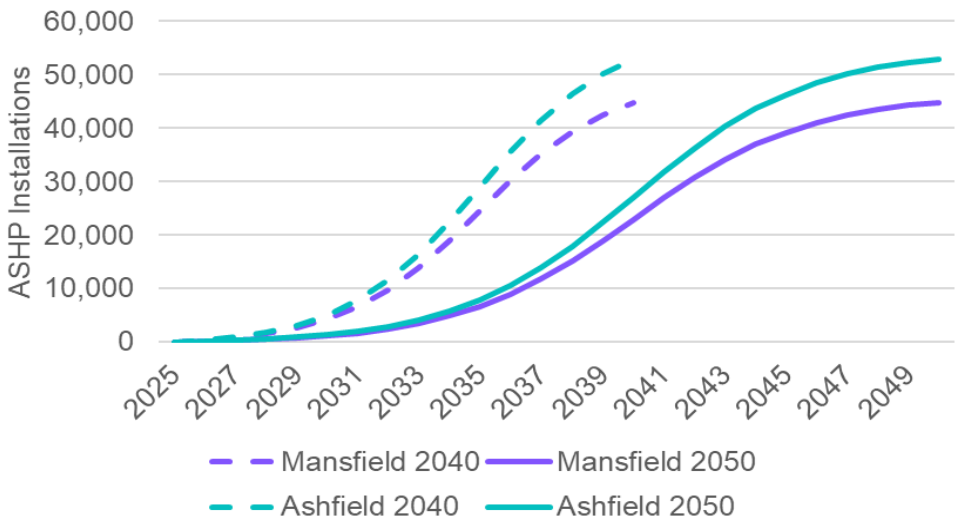
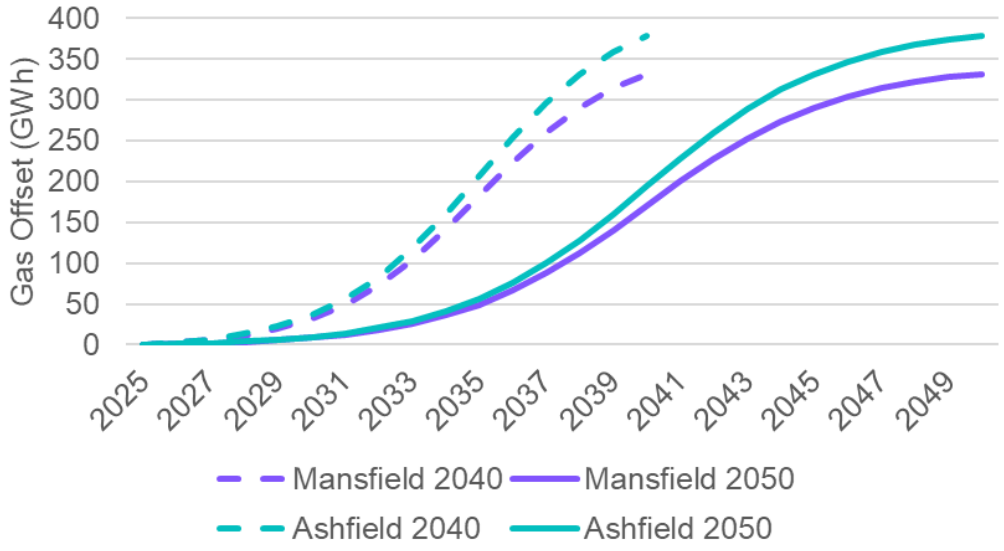


Figure 7.8: Mansfield and Ashfield Projected Gas Savings from Domestic Heat Pump Uptake (2040 and 2050)



The projections show a consistent pattern across both councils; an initial period of gradual gas displacement followed by a rapid expansion as heat pumps become more prevalent and supporting market conditions strengthen. Although absolute savings differ slightly between councils (reflecting likely variations in housing stock composition, grid readiness, and retrofit uptake) the overall trend is uniform, with heat pump adoption being a key driver of declining natural gas use in the domestic sector.

Collectively, these results highlight the significant contribution that low-carbon heating technologies can make toward local and regional decarbonisation objectives, reinforcing the importance of sustained investment in retrofit support, installer capacity, and grid infrastructure to enable continued growth in heat pump deployment.

7.1.6 Modelled Interventions

The technologies considered for heating decarbonisation are set out in Table 7.1. Of these, air source heat pumps (ASHPs) are the most viable and economical option going forward due to grid decarbonisation and their high efficiencies, providing heat for the building while meeting the net zero targets.

In comparison, GSHPs offer slightly higher efficiencies than ASHPs but come with higher upfront costs and require sufficient outdoor space for ground loops. Direct electric heating, though simple to install, is far less efficient and results in higher running costs and electricity demand. Finally, district heat networks can provide low-carbon heat in dense urban areas or large developments but are generally less cost-effective or practical for dispersed and rural housing.

ASHPs are electrically powered and use refrigerant to extract low grade heat from the air, which is then upgraded using compression. The resulting heat is then transferred to a wet central heating system through a plate heat exchange. The efficiency of a heat pump is known as Coefficient of Performance (COP) and measures the heat output in kWh of heat produced per kWh of electricity used (i.e., a system that produces 3kWh of heat per kWh of electricity has a CoP of 3). In our modelling, anticipated demand for ASHPs was represented by the building's new electrical consumption for space heating and DHW, with an assumed COP of 2.7.

Table 7.1: Modelled Interventions

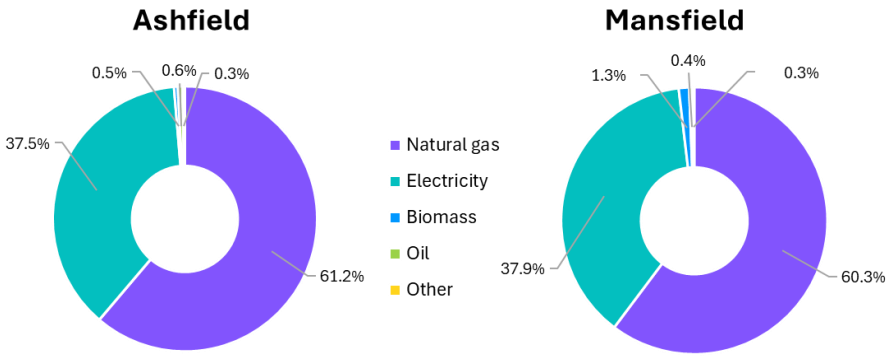
Technology	Description
Fossil Fuel Boiler	Heating technology that combusts fossil fuels to heat water for space heating and DHW demands. Most of these installations currently in the County use natural gas as the fuel source, although there are some using LPG and Oil in the off-gas grid postcodes. This is the most common heating system for domestic buildings in Mansfield and Ashfield.
Direct Electric	This category of heating technologies includes electric boiler, electric storage heaters, electric heat batteries and other direct electric technologies. They are typically cheaper to install than heat pumps, but more costly to run due to their lower efficiency. Any home currently with this technology is assumed to keep it in all scenarios. Some homeowners and landlords may opt to install one of these technologies instead of a heat pump.
Air Source Heat Pump (ASHP)	Electrical heating system that takes heat from the ambient air outside and delivers it internally, consuming electricity. This technology typically has significantly higher efficiencies compared to direct electric or fossil fuel boilers, with COPs of between 2.5 and 3.0 (compared to gas boilers efficiencies of between 0.7 and 0.95 depending on age). All heat pump uptake is assumed to be air source, unless otherwise specified.
Ground Source Heat Pump	Similar to an air source heat pump, but extracts heat from the ground via boreholes or pipes. Will typically have a higher efficiency compared to an ASHP, but usually require a garden and are costly and disruptive to install. These will likely represent an alternative to an ASHP for homes and buildings with available external space, that can front the additional capital required.
District Heat Network Connection	Some buildings in Mansfield and Ashfield may be able to decarbonise their energy usage by connecting to a district heating network; however, these are location specific and only in a feasibility stage for the area. District heat networks supply heat to buildings via hot water in underground pipes, from a centralised plant. See Section 7.3 for more details.
Hydrogen Boilers	Similar to a fossil fuel boiler but provides heat through burning hydrogen. If this hydrogen is considered ‘green’ (created via renewables) or ‘blue’ (created via carbon capture and storage of fossil fuel combustion) then it can be considered low carbon. This heating technology has not been considered for the regional LAEP, due to hydrogen for space heating not being considered viable as part of this programme, however it should be noted that some industrial process loads could having hydrogen as a possible alternative fuel source.

7.2 Non-Domestic Sector

7.2.1 Existing System

Alongside the domestic sector, the non-domestic sector will require significant uptake of low-carbon heating technologies to decarbonise emissions associated with space heating. Figure 7.9 illustrates the current fuel split for non-domestic buildings across Ashfield and Mansfield.

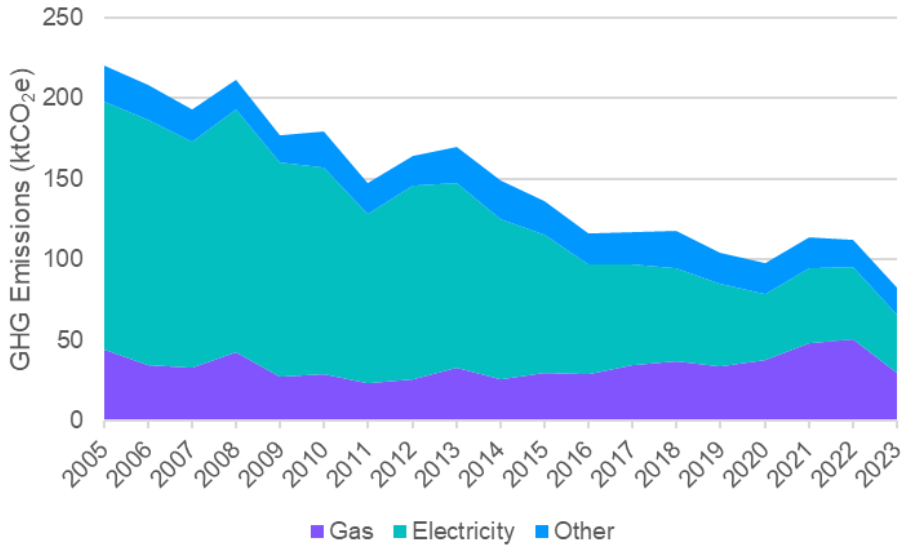
Figure 7.9: Mansfield and Ashfield Non-domestic buildings Fuel Split



Similarly to the domestic sector, natural gas remains the predominant fuel source, accounting for 61% of non-domestic buildings. This likely reflects the strong gas network coverage and the prevalence of gas-fired heating systems in commercial and public premises. Electricity represents the second-largest share at around 37.5%, indicating that a substantial proportion of non-domestic properties already utilise electric heating or electrically driven processes, which are comparatively lower-carbon and will benefit further from grid decarbonisation.

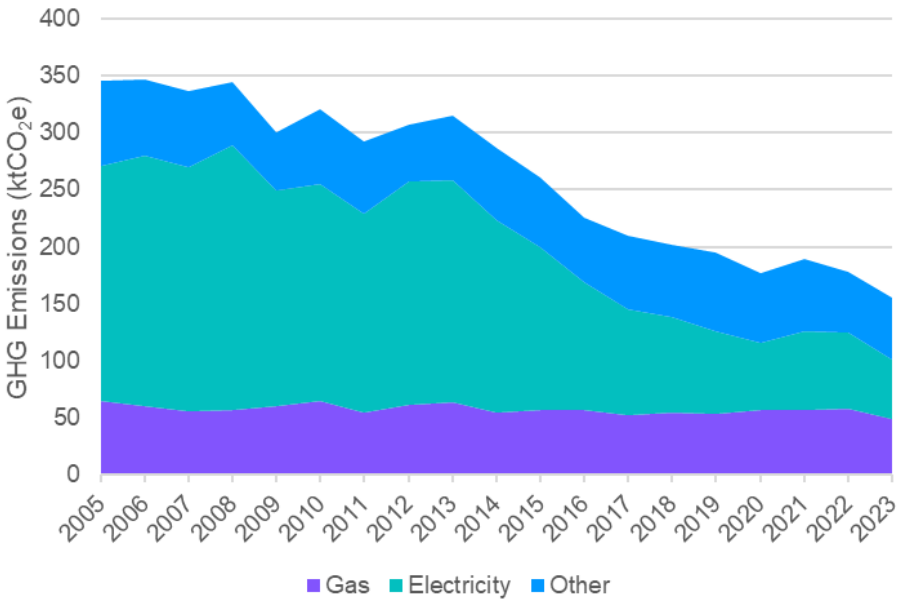
Oil accounts for 1%. This is usually concentrated in rural and off-gas commercial sites, such as agricultural businesses and smaller industrial operations. The remaining fuels (biomass & LPG) represent around 1%, typically in niche applications or renewable heating systems in off-grid locations. These properties will need to transition to fully decarbonised heat sources over time. The relatively high share of electricity compared to the domestic sector suggests that nearly one-third of non-domestic energy demand is already aligned with low-carbon pathways, reducing the scale of heating system replacement required. However, the continued reliance on natural gas, particularly in energy-intensive industries presents a major challenge.

Figure 7.10: Historical Carbon Emissions from Non-Domestic Buildings in Mansfield ($ktCO_2e$)



Source: UK local authority and regional greenhouse gas emissions statistics - GOV.UK

Figure 7.11: Historical Carbon Emissions from Non-Domestic Buildings in Ashfield ($ktCO_2e$)



Source: UK local authority and regional greenhouse gas emissions statistics - GOV.UK

Figure 7.10 and Figure 7.11 show historical emissions from non-domestic buildings, including those in the industrial, commercial, and public sectors. Both Ashfield and Mansfield exhibit a long-term downward trend in emissions since 2005, driven primarily by the decarbonisation of the national electricity grid and improvements in building energy efficiency. While electricity consumption historically represented the largest source of emissions, its contribution has declined sharply over time. In 2023, emissions from electricity use in Mansfield were approximately 35 $ktCO_2e$, compared to 30 $ktCO_2e$ from natural gas and 18 $ktCO_2e$ from other fuels. In Ashfield, the respective figures were 52 $ktCO_2e$ for electricity, 49 $ktCO_2e$ for natural gas, and 54 $ktCO_2e$ for other fuels.

Both districts display similar overall downward trajectories in emissions from their non-domestic sectors, with a particularly steep decline in electricity-related emissions. This reflects both national grid decarbonisation and improved energy efficiency. Natural gas emissions have also reduced gradually but remain significant, highlighting the need for targeted interventions in commercial premises and smaller industrial sites.

Emissions from natural gas and other fuels, including oil and LPG, are slightly more prevalent in Ashfield. This reflects the district's stronger reliance on fossil fuel heating in commercial buildings and manufacturing facilities. As a result, greater effort will be required in Ashfield to prepare for further electrification. This should be supported by engagement with large energy users and the exploration of additional efficiency measures, such as process heat decarbonisation and waste heat recovery.

Overall, both districts mirror the regional trend of declining non-domestic emissions, but their contrasting fuel profiles highlight different priorities for decarbonisation.

7.2.2 Scenarios Overview

For the non-domestic sector, two net-zero compliant scenarios were developed by assuming all non-domestic buildings will have a low-carbon heating system by 2040 or 2050. The scenarios developed followed the methodology as described in section 7.1.4. Whereby, the carbon and energy savings from replacing all fossil fuel heating technologies with a low carbon alternative were modelled using a digital twin.

Building on the approach applied to the domestic sector (see Section 7.1), the non-domestic modelling adopts consistent assumptions on technology performance, uptake rates and policy influences, while incorporating adjustments to reflect the differing characteristics and policy regulations of commercial, industrial and public buildings. ASHPs have been identified as the most feasible low-carbon heating option across the non-domestic stock, owing to their modular scalability, lower spatial requirements, and simpler installation compared with ground source systems.

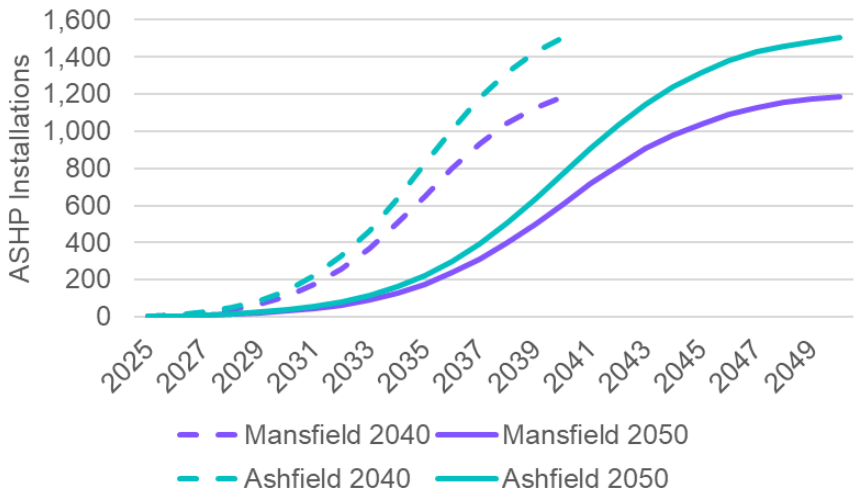
Many non-domestic buildings also benefit from suitable external areas such as rooftops, service yards and plant enclosures that can accommodate ASHP units without major disruption. In addition, their higher and more consistent heating loads allow larger-capacity ASHP systems to operate efficiently and deliver substantial energy savings at scale. These assumptions have been applied consistently across the 2040 and 2050 scenarios.

Both scenarios also assume a reduction in the total number of non-domestic properties using other types of electric heating, assuming that many will transition to heat pumps as the technology matures and funding becomes available.

This is based on the replacement rate of boilers with a 15-20 year life span, using historic ASHP installation data to inform the rate at which heat pumps would be installed. Gas boilers are assumed to have an efficiency of 85%, ASHPs a COP of 2.7, with CAPEX for boilers assumed to be £2–5k, and ASHPs (£10–15k).

As heat pump technology improves and installation costs fall, larger scale heat pumps will become more accessible and cost effective, which means that some non-domestic users and businesses may opt to implement a larger communal installation, serving multiple buildings in a mini heat network.

Figure 7.12: Mansfield and Ashfield Projected Non-Domestic Heat Pump Uptake for 2040 and 2050

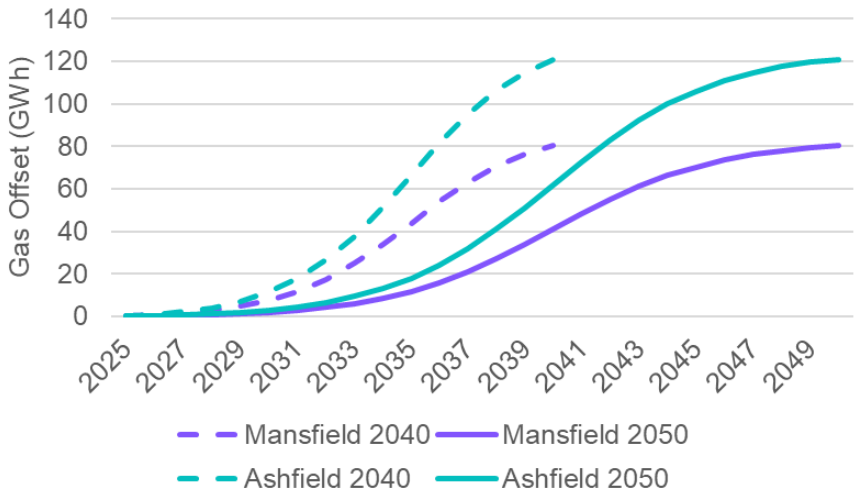


The non-domestic 2040 and 2050 scenarios assume full electrification of heating within commercial, industrial, and public sector buildings, with no hybrid systems retained beyond 2035. Figure 7.12 above outlines the required uptake rates of heat pumps in non-domestic buildings, reflecting an initial steady rate of growth through the late 2020s and early 2030s, followed by a rapid increase in installations during the 2040s as policy support, technological maturity, and private investment accelerate deployment.

The 2040 scenario achieves near-complete uptake around a decade earlier than the 2050 pathway, demonstrating the impact of earlier intervention through national and local decarbonisation funding programmes. Key enablers include, or have included, the Public Sector Decarbonisation Scheme (PSDS) for public buildings, the Industrial Energy Transformation Fund (IETF) for industrial sites, and the Energy Company Obligation for smaller non-domestic premises. The projections highlight the growing role of large commercial and public sector buildings in driving the transition, supported by corporate net zero commitments and local authority climate strategies.

The non-domestic gas savings projections indicate a clear reduction in fossil fuel consumption across the area, driven by the progressive replacement of gas-based heating systems with electric heat pumps. As shown in the figures below, both the 2040 and 2050 scenarios for both districts, exhibit a steady decline in gas demand through the late 2020s and 2030s, followed by a sharp acceleration once large-scale retrofit and installation programmes take effect.

Figure 7.13: Mansfield Projected Gas Savings from Non-Domestic Heat Pump Uptake



The 2040 pathway delivers substantial cumulative gas savings earlier than the 2050 scenario, reflecting faster adoption under more ambitious decarbonisation timelines. Differences between councils largely stem from variations in building stock, heating demand intensity and retrofit potential, but the overall trend remains consistent.

It is essential that financial support mechanisms are available to help non-domestic buildings with good potential for heat pump installation to undertake the necessary fabric upgrades, enabling faster and more effective adoption of low-carbon heating technologies.

Buildings located outside potential district heat network zones have been identified as likely candidates for heat pumps. Those currently using older or less efficient electric systems may require additional improvements to ensure compatibility and optimal performance.

7.3 District Heating

Heat provision across both districts is dominated by individual gas boilers, with only limited deployment of communal heating systems. This reliance on decentralised fossil fuel heating remains a major contributor to local carbon emissions.

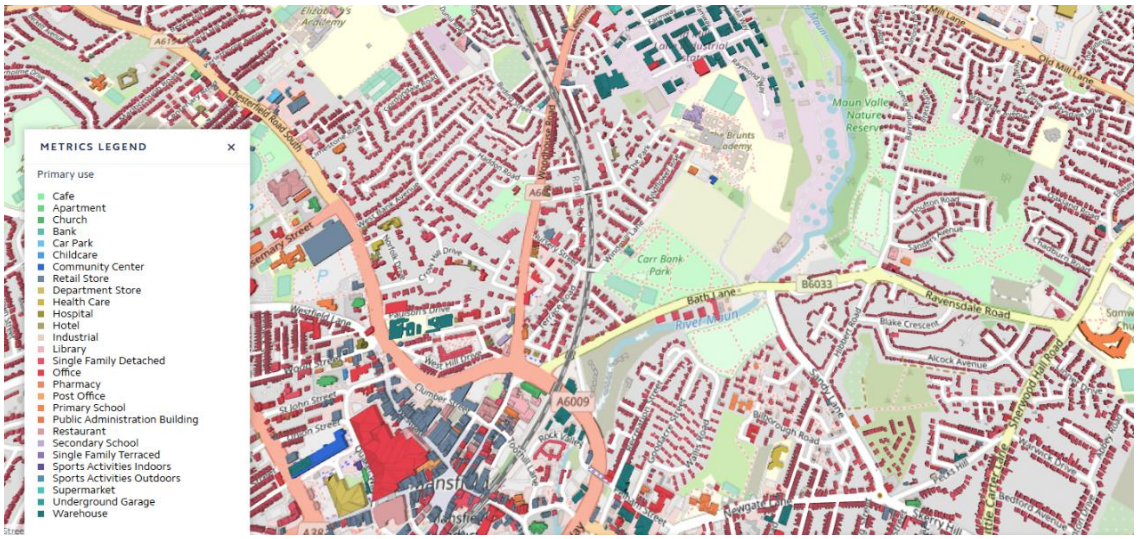
Currently, neither Mansfield nor Ashfield has a large-scale operational district heat network, but both districts are strategically positioned for future development. Several locations within these districts have been assessed against key feasibility criteria, including the presence of low-carbon heat sources, suitable anchor loads, and geographic constraints.

Future heat networks in these areas would likely integrate large-scale heat pumps, thermal storage, and flexible backup generation to ensure reliability and cost optimisation. Development will require close collaboration between local authorities, developers, and energy providers to align planning policy, zoning, and investment strategies.

7.3.1 Emerging Heat Network Development Areas

Figure 7.14 illustrates the potential heat network development area within Mansfield. Situated just north of the town centre, the proposed network is in close proximity to a diverse mix of commercial and public buildings, creating opportunities to supply heat to a wide range of end users including retail outlets, schools, and residential housing. This network could potentially use water source heat pumps to tap into waste heat available from the wastewater treatment plant by the Maun River. Low-carbon heat collected in such a manner is typically more efficient than using an air source heat pump and can help reduce the costs for end users connecting to the heat network. The industrial estate in the top of the image, and some of the commercial properties in the town centre could potentially serve as anchor loads.

Figure 7.14: Mansfield Potential Network Development area

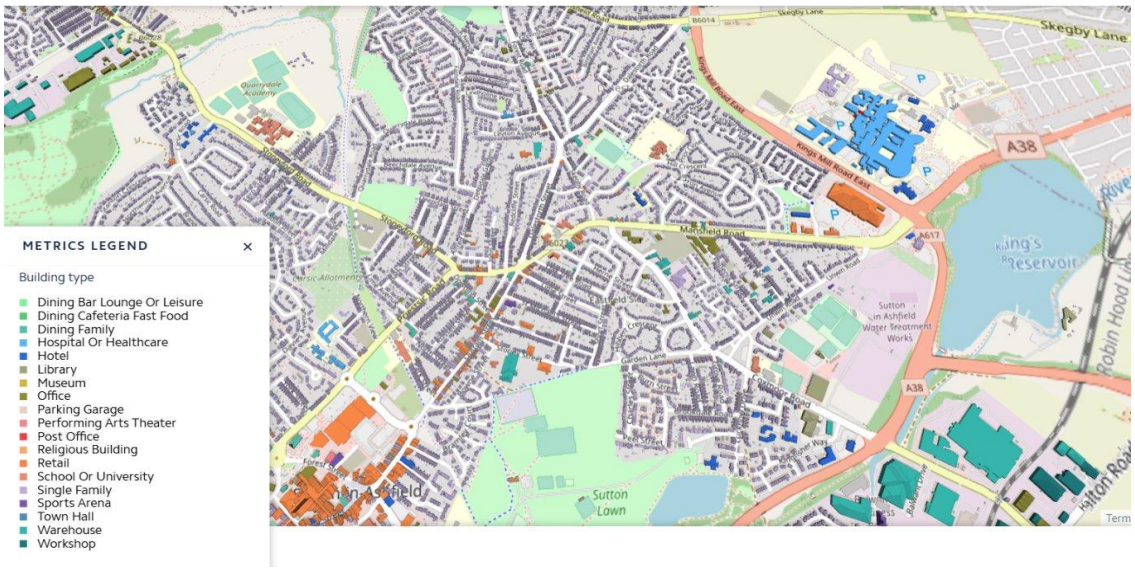


A current constraint in the Mansfield network area is the railway which runs from north to south through the town centre. Heat network piping cannot be routed beneath railway tracks due to risks to track stability, safety, and maintenance. This creates a physical barrier between the primary heat generation site and the town centre, which represents one of the largest demand clusters. To overcome this, the network would need to cross the railway via overhead piping. Which, while technically feasible, this solution introduces additional complexity and costs, requiring reinforced structures and enhanced insulation to mitigate heat losses associated with exposure to open air.

The modelled heat network area for Ashfield is displayed in Figure 7.15. The area encompasses a large proportion of Sutton-in-Ashfield, giving opportunity to meeting heat demand in larger number of different building archetypes. It can be seen that alongside a vast amount of domestic properties, there are a number of large non-domestic properties such as the Kings Mill Hospital, a primary school, and retail sites. These areas offer strong anchor loads and manageable constraints, making them suitable for initial development.

This potential network area also is in the vicinity of a wastewater treatment works, which could supply low cost, low carbon heat to the network.

Figure 7.15: Ashfield Potential Network Development area



7.3.2 Policy and Market Drivers

The forthcoming UK Heat Network Zoning (HNZ) Regulations, set for rollout in 2026 under the Energy Act 2023, will be a key catalyst for local heat network delivery across the Ashfield and Mansfield area. HNZ will define areas where heat networks represent the lowest-cost decarbonisation pathway, and within these zones certain building types, such as large public, commercial, and multi-residential developments, will be required or strongly encouraged to connect.

For both the local authorities, zoning provides clear spatial and policy signals about where networks are technically and economically viable. Embedding this framework allows the districts to align heat-demand mapping, anchor-load identification, and spatial planning policy with designated zones. This integration helps to:

- Direct investment and development activity toward areas with strongest network potential
- Secure anchor connections from public-estate or regeneration sites
- De-risk private-sector investment by demonstrating long-term demand certainty
- Strengthen funding bids to programmes such as the GHNF (Green Heat Network Fund)

Alongside the introduction of national consumer-protection and technical-performance standards, Heat Network Zoning will create a more stable and transparent market for heat network projects. By incorporating these policy mechanisms, Ashfield and Mansfield can ensure that heat networks are developed as part of a coordinated, place-based energy and planning

strategy, supporting net-zero targets while enabling predictable, low-carbon heat for communities and businesses.

7.3.3 Next Steps

To fully realise this opportunity, coordinated action will be essential across stakeholders. Key priorities include supporting zoning implementation, securing anchor load commitments, and aligning local planning and development policies with heat network rollout. As networks expand, they are expected to become a cornerstone of sustainable infrastructure in Ashfield and Mansfield, enabling future connections and integration of additional renewable and low-carbon technologies.

8 Industrial Decarbonisation

This section examines the current industrial process loads across the area and models the expected changes in energy sources required to achieve full decarbonisation. Data from Cadent Gas has been used to map existing process loads. The analysis assumes that most low-temperature process loads will transition to electrification, while the majority of high-temperature process loads will require a shift to hydrogen.

8.1 Methodology

To analyse the industrial process loads currently operating in Ashfield and Mansfield, data from Cadent Gas was used to identify gas consumption for each non-domestic connection to the gas network. The primary use of each connection was determined using Standard Industrial Classification (SIC) codes, which Cadent applies to categorise commercial and industrial connections. Cadent also provided descriptions of the primary uses associated with each SIC code to support this classification process.

Each industrial SIC code present in the districts was then assessed and categorised as either low-temperature or high-temperature, based on information gathered directly from stakeholders and site operators during one-to-one engagements with high energy users. Where stakeholder input was unavailable, an informed assessment was made of the typical heat requirements for the relevant industry.

This process enabled the modelling and mapping of existing low- and high-temperature process loads at Middle Layer Super Output Area (MSOA) level. These mapped loads were then used to calculate projected additional electricity and hydrogen demand required to decarbonise industrial processes by phasing out fossil fuel use.

8.2 Overview of Key Industrial Sectors

8.2.1 Key Industrial Sectors in Ashfield

Ashfield has a growing advanced manufacturing and technology base, supported by proposed new initiatives such as the Ashfield Innovation and Technology Park. This development aims to position the district as a hub for automation, high-value manufacturing, and research, creating significant local employment opportunities in sectors like advanced engineering and distribution. The area benefits from strong transport links and proximity to major markets, making it attractive for industrial investment.

Existing industry in Ashfield is spread across several mixed-use industrial estates and includes distribution and packaging, construction related manufacturing, food and drink processing, and motor vehicle parts and repair. Most of the manufacturing in Ashfield can be considered as “light”, with minimal energy intensive high temperature process loads. However, there are some sites which likely require high temperatures, specifically in the aerospace and metal packaging manufacturing sectors.

8.2.2 Key Industrial Sectors in Mansfield

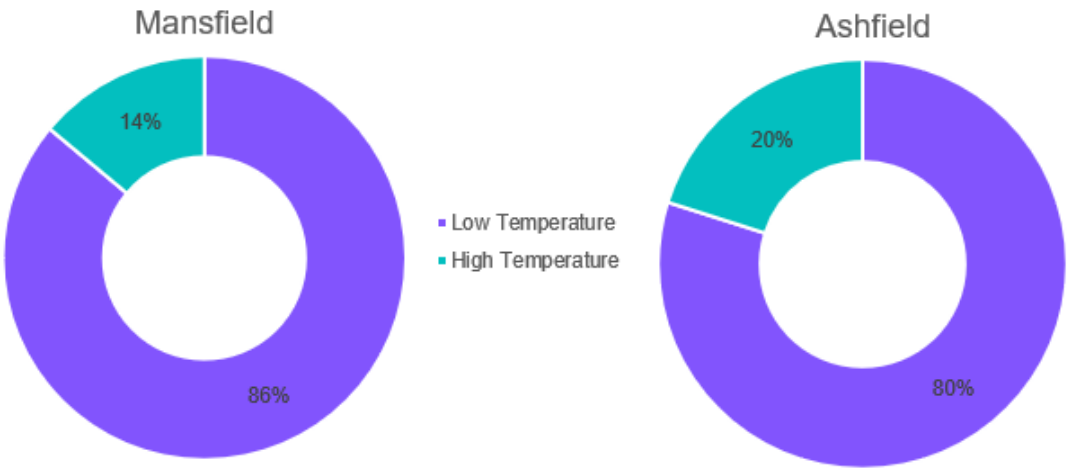
Mansfield has a diverse industrial base, with manufacturing playing a key role in the local economy. Key sectors include food and drink processing, plastics and polymer manufacturing, and machinery and cable production, alongside a strong logistics and warehousing presence due to its strategic location near major transport corridors. The district also benefits from

proximity to advanced manufacturing clusters in the wider Nottinghamshire area, supporting innovation and supply chain integration.

Like Ashfield, most of the manufacturing in Mansfield can be considered “light”, with most process loads requiring low temperatures and likely able to electrify within the coming years. However, there are brick manufacturing sites which consume significant amounts of natural gas and will likely require hydrogen (or a suitable alternative) to decarbonise their high temperature process loads. Brick making is an industry where hydrogen blended gasses are currently being trialled at other sites, both in the East Midlands and nationwide, as an alternative to natural gas.

8.3 Existing System

Figure 8.1: Breakdown of Process Load



Source: Mott MacDonald Analysis of Cadent Gas Data

Figure 8.1 presents the distribution of natural gas consumption for industrial process loads in the districts of Ashfield and Mansfield, segmented into low-temperature and high-temperature categories. Low-temperature processes dominate, accounting for more than 80% of total industrial gas use in both districts.

Given this context, the pathway to decarbonisation must be tailored to the nature of thermal demand. Low-temperature processes, which account for 80-86% of industrial gas use and typically involve heating below 150°C, are well-suited to electrification, particularly as the electricity grid continues to decarbonise. In contrast, high-temperature processes, though only 14-20% of total demand, are concentrated in energy-intensive sectors. Examples of these in Ashfield and Mansfield include metal packaging manufacturing, aerosols manufacturing, aerospace industries and concrete brick manufacturing. These operations are technically challenging to electrify and will likely require low-carbon hydrogen or other advanced solutions to achieve deep decarbonisation.

8.4 Decarbonisation Requirements

A profile was developed to project the rate of fuel switching for process loads, using the UK Government’s 7th Carbon Budget projections scaled to the industrial base of Ashfield and Mansfield. The detailed conversion rates and associated demand levels for the 2050 Net Zero scenario are shown in Figure 8.2. This profile incorporates an estimated 6% reduction in total

energy demand due to efficiency improvements, alongside additional gains from the higher efficiency of electrical systems compared to fossil fuel boilers for low-temperature loads. The electrification of low temperature loads has a faster uptake rate in the short term, due to the current availability of these technologies, whereas a consistent supply of blue or green hydrogen may not be available until the mid 2030s, based on the current planned timelines of the East Coast Hydrogen pipelines.

To model the projected changes in energy consumption and associated carbon emissions for industrial process loads in Ashfield and Mansfield, the analysis assumes that all low-temperature process loads will electrify, while all high-temperature process loads will convert to hydrogen. The low-temperature category includes certain industries where cost-effective electrification technologies are not yet widely available but are expected to emerge within the next decade. High-temperature processes generally refer to operations requiring heat above 150°C, such as metal fabrication and ceramics.

The original Carbon Budget projections include contributions from Carbon Capture and Storage (CCS). However, CCS was excluded from this analysis because it is generally viable only for very large industrial sites of national significance. Based on available data, there are no significant suitable CCS candidates within these districts.

Figure 8.2: Ashfield Projected Energy Consumption for Process Loads

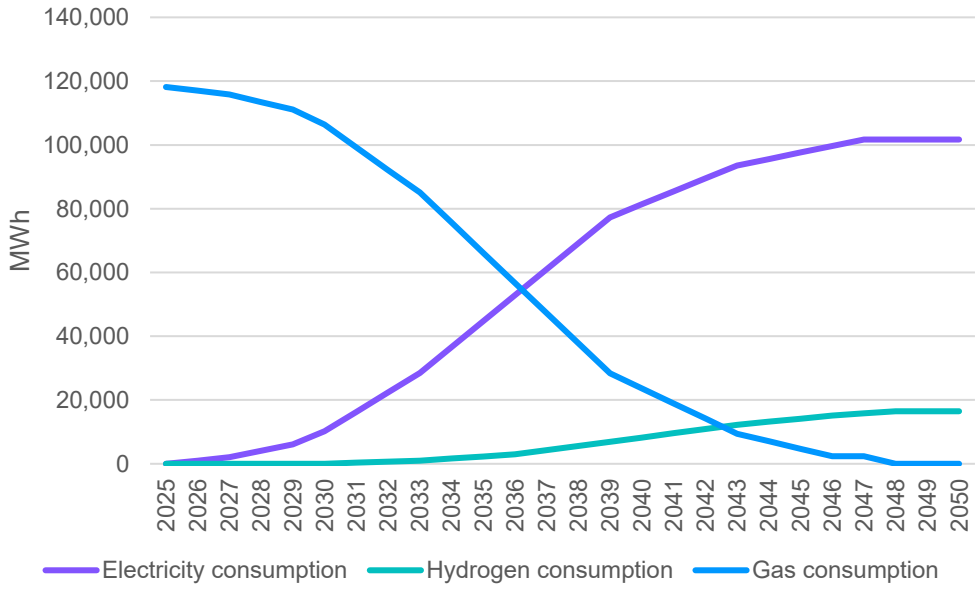
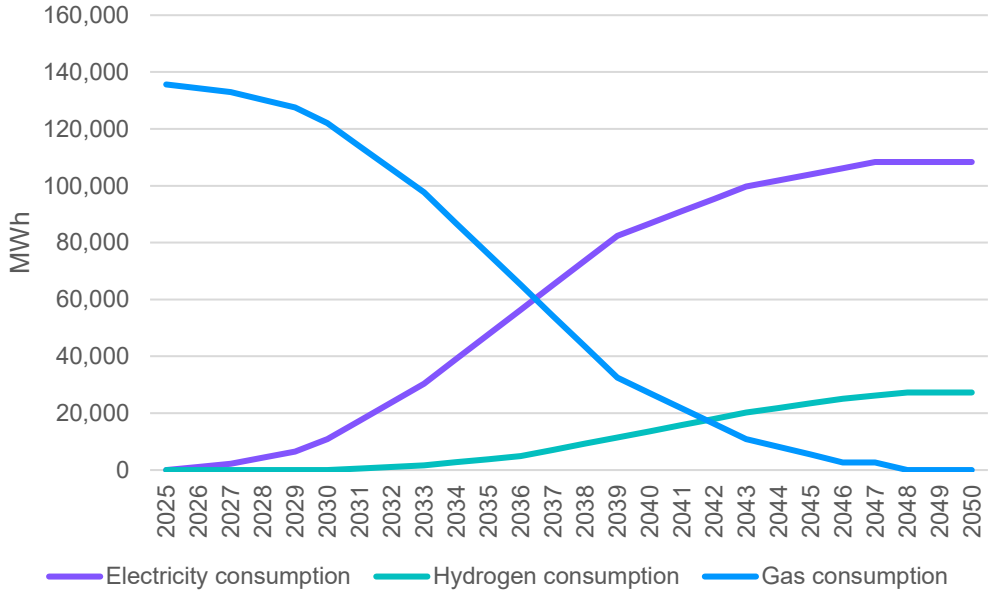


Figure 8.3:Mansfield Projected Energy Consumption for Process Loads



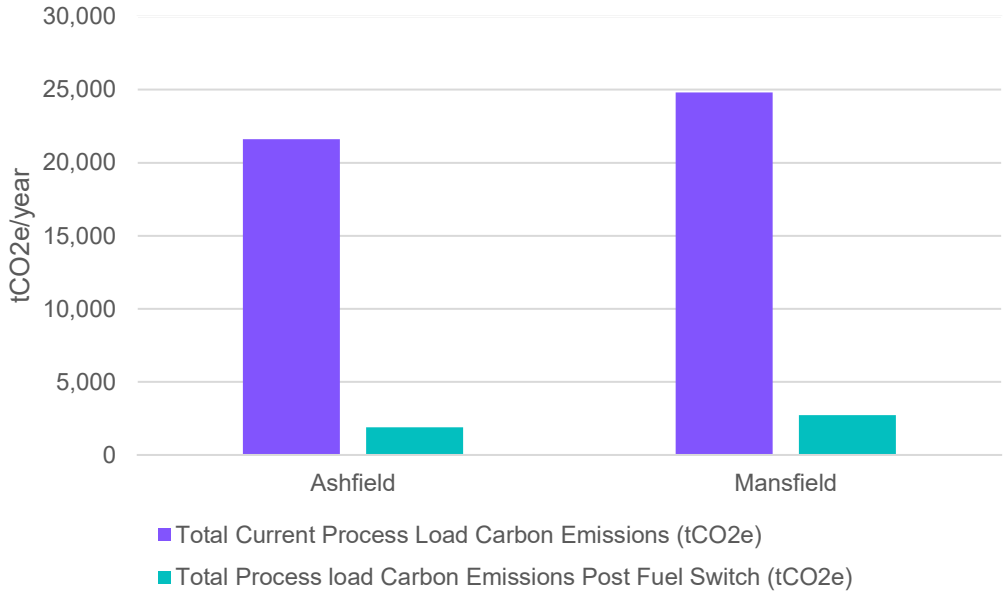
The above figures illustrate the expected consumption of gas, electricity, and hydrogen under the modelled scenarios. The ratio of hydrogen to electricity consumption in 2050 is higher than the current ratio of high- to low-temperature process loads, reflecting efficiency improvements when electrifying burners and other processes previously reliant on combustion.

Table 8.1: Summary of Process load Emission Post Fuel Switch

District council	Gas Consumption for Process use (MWh)	Total Current Process Load Emissions(tCO_2e)	Electrical Emissions post fuel switch (tCO_2e)	Hydrogen Emissions Post Fuel Switch (tCO_2e)	Total Process load Emissions Post Fuel Switch (tCO_2e)	Percentage Reduction (%)
Ashfield	118,159	21,611	712	1,186	1,898	91%
Mansfield	135,639	24,808	758	1,964	2,723	89%

Table 8.1 provides a breakdown of carbon emissions from process loads after fossil fuel removal, showing the respective contributions of electricity and hydrogen. Electrification is prioritised wherever feasible because, post grid decarbonisation, electricity will have a lower carbon intensity than green hydrogen.

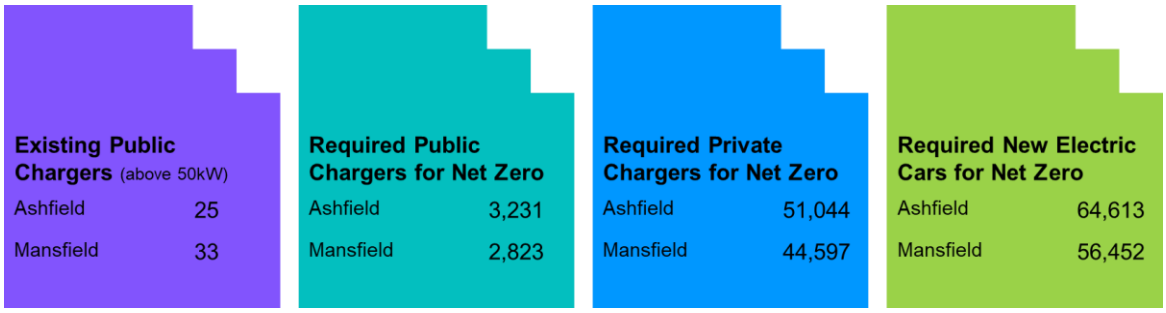
Figure 8.4: Process Load Carbon Emission Post Fuel Switch



To ensure a structured and timely transition, industrial operators in Ashfield and Mansfield should develop comprehensive decarbonisation plans. These plans should specify timelines for phasing out fossil-fuel-based processes and identify whether electricity or hydrogen will replace each process. Such planning is critical to achieving cost-effective, reliable, and sustainable industrial decarbonisation.

9 Electrification of Private Transport

This section outlines the current state of transport emissions in Ashfield and Mansfield and the role electrified transport plays in reducing these. This section details the interventions modelled in the net-zero aligned scenarios to achieve decarbonisation of private vehicles.



9.1 Existing System

Transportation accounted for 35% of Ashfield and Mansfield's emissions[48] in 2023 (32% in Mansfield and 38% in Ashfield), so supporting the decarbonisation of this sector is crucial to enabling net zero achievement.

The scope of this LAEP (set out in Section 1.2) does not include transport planning, therefore this chapter focuses on the uptake of private electric vehicles only, as a key part of the transport sector decarbonisation challenge.

As of Q2 2025, the total number of licenced vehicles in Ashfield is 77,800 and 67,500 in Mansfield[49] , of which 91.8% of vehicles in Ashfield, and 90.8% in Mansfield are petrol or diesel internal combustion engine (ICE) vehicles. Of these vehicles, 91% are privately-owned cars. The total number of licensed vehicles is expected to remain broadly stable over time. Despite population growth increasing the total number of people who could own a vehicle, future modal shifts are expected to reduce the likelihood of an individual vehicle ownership, resulting in no material net change in overall volumes.

Electric Vehicles (EVs) produce zero tailpipe emissions, which contributes to improved local air quality through not producing nitrogen oxides and particulate matter typically emitted by internal combustion engine vehicles. Therefore, expanding the current proportion of EVs to beyond its current level in the Ashfield and Mansfield fleets is key to reducing the emissions from private transport.

9.2 Local Context

There are currently 61 publicly available charge points (of any speed) in Ashfield and 57 in Mansfield.[50] This equates to 48.0 and 51.8 public chargepoints per 100,000 people in both councils respectively, both lower than the Nottinghamshire average of 80.0 and considerably lower than the England average of 129.8 chargepoints per 100,000.

[48] UK local authority and regional greenhouse gas emissions statistics, 2005 to 2022 - GOV.UK

[49] Vehicle licensing statistics data files - GOV.UK

[50] Electric vehicle public charging infrastructure statistics: October 2025 - GOV.UK

As well as low access to public chargepoints, another barrier to EV adoption is practicality of private charging, specifically if a household only has access to on-street parking. 93% of current EV owners in the East Midlands have off-street parking, whereas only 68% of all East Midlands households have this access to easier private charging[51]. This means a considerable amount of work will be necessary to enable cross pavement charging or other solutions, to encourage all households to adopt EVs.

Nottinghamshire's Local Electric Vehicle Infrastructure (LEVI) Strategy aims to accelerate EV adoption by creating a comprehensive, accessible charging network across the county. The strategy focuses on making EV ownership easier, more affordable, and practical for all households, particularly those without off-street parking. It prioritizes the deployment of charging infrastructure in residential areas, destination sites, and transit corridors, while also developing rapid and ultra-rapid charging hubs to support commercial and long-distance travel. Nottinghamshire County Council has secured £5.5 million in LEVI funding to deliver over 1,000 new chargepoints, ensuring equitable coverage and 100% renewable energy supply. This approach aligns with Midlands Connect's regional ambition to install nearly 59,000 chargepoints by 2030 and supports Nottinghamshire's commitment to achieving net zero by the end of the decade.

According to Midlands Connect the Midlands could have over 2 million electric vehicles (EVs) on the roads by 2030, with 32.5% of all vehicles expected to be electric[52]. To support this growth, 58,997 new public EV charging points will need to be installed across both districts by the end of the decade. This translates to 27 new charging points per day, 194 per week, and 9,832 each year until 2030.

In Nottinghamshire, EV adoption is projected to increase dramatically by 2030. As of late 2023, there were approximately 6,600 plug-in electric vehicles registered across the county, supported by around 375 publicly accessible chargepoints. Forecasts suggest that by 2030, Nottinghamshire could see EV numbers rise to over 36,000 vehicles, representing a growth of more than 440% from today's levels. To meet this demand, the county will require a significant expansion of charging infrastructure. Current plans under the Local Electric Vehicle Infrastructure (LEVI) programme aim to deliver over 1,000 new chargepoints in the next few years, but long-term projections indicate that thousands more will be needed by 2030 to ensure equitable access and support the transition to net zero.

9.3 Do Nothing

The Do Nothing scenario represents the best estimate of outcomes if minimal additional local action is implemented in this space. In terms of travel behaviour (people switching to more sustainable modes of travel), no modal shift is assumed, and private car use is expected to remain the dominant mode of transport. Instead, changes in emissions arise solely from nationally mandated vehicle policies affecting the composition of the car fleet.

As of 2025, these policies in the UK include the ban on the sale of new internal combustion engine (ICE) vehicles from 2030, as well as the Zero Emission Vehicle (ZEV) mandate, which requires vehicle manufacturers to sell an increasing proportion of zero-emission vehicles each year[53].

While these existing policies would lead to the continued growth in trends of EV ownership, the insufficient charging infrastructure and lacking policy support would lead to limited progress

[51] Midlands Connect - Supercharging the Midlands

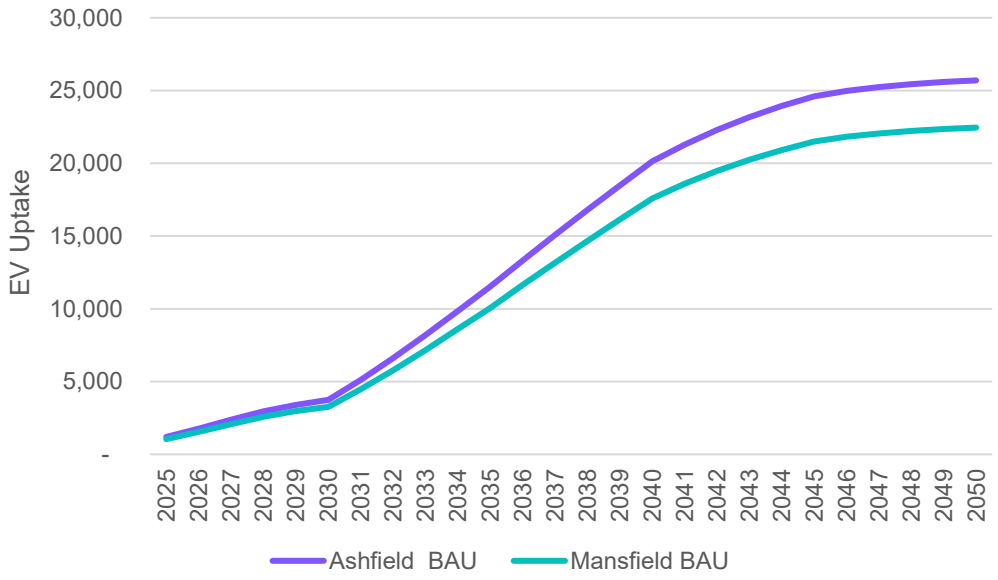
[52] Midlands Connect - Midlands still on track for EV boom, according to new research

[53] Phasing out sales of new petrol and diesel cars from 2030 and supporting the ZEV transition - GOV.UK

towards decarbonisation. This highlights a significant scale of action would be required to shift both districts away from reliance on petrol and diesel vehicles.

To evaluate this scale of intervention required, Midlands Connect conducted modelling to examine a business-as-usual scenario (BAU) through to 2050, as illustrated below[54]

Figure 9.1: Do Nothing EV Uptake Scenario



Source: Mott MacDonald analysis based on Midlands Connect Business-as-Usual and Accelerated EV uptake projections

The Do Nothing estimates that 25,702 electric vehicles would be adopted by 2050 in Ashfield, and 22,406 in Mansfield, representing 36% and 28% respectively of currently licensed vehicles. Demonstrating that under existing policy conditions, both districts are likely to fall considerably short of transitioning its entire vehicle fleet to zero-emission alternatives.

The Midlands Connect BAU scenario reflects projections based on current government policies that are confirmed and funded, as well as exogenous factors influencing adoption rates. This scenario anticipates that growth in the electric vehicle market will largely be shaped by factors such as national legislation and the natural turnover of the vehicle fleet. As this BAU scenario aligns with the criteria of the Do Nothing scenario within this LAEP, it has been adopted as the modelled Do Nothing scenario.

9.4 Modelling Methodology

The modelling approach drew on 2021 ONS population data (as the most recent census) for Ashfield and Mansfield's MSOAs to determine the existing number of cars per area using a cars per capita assumption derived from midlands data[55]. By apportioning this national projection according to both district's population, the analysis provides locally specific estimates of EV uptake.

[54] STB EV Charging Infrastructure Visualiser

[55] Middle layer Super Output Area population estimates (supporting information) - Office for National Statistics

The uptake trends were modelled using the Climate Change Committee's Seventh Carbon Budget. The CCC pathway is slightly more ambitious than the EV mandate, citing reductions in EV costs as making this achievable.

This pathway results in 97.5% of cars being battery electric by 2050. A large portion of the remainder is covered by other zero emission vehicle types including hydrogen fuel cell and biofuels. The remainder covers 1% of current transport emissions (made up of antique cars and 15-year-old ICE cars still in operation in 2050) and is covered by nationally managed engineered removals, such as bioenergy with carbon capture.

To estimate the number of public EV chargers needed, a ratio of public chargers to EVs was taken from Midlands Connect 'Supercharging the Midlands' report which cites 1-in-20. As chargers are seen as a necessary precursor to mass EV adoption, the uptake curve of public chargers matches the uptake in EVs. Keeping the pace of charging infrastructure roll-out in line with growth in EVs is fundamental to growing public confidence in the viability of EV ownership and therefore achieving the emissions reductions required in private transport.

Similarly, private charger projections were derived using the EV uptake and an EV to private charger ratio based on Zapmap data and an assumption that development in cross pavement charging will enable the percentage of private charger installations to remain the same at 79%, even as uptake spreads further beyond households with off-street parking[56]. Further details of the assumptions used within the modelling are outlined below in section 9.6.

For the 2040 scenario, the same uptake curve has been used accelerating from 2032, reaching the same final total volume as the 2050 scenario, ten years earlier. The total abated emissions differ from the 2050 scenario due to the changing grid emission intensity factor, across the transition timeline.

For the Do Nothing scenario the uptake curve has utilised the Midlands Connect BAU data. The annual percentage vehicle uptake in BAU compared to their accelerated uptake, is applied to our 2050 scenario uptake. For example, for the year 2050 the BAU scenario only has 40% of the volume of EVs in the accelerated uptake scenario, thus a factor of 40% is applied to the 2050 volume of EVs in our 2050 scenario to obtain the Do Nothing 2050 uptake value.

9.5 Modelling Assumptions

9.5.1 Datasets

Modelling has been undertaken using the following publicly available statistics and datasets:

- ONS Middle layer Super Output Area population estimates (supporting information)[55]
- Research on East Midland cars[57] and people[58] per household
- CCC 7th Carbon Budget[1]
- Midlands Connect 'Supercharging the Midlands' report[51]
- ZapMap[56]

9.5.2 Socioeconomic Parameters

To perform modelling, socioeconomic parameters have been retrieved from available statistics and datasets:

- Population of Ashfield = 126,300 (ONS, 2021)

[56] Home and community EV charging stats

[57] https://www.nimblefins.co.uk/cheap-car-insurance/number-cars-great-britain

[58] https://www.statista.com/topics/12526/families-in-the-uk/#topicOverview

- Population of Mansfield = 110,482 (ONS, 2021)
- Average number of cars per household in the East Midlands (2023) = 1.23
- Average number of people in an East Midlands household, (2023) = 2.4

9.5.3 Assumptions and Exclusions

- Not all ICE vehicles are decommissioned within the 2040 and 2050 scenarios.
- The CCC EV uptake projection is assumed proportionate across the UK.
- The model only includes the uptake of Battery Electric Vehicles (BEVs) and therefore does not account for Plug-in Hybrids (PHEVs), Hybrid Electric Vehicles (HEVs), Fuel Cell Electric Vehicles (FCEVs), Range-Extended EVs (REEVs), biofuel/biodiesel or other transitional technologies, which are assumed negligible by 2050
- The model only considers private transport and therefore does not account for public transport, freight transport, or heavy-duty vehicles.
- Motorcycles, mopeds, and other forms of micro-mobility are excluded.
- Behavioural changes such as modal shift, car-sharing, or reductions in private car ownership are assumed to match the relative increase in population resulting in an equal volume of private cars in 2050 compared to today

9.6 Results

EV uptake for Ashfield and Mansfield required from the present day (2025) to 2050 is approximately 60,747 and 53,075 additional EVs respectively. This represents growth from around 3,865 to 64,312 EVs in Ashfield and from around 3,377 to 56,190 EVs in Mansfield over the modelling period.

These uplifts represent a significant proportion of the districts' current vehicle fleets, with the 2040 scenario requiring over 80% of the current fleet to be replaced by 2035, and around 60% in the 2050 scenario by 2035. To provide a sense of scale, a quick calculation based on (Society of Motor Manufacturers and Traders (SMMT)[59] data and government vehicle registration statistics shows that there are nearly 2 million cars registered each year and approximately 34 million cars licensed nationally, resulting in an expected renewal rate to 2035 of around 57% of the total UK car fleet. As this level of EV uptake must occur before the ban on the sale of new internal combustion engine (ICE) vehicles, it will require significant additional coordinated policy interventions, incentives, and infrastructure investment to reduce the risk of fossil-fuel lock-in during this period.

Figure 9.2 and Figure 9.3 show the number of public and private EV chargers required in Ashfield and Mansfield under the modelled scenarios to support the forecast levels of EV uptake.

[59] https://www.smmt.co.uk/vehicle-data/car-registrations/

Figure 9.2 Required Number of Private Chargers

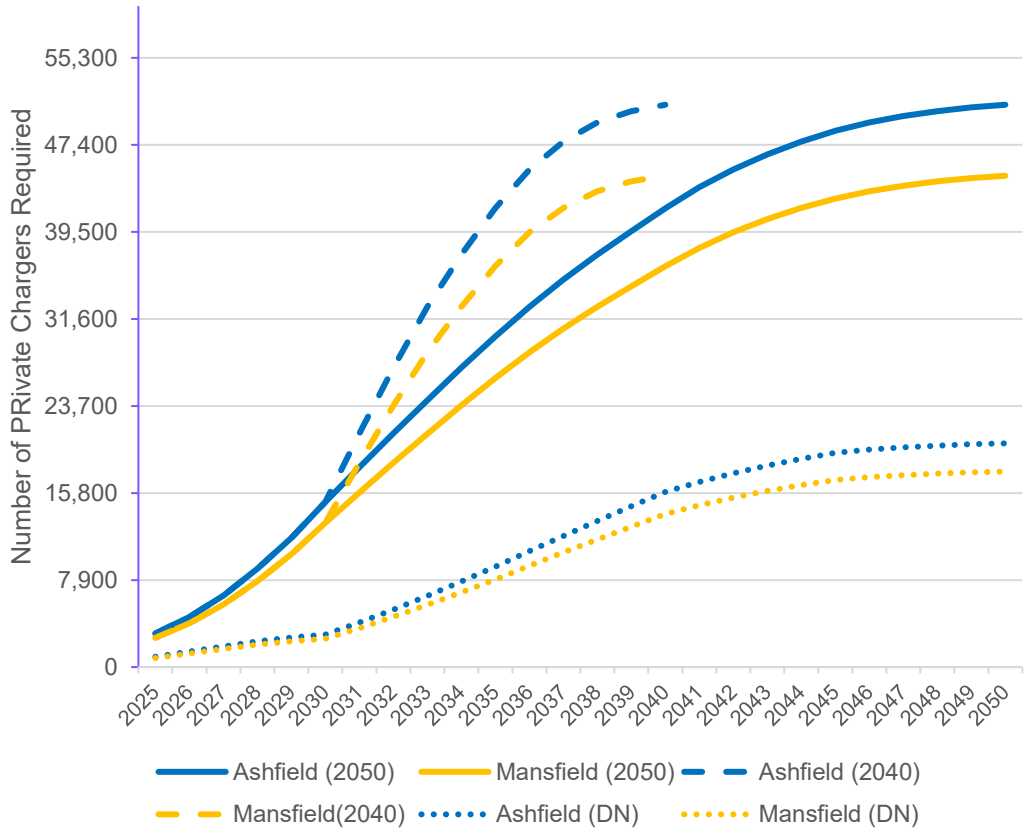
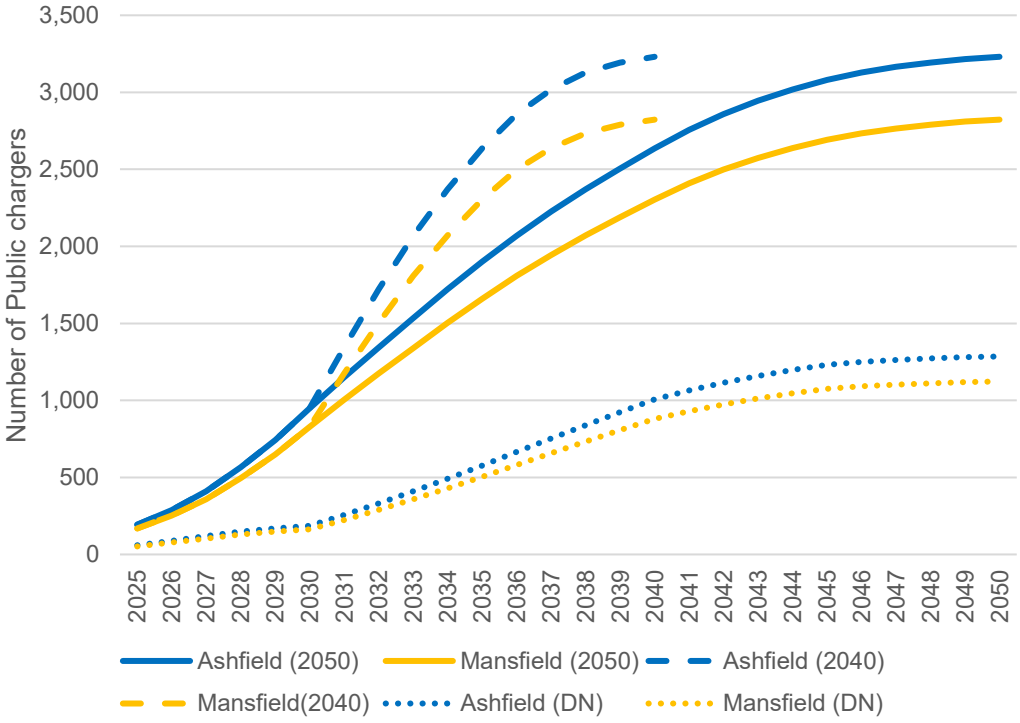


Figure 9.3 Required Number of Public Chargers



As described in Section 9.3, this figure is derived from the 2025 ratio of EVs to private chargers, with the assumption that this proportion remains constant through to 2050. This reflects the expectation that many EV owners will continue to prefer access to their own private charger in order to ensure reliable and affordable charging.

Alongside private chargers, public chargers play a critical complementary role in ensuring that charging is accessible to all road users and in providing driver confidence for undertaking longer and inter-urban journeys. The LAEP pathway highlights that the rollout of public charging infrastructure must keep pace with EV uptake to avoid infrastructure becoming a limiting factor to decarbonisation.

Based on the modelled EV uptake for Ashfield and Mansfield, a substantial expansion of both private and public charging infrastructure will be required to support the 2040 and 2050 scenarios. This indicates that a vast and comprehensive charging network will be necessary, with a broad geographical distribution across residential areas, town centres, employment zones, and transport corridors to meet future charging demand. Charging points should be placed across both districts so that they are accessible within a short distance, with placement decisions based on anticipated demand. This is discussed further in section 9.7.1.

9.7 Impacts

9.7.1 Grid Impact of EV Infrastructure

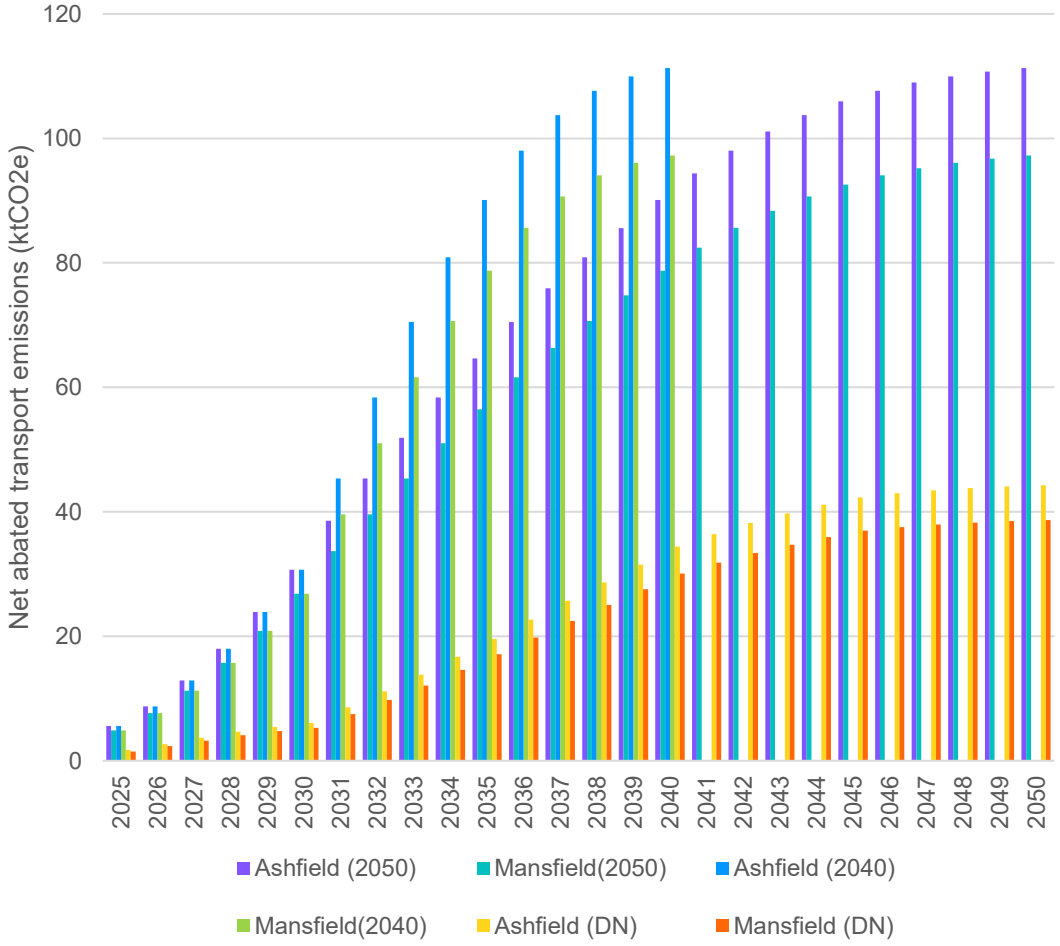
Ashfield and Mansfield will require more electricity to power these new EVs. It is key to determine which areas should take prioritisation when selecting the areas for continued EV charge point growth. Areas with high population densities, large coverage of flats and terraced housing, correlating with low percentages of off-street parking should take priority.

It will be crucial to work collaboratively and openly with the local DNO to ensure both district's electricity grid is equipped to incorporate the extra demand increase EV use will bring, as well as the opportunities in Vehicle-to-Grid electricity storage flexibility. Please refer to Section 11 to find more information regarding impacts to the grid infrastructure.

9.7.2 Carbon Impact of EV Infrastructure

Figure 9.4 illustrates the net abated carbon emissions resulting from the transition away from ICE vehicles across both scenarios. It presents the total carbon savings achieved through this transition factoring in both reduced ICE emissions and a change in emissions from electricity usage.

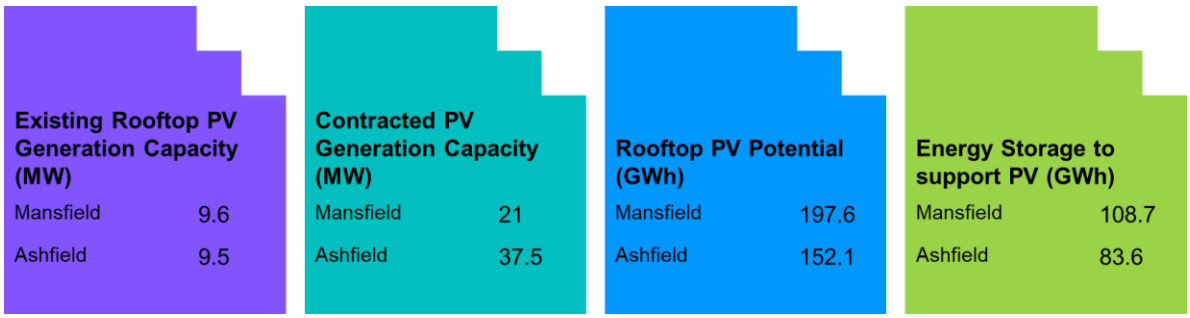
Figure 9.4 Total Abated Emissions from the transition away from Internal Combustion Engines ($ktCO_2e$ /year)



The data shows the abated emissions from both district's vehicle fleet is influenced by two main factors: increased use of EVs and the ongoing decarbonisation of the electricity grid. In the 2040 and 2050 scenarios the final average emissions per vehicle are expected to be 59 and 46 $kgCO_2$/year, respectively, down from 1,641 $kgCO_2$/year in 2025 (the larger value in 2040 for the 2040 scenario is accounted to a higher average grid intensity factor than in 2050).

10 Local Generation

This section outlines the opportunity to deploy local generation to support the net zero scenarios for Ashfield and Mansfield. Overall, the generation considered in the LAEP is that likely to have local impacts, such as behind-the-meter solar PV and community energy schemes where the output is consumed locally. Utility-scale generation, which contributes to overall electricity grid decarbonisation is not considered within this LAEP.



10.1 Existing System

While electricity demand in Ashfield and Mansfield is primarily met via the UK national electricity grid, heat demand is largely supplied by the national gas grid. According to the Non-Gas Map, approximately 5–15% of properties across both districts are off the gas grid, relying on alternative heating sources such as oil, LPG, or electricity.[60]

Most of the energy consumed in the districts is sourced externally, with limited local generation currently in operation. While granular asset-level data for Ashfield and Mansfield is not publicly available, regional datasets provide useful proxies. Based on the Embedded Capacity Register[61] and the Renewable Energy Planning Database (REPD)[62], the combined local generation capacity across Nottinghamshire was approximately 270.5 MW in 2021 (the most recent information), primarily from distribution-connected renewable sources. These include solar PV (~76%), onshore wind (~10%), and energy from waste (~10%). These figures represent aggregated capacity across the county which offer a reasonable approximation of the scale and composition of local generation.

[60] Non-gas map
[61] National Grid - Embedded capacity register
[62] Renewable Energy Planning Database: quarterly extract - GOV.UK

Figure 10.1: Total solar capacity in Ashfield and Mansfield (kW)

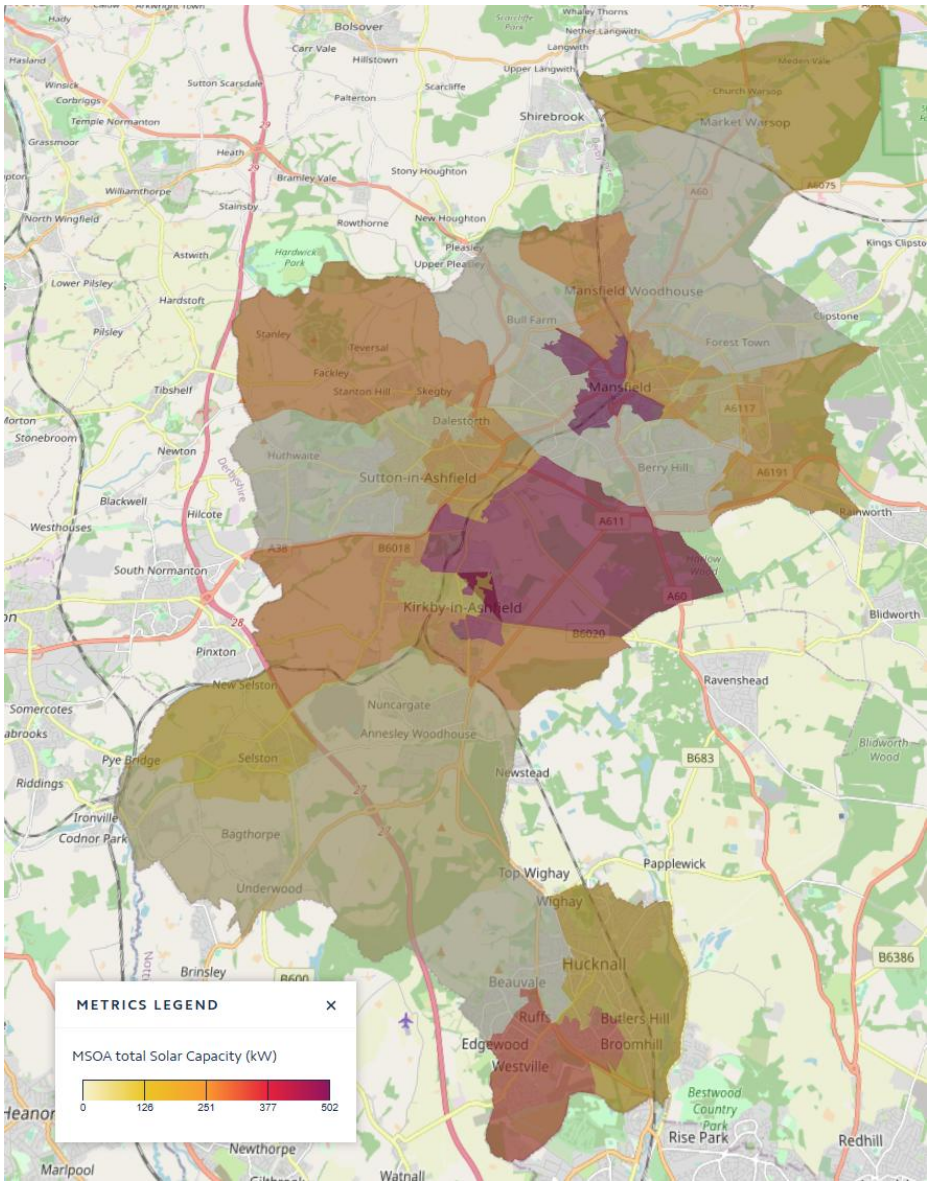


Figure 10.1, above shows the total currently installed solar capacity in Ashfield and Mansfield, with the red and orange areas marking locations with increased capacity. It can be seen that the urban areas near Ashfield and Mansfield town centres, as well as the rural MSOA to the northeast of Ashfield, have the highest installed capacity of solar PV.

While there is no statutory requirement for rooftop solar installation, uptake has been increasing, driven by falling costs, energy security concerns, and local authority support.

10.2 Do Nothing

The “Do Nothing” scenario assumes no additional local action beyond existing national legislation. Opportunities for large-scale distributed generation connected at grid supply point or high voltage level are excluded from this LAEP, as these assets contribute to national supply and are accounted for in carbon intensity factors.

This LAEP focuses on distribution-connected and locally influenced generation, such as rooftop solar and community-scale renewables. While there is currently no legislation mandating local generation, the government's Clean Power Action Plan does set out ambition for high level regions.

10.3 Context

NESO's Future energy scenarios predict increased national energy demand between 2022 and 2040, driven by population growth, housing expansion, and commercial and industrial development.[63] To meet this rising demand, it is important to expand local energy generation across both districts.

Currently, some initiatives are underway, including the rollout of rooftop solar panels and battery installations across 120 council-owned properties in Ashfield, aimed at reducing energy bills for residents.[64] In Mansfield, government funded household retrofits and regeneration projects have been targeted, incorporating energy efficiency measures and PV installations.[65]

Looking ahead, both districts must build on these initiatives by significantly scaling up the deployment of local low-carbon energy solutions. By expanding rooftop solar PV across domestic and non-domestic sectors and integrating battery energy storage systems, Ashfield and Mansfield can accelerate the decarbonisation of their local energy systems, supporting both regional and national net zero targets.

Battery Energy Storage Systems (BESS) present a promising opportunity for supporting the decarbonisation of Mansfield and Ashfield's energy systems, particularly at the domestic and commercial scale. When paired with rooftop solar PV, BESS can help maximise self-consumption of locally generated electricity, reducing reliance on the grid and improving energy resilience. Ashfield already has underway an innovation project relating to distribution-connected BESS, which could provide a useful precedent for other local authorities.

10.4 Intervention Methodology

A suitability assessment was conducted using rooftop area and orientation data. It assumes optimal solar PV installation on 80% of feasible South, South-East, and South-West facing rooftops across domestic and non-domestic buildings. Suitability was determined based on roof orientation, size, and shading constraints, with architectural features like hipped/gabled roofs, chimneys and skylights reducing viability.

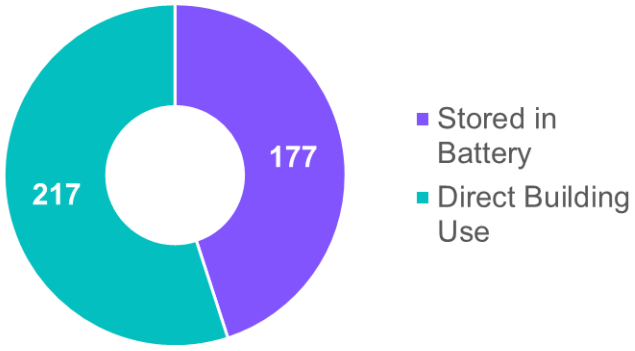
Under these assumptions, rooftop PV could enable up to 231 GWh of generation from domestic properties and 163 GWh from non-domestic properties annually. Solar panel efficiency was modelled at 18%. Domestic and non-domestic buildings were categorised as either single or multi-dwelling/unit, and total energy generation was calculated for each roof orientation (south, southeast, and southwest).

Although specific battery capacities (in terms of energy and power) are not calculated, it is assumed based on UK research that 45% of the photovoltaic energy yield is used by the building, while the remaining 55% is stored for later use. This storage capacity could be provided by a mix of technologies, such as home batteries or vehicle-to-grid connections. The share of storage to PV is considered to be representative at the local authority level, rather than at the individual property level, to allow for the flexibility in consumer choice and energy usage

[63] Future Energy Scenarios (FES) | National Energy System Operator
[64] Green energy to slash heating bills - Ashfield District Council
[65] Mansfield targeted for energy efficiency projects - labm

patterns at time of generation by the battery. Ground-mounted solar was excluded due to limited suitable council-owned land.

Figure 10.2: Solar Energy Potential Generation Distribution (GWh)



10.5 Scenarios

Figure 10.3, Figure 10.4 and Figure 10.5 illustrate the projected uptake of rooftop solar PV installations across domestic and non-domestic sectors.

The uptake curves are shaped to reflect timing that is beneficial for both carbon and cost savings from rooftop PV installations, with uptake rates aligned to CCC projections.[66] The majority of installations take place before grid decarbonisation in 2035. In the 2040 scenario, 80% of panels are installed by 2035, compared with 69% in the 2050 scenario. After 2035, uptake slows as demand for roof-mounted PV is expected to decline once the grid has decarbonised. Subsequent installations are primarily driven by users seeking cost savings rather than emissions reductions. The detailed uptake rates are shown in Figure 10.3.

Since the carbon intensity of the electricity grid is expected to decline significantly by 2035, the greatest carbon benefit from rooftop PV occurs when installations happen before full grid decarbonisation. Beyond this point, the marginal carbon savings from additional rooftop PV diminish.

Nonetheless, local expansion of grid capacity and generation capability will continue to bring benefits such as reducing grid connection and capacity constraints, particularly as electrification increases through technologies like space heating and EV charging. It also enhances demand-side response resilience, especially when paired with local storage capacity.

Recent market analysis indicates that the cost of solar PV panels and battery storage systems continues to decline, driven by technological innovation, economies of scale, and supportive policy frameworks. For example, capital expenditure for battery energy storage in the UK has fallen by approximately 30% since 2022, with further reductions expected over the next five years. Global forecasts suggest battery storage costs could drop by up to 40% by 2030, making solar-plus-storage systems increasingly competitive with conventional energy sources.

[66] A reliable, secure and decarbonised power system by 2035 is possible – but not at this pace of delivery - Climate Change Committee

Figure 10.3: Rooftop PV annual uptake of installations in 2040 and 2050 scenarios.

Year	2050		2040	
	Annual uptake	Cumulative uptake	Annual uptake	Cumulative uptake
2025	**0.0%**	**0%**	0.0%	0%
2026	1.0%	1%	1.0%	1%
2027	2.0%	3%	2.0%	3%
2028	5.0%	8%	4.0%	7%
2029	9.0%	17%	8.0%	15%
2030	**15.0%**	**32%**	15.0%	**30%**
2031	13.0%	45%	20.0%	50%
2032	8.0%	53%	10.0%	60%
2033	7.0%	60%	10.0%	70%
2034	5.0%	65%	5.0%	75%
2035	**4.0%**	**69%**	5.0%	**80%**
2036	3.0%	72%	5.0%	85%
2037	3.0%	75%	5.0%	90%
2038	3.0%	78%	5.0%	95%
2039	3.0%	81%	5.0%	100%
2040	**3.0%**	**84%**	0.0%	**100%**
2041	3.0%	87%		
2042	3.0%	90%		
2043	2.5%	93%		
2044	2.5%	95%		
2045	**2.5%**	**98%**		
2046	2.5%	100%		
2047	0.0%	100%		
2048	0.0%	100%		
2049	0.0%	100%		
2050	**0.0%**	**100%**		

In the context of this LAEP modelling, these cost trends support the assumption that solar PV and battery systems may become cost-effective for a majority of households within the next 5–7 years. This assumption directly influences the uptake trajectory in net zero scenarios, where widespread adoption is essential to meet carbon reduction targets.

Figure 10.4: 2050 and 2040 scenario domestic rooftop solar uptake projections in Ashfield and Mansfield

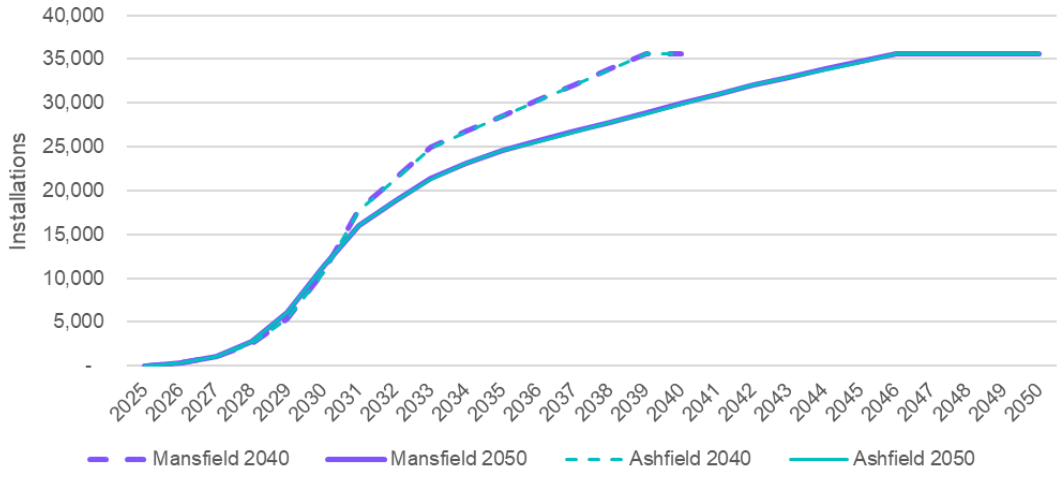


Figure 10.5: 2050 and 2040 scenario non-domestic rooftop solar uptake projections in Ashfield and Mansfield



The affordability of solar PV and battery storage technologies is a key enabler for achieving Ashfield and Mansfield's net zero ambitions, particularly within the residential sector. Decentralised energy generation and on-site storage can reduce pressure on the local network and national grid and enhance local energy resilience, especially as electrification of heat and transport accelerates. However, there is currently no direct funding available from the UK Government for domestic solar PV installations. This presents a significant barrier to uptake, not only for fuel-poor households, but also for middle-income families who may struggle with the upfront capital costs. Without financial support, the pace of adoption required to meet local and national carbon reduction targets may be hindered.

To address this, there is scope to encourage more widespread adoption through community-owned renewable schemes. These initiatives allow groups of homeowners and landlords to collectively purchase solar PV systems for their street or neighbourhood, reducing costs through economies of scale. Such schemes have the potential to lower upfront costs and energy bills for residents, while also fostering local engagement and ownership of the energy transition.

10.6 Results

Figure 10.6 and Figure 10.7 below present the projected annual solar PV yield for the domestic and non-domestic sectors in Ashfield and Mansfield. The domestic sector is expected to generate over 160 GWh per year, while the non-domestic sector is projected to produce approximately 186 GWh annually. Combined, these sectors could deliver more than 350 GWh of renewable electricity each year, representing a substantial contribution to the local energy supply in Ashfield and Mansfield.

This level of generation would significantly reduce reliance on grid-supplied electricity, helping to lower carbon emissions and support the districts' transition to net zero. The increased availability of locally generated renewable energy enhances energy resilience by reducing exposure to national energy price fluctuations and supply disruptions. Additionally, the deployment of solar PV systems across domestic and commercial buildings can stimulate local economic activity through job creation in installation and maintenance.

Figure 10.6: Domestic rooftop solar annual yield projections in Ashfield and Mansfield

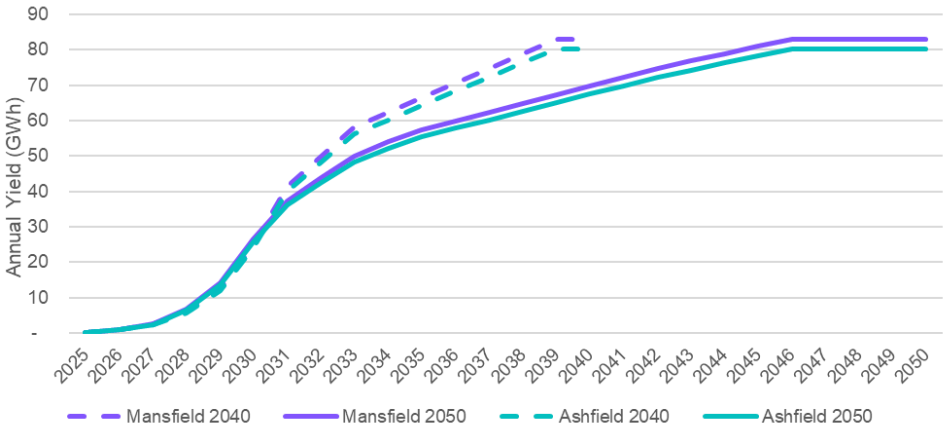


Figure 10.7: Non-domestic rooftop solar annual yield projections in Ashfield and Mansfield

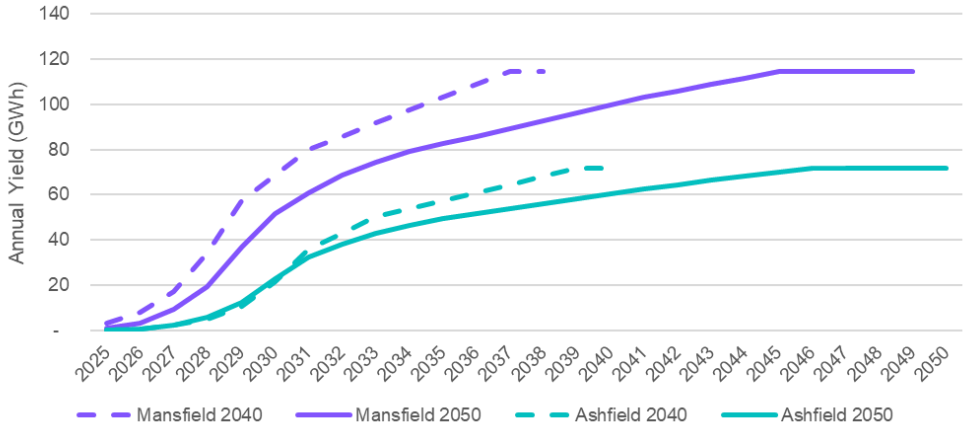


Figure 10.8 and Figure 10.9 compares baseline electricity demand in Ashfield and Mansfield with the estimated annual yield from rooftop solar PV in the domestic and non-domestic sectors. Based on this analysis, solar PV could offset approximately 13% of domestic electricity demand (post heat electrification) for Ashfield, and 15% for Mansfield. In the non-domestic sector, the potential offset is around 16% for Ashfield and 32% for Mansfield. These projections reinforce the strategic value of rooftop solar as a local intervention, particularly when paired with battery energy storage systems (BESS) to maximise self-consumption and grid flexibility.

Figure 10.8: Electricity Demand vs PV Generation - Domestic Sector

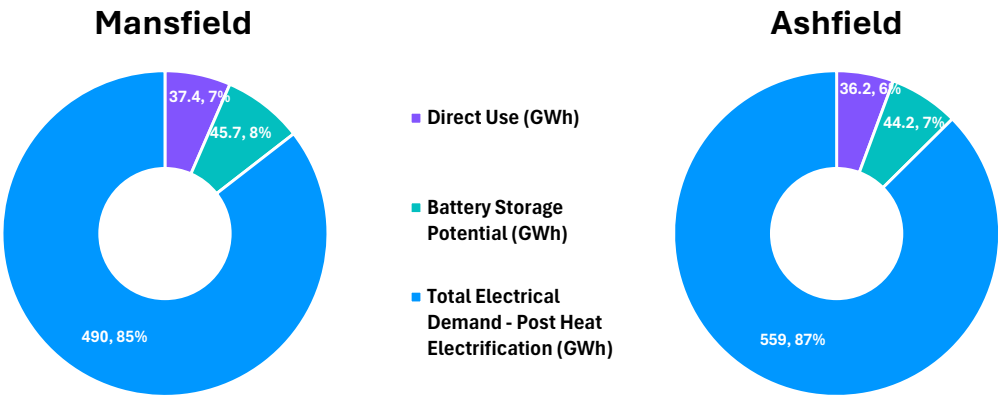
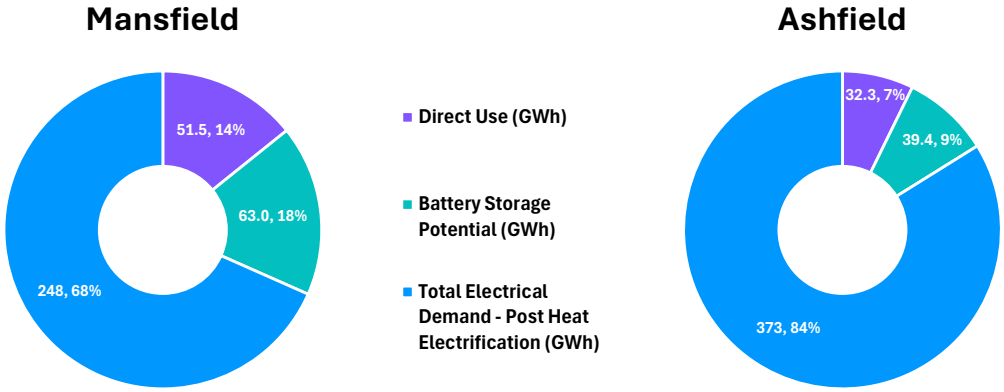


Figure 10.9: Electricity Demand vs PV Generation – Non-Domestic Sector



11 Networks, Storage and Flexibility

This section explores the current state of the electricity network in Ashfield and Mansfield, the implications of planned infrastructure upgrades, and the impact of Low Carbon Technologies (LCTs) on local energy planning.

11.1 Existing Network Constraints

Electricity distribution in Ashfield and Mansfield is managed by National Grid Electricity Distribution (NGED) under its East Midlands licence area. NGED is the Distribution Network Operator (DNO) responsible for maintaining and operating the local electricity network infrastructure.

The local distribution grid connects to the National Grid Transmission System via Grid Supply Points (GSPs), which step down voltage from 400 kV/275 kV to 132 kV. From these GSPs, Bulk Supply Points (BSPs) (typically 132/33 kV) feed primary substations (usually 33 kV/11 kV), which then distribute electricity to homes, businesses, and industrial users across the districts.

The East Midlands licence area has 14 GSPs, of which the following are most relevant to Ashfield and Mansfield include:

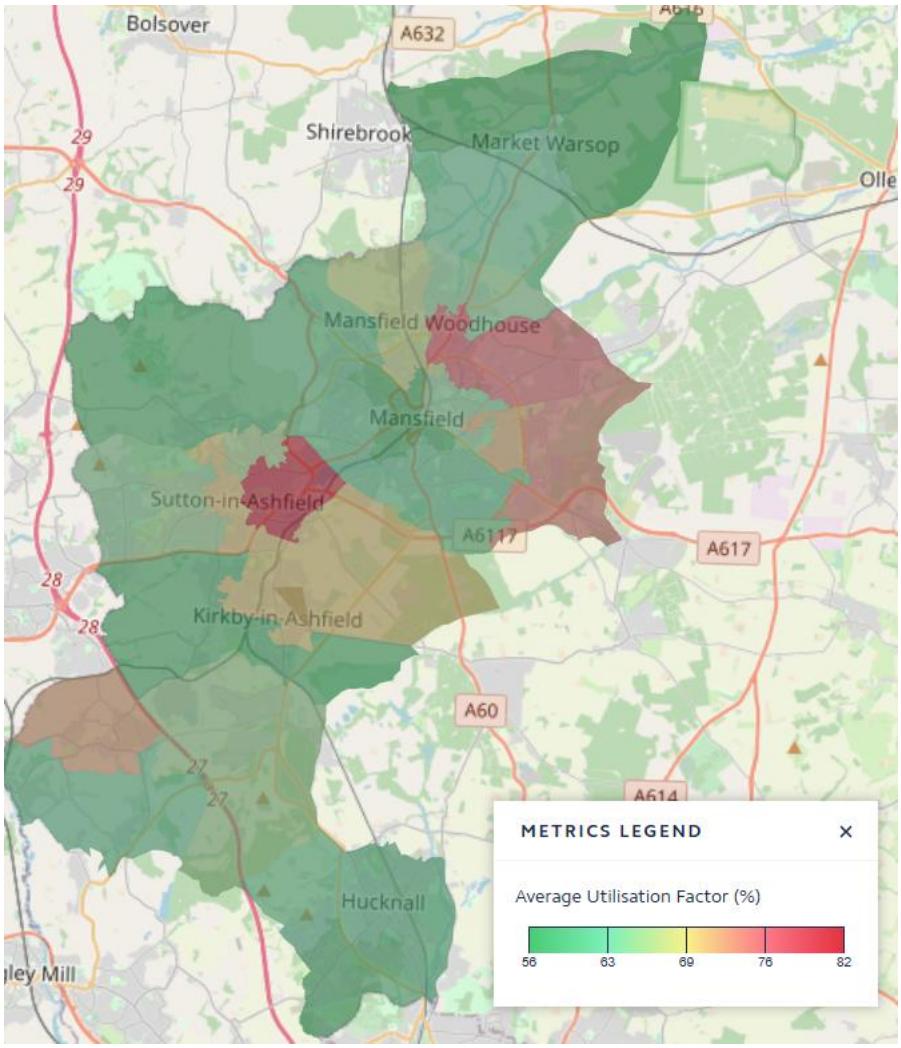
- Stoke Bardolph GSP: Located near Nottingham, serving parts of Ashfield and contributing to network resilience in the wider Nottinghamshire area.
- Ratcliffe GSP: A major East Midlands transmission node that provides capacity and resilience across the region, including Ashfield and Mansfield.
- Staythorpe GSP: While primarily serving Newark & Sherwood, it also contributes to regional capacity that supports Mansfield.

These GSPs are critical nodes in the regional network and are referenced in NGED's Distribution Future Energy Scenarios (DFES) for planning reinforcement and flexibility interventions.

Figure 11.1 illustrates the average grid utilisation factor (%) of secondary substations across the electricity distribution network in Ashfield and Mansfield, colour coded by MSOA. The utilisation factor represents the ratio of maximum demand to the rated capacity of each local substation, providing an indication of how intensively the existing grid infrastructure is being used. Areas with higher utilisation (above 70%, shown in orange and red) are operating closer to capacity and are more likely to require reinforcement in the short-to-medium term as electrification of heat and transport accelerates, while areas with lower utilisation retain greater flexibility to accommodate new electrical loads in the short term. The colour coding of this visualisation has been automatically scaled based on the IES digital twin based on the minimum and maximum values.

On average, both districts exhibit a utilisation factor of around 65%, indicating moderate pressure on existing infrastructure. In Ashfield, MSOA 004 (Sutton Forest Side & New Cross) records the highest utilisation at 82%, while in Mansfield, the Yeoman Hill & Maun Valley and Forest Town & Newlands MSOAs lead with 77% and 75% respectively. These areas are likely to require early reinforcement or flexibility measures to enable electrification.

Figure 11.1: Average Utilisation Factor (%)



Conversely, Kirkby Larwood & Kingsway, Stanton Hill & Skegby, and Hucknall Westville show the lowest utilisation in Ashfield at 58%. For Mansfield, Church Warsop & Meden Vale and Mansfield Town Centre & Broomhill register 56%. These zones present significant capacity to accommodate early deployment of heat pumps, EV charging infrastructure, and distributed renewable generation without immediate reinforcement.

This variation underscores key opportunities for strategic sequencing of low-carbon initiatives. Areas with lower utilisation can support early electrification and distributed energy schemes, while higher utilisation zones will require close collaboration with National Grid Electricity Distribution (NGED) to plan reinforcement, flexibility services, or demand-side management. Coordinating these actions will be essential to ensure network readiness for the scale of electrification needed to achieve net zero across Ashfield and Mansfield.

Figure 11.2: Average Headroom (%)

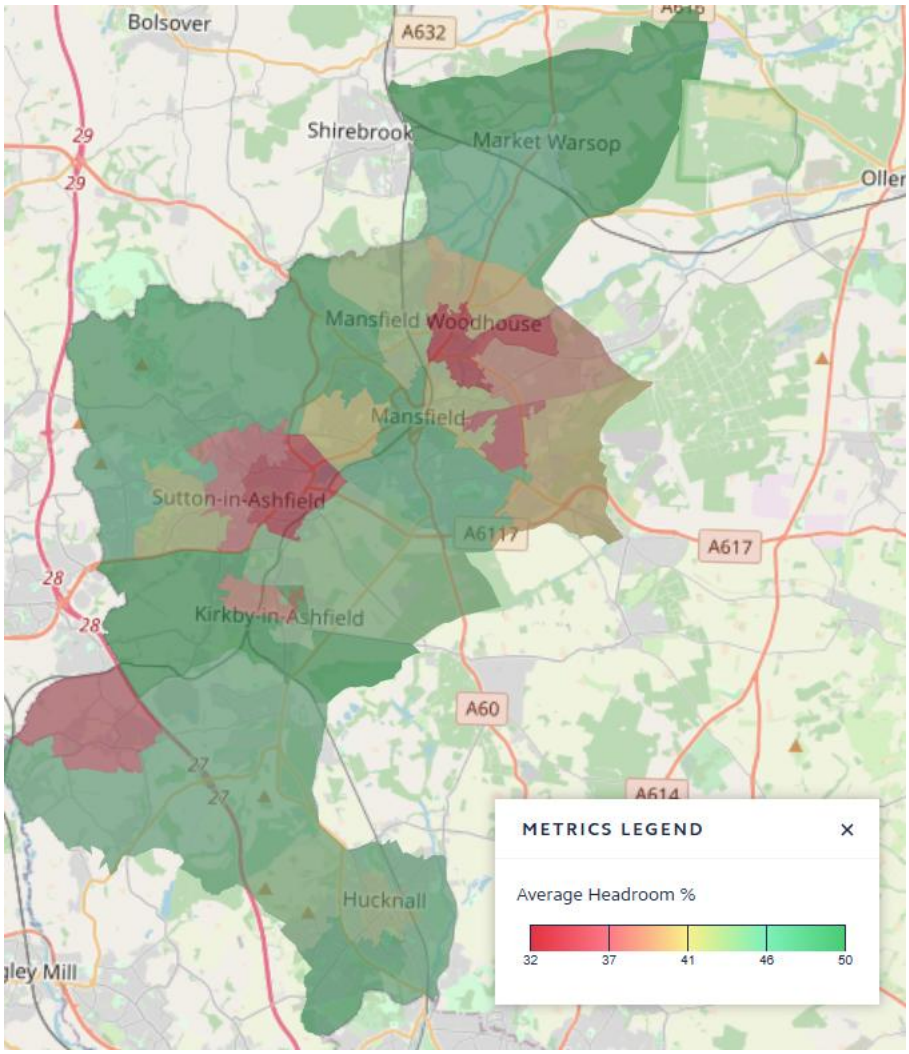


Figure 11.2 illustrates the average available headroom (%) across the electricity distribution network in Ashfield and Mansfield. Headroom represents the proportion of existing grid capacity that remains unused under normal operating conditions, providing a key indicator of the network's ability to accommodate future increases in demand from electrified heat, EVs, and new developments.

Across the two districts, average headroom stands at 43% for Ashfield and 42% for Mansfield. In Ashfield, Sutton Forest Side & New Cross has the lowest headroom at 33%, followed by The Dales & South Skegby and Selston, both at 36%. For Mansfield, Yeoman Hill & Maun Valley records the lowest headroom at 32%, with Eakring & Ling Forest close behind at 35%.

Conversely, Kirkby Larwood & Kingsway in Ashfield and Church Warsop & Meden Vale in Mansfield offer the highest headroom at 50%. These areas are well positioned to support early deployment of heat pumps, direct electric heating systems, EV charging infrastructure, and distributed renewable generation without the need for immediate reinforcement.

This spatial variation has important implications for sequencing low-carbon technologies. Areas with high headroom should be prioritised for early electrification and distributed energy schemes, while lower headroom zones will require targeted engagement with NGED to plan

reinforcement, flexibility solutions, or smart demand management ahead of widespread heat and transport electrification.

Figure 11.3 and Figure 11.4 illustrate contracted demand headroom across primary substations in Ashfield and Mansfield respectively. Each pin on the map corresponds to a substation and indicates the potential demand that could be connected without triggering reinforcement, excluding any upstream constraints.

Each substation is colour-coded on NGED's platform using the standard RAG (Red-Amber-Green) rating:

- Green indicates more than 5% spare capacity,
- Amber represents a positive headroom of less than 5%, and
- Red signifies negative headroom, where demand exceeds available capacity.

These figures highlight existing network pinch points and identify areas where infrastructure is already constrained, based on NGED's own data. These constraints reinforce the need for targeted reinforcement measures to accommodate future demand and enable the deployment of low-carbon technologies such as electric vehicles and heat pumps.

Figure 11.3: Ashfield Network Map: Primary Demand Headroom

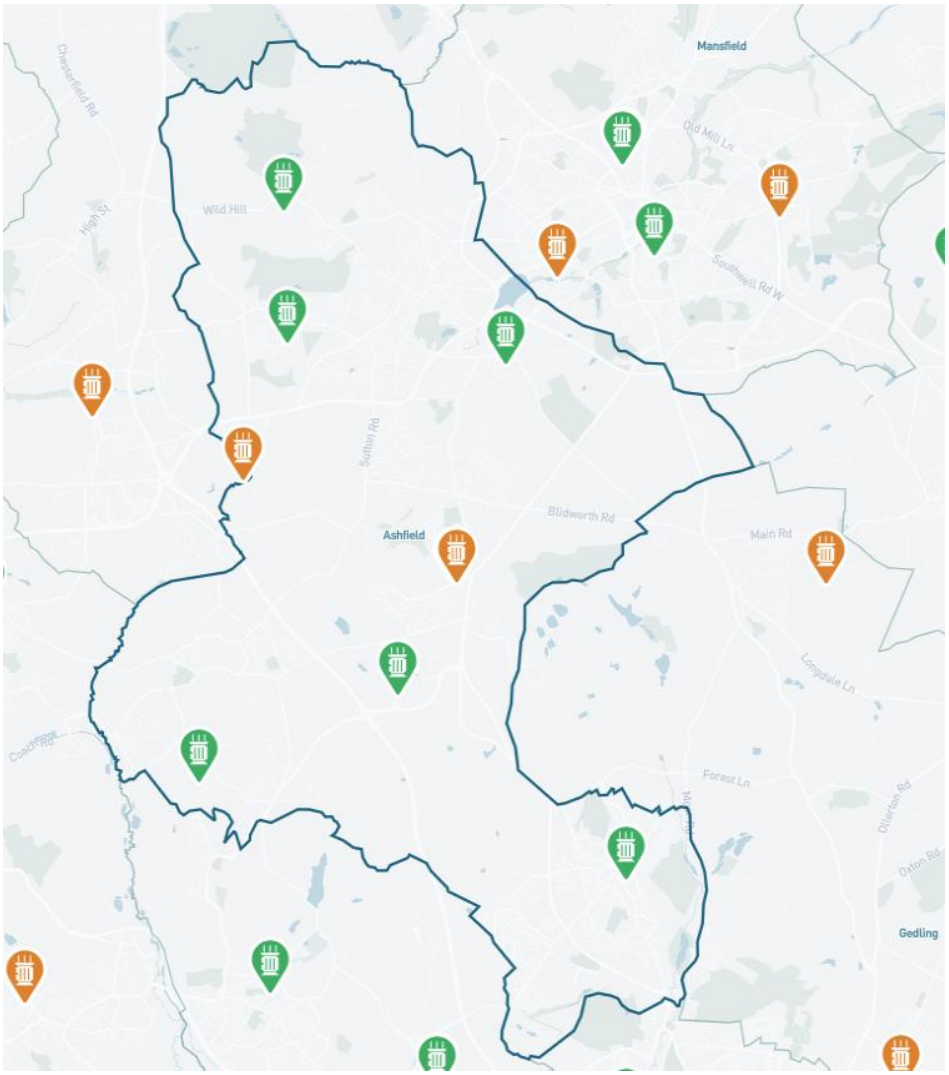
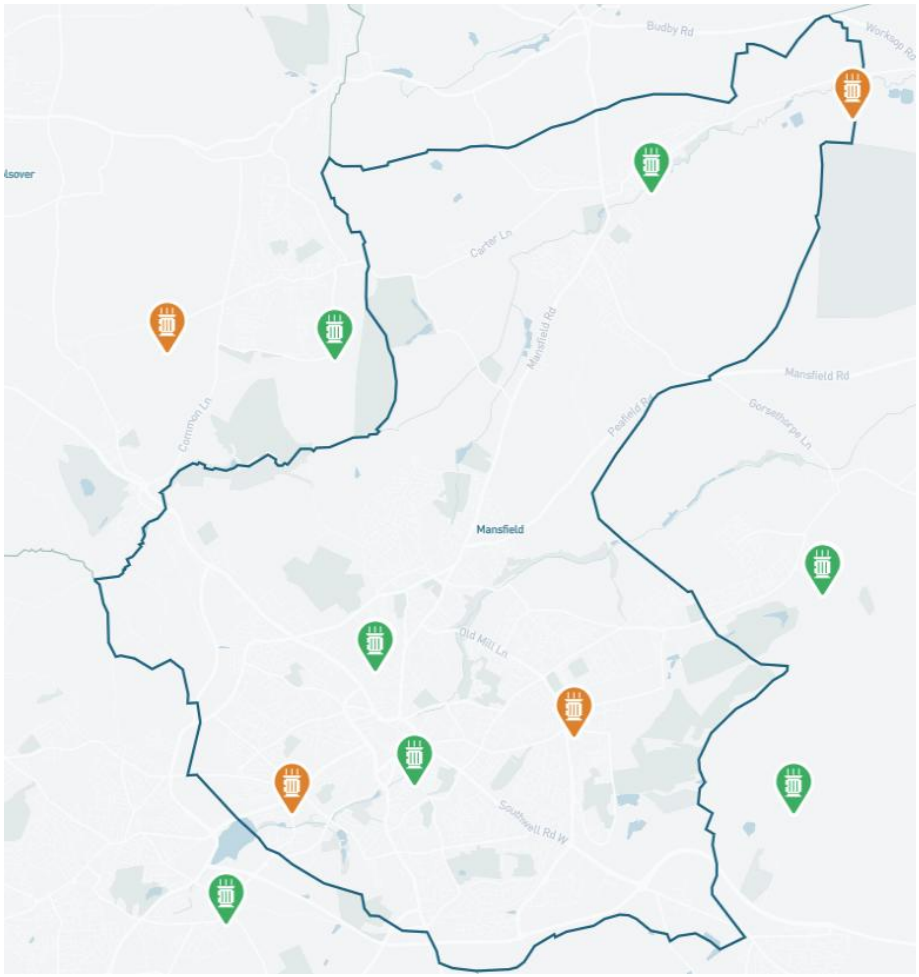


Figure 11.4: Mansfield Network Map: Primary Demand Headroom



Ashfield and Mansfield are projected to experience significant growth in energy demand driven by planned housing developments, population increases, and expansion of commercial and industrial activity through to 2040. The transition to low-carbon technologies will substantially raise electricity consumption and peak loads. This shift places pressure on the capacity and resilience of the local electricity network. To meet future needs, targeted reinforcement, flexibility solutions, and smart energy management will be essential to enable decarbonisation and maintain security of supply.

11.2 Network Impact

After Diversity Maximum Demand (ADMD) represents the maximum expected electrical demand, adjusted to reflect the fact that not all homes and businesses will use their peak load simultaneously. This diversity of usage, where appliances and systems are not all operating at full capacity at the same time, enables network planners to design infrastructure more efficiently, avoiding unnecessary oversizing while still maintaining reliability. ADMD is a critical metric in assessing the total connected capacity required at substations. By applying ADMD values to the number of dwellings or technologies modelled, planners can estimate the aggregate peak demand that substations must be capable of handling. This informs decisions about transformer sizing, cable ratings, and switchgear specifications.

In Ashfield and Mansfield, ADMD modelling has been applied to assess the impact of LCT adoption, particularly ASHPs and EV charging infrastructure. The modelling includes both domestic and non-domestic heat pump installations, as well as public and private EV chargers. Scenario-based uptake rates have been used to reflect different levels of adoption, with diversity factors applied to account for usage patterns: 0.7 for EV chargers, 0.8 for non-domestic ASHPs, and 0.65 for domestic ASHPs. These diversity factors are included to account for the fact that in practise, not all heat pumps or chargers will ever be in operation at the exact same time. For example, a diversity factor of 0.7 indicates that the total instantaneous electrical demands for all installations of a given technology, will likely never exceed 70% of the total installed capacity.

Table 11.1: Estimated increase in ADMD across Ashfield and Mansfield attributable to adoption of LCTs (EV charging and ASHPs)

	Scenario	2030	2035	2040	2050	Annual Growth (MW)
Ashfield	2040 Net Zero	117	301	463		31
	2050 Net Zero	87	192	324	467	18
Mansfield	2040 Net Zero	100	258	395		26
	2050 Net Zero	76	167	280	402	16

Figure 11.5: Ashfield aggregated ADMD increases (MW)

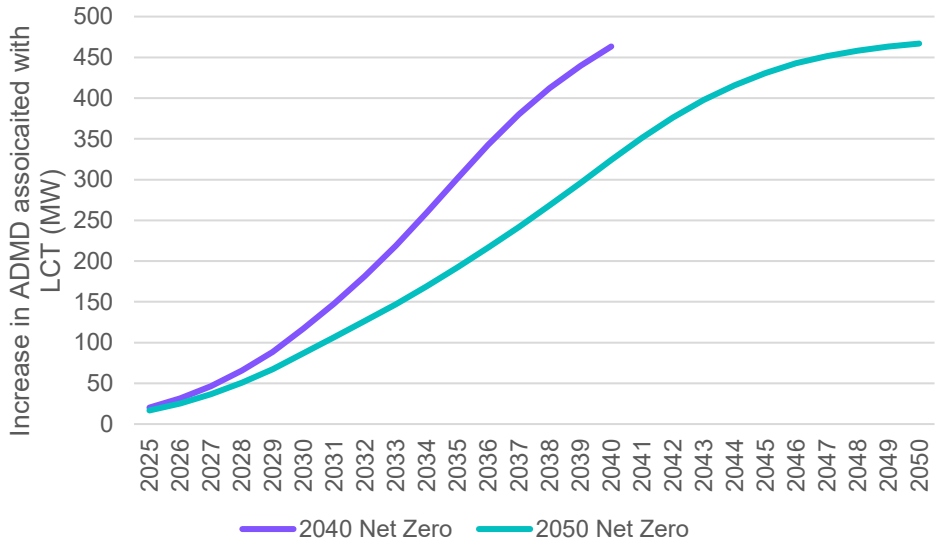


Figure 11.6: Mansfield aggregated ADMD increases (MW)

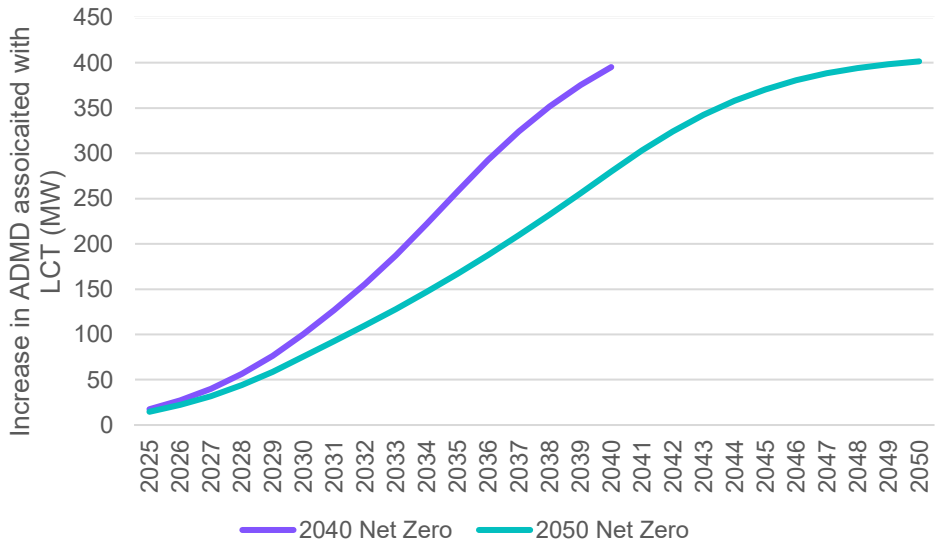


Figure 11.7: ADMD Increase by MSOA

MSOA	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Ashfield 001 - Stanton Hill & Skegby	1.0	1.6	2.3	3.3	4.5	5.9	7.4	9.1	11.0	13.0	15.1	17.1	18.9	20.6	21.9	23.1
Ashfield 002 - The Dales & South Skegby	0.9	1.4	2.0	2.8	3.8	5.0	6.3	7.7	9.2	10.9	12.6	14.2	15.8	17.1	18.2	19.2
Ashfield 003 - Huthwaite	1.1	1.7	2.5	3.5	4.8	6.3	8.0	9.9	12.0	14.4	16.7	19.1	21.2	23.1	24.6	26.0
Ashfield 004 - Sutton Forest Side & New Cross	1.6	2.5	3.7	5.2	7.1	9.3	11.7	14.3	17.2	20.3	23.5	26.7	29.5	32.0	34.1	35.9
Ashfield 005 - Stton Central & Leamington	1.2	1.9	2.8	4.0	5.4	7.1	8.9	10.9	13.1	15.5	17.9	20.3	22.4	24.3	25.9	27.3
Ashfield 006 - Sutton St Mary's & Ashfields	1.6	2.4	3.6	5.0	6.8	9.0	11.4	14.0	16.9	20.0	23.3	26.5	29.4	31.9	34.0	35.8
Ashfield 007 - East Kirkby	1.2	2.0	3.0	4.3	5.8	7.8	10.1	12.7	15.7	19.0	22.5	26.0	29.1	31.8	34.0	35.8
Ashfield 008 - Kirkby Central	1.0	1.5	2.3	3.2	4.4	5.7	7.2	8.9	10.7	12.7	14.7	16.7	18.5	20.0	21.4	22.5
Ashfield 009 - Kirkby Larwood & Kingsway	1.5	2.3	3.4	4.9	6.6	8.7	10.9	13.4	16.2	19.1	22.2	25.2	27.9	30.3	32.3	34.0
Ashfield 010 - Annesley & Kirkby Woodhouse	1.2	1.9	2.9	4.1	5.6	7.4	9.4	11.7	14.2	16.9	19.8	22.7	25.2	27.4	29.3	30.9
Ashfield 011 - Selston	1.0	1.6	2.4	3.3	4.5	6.0	7.5	9.3	11.2	13.3	15.4	17.5	19.4	21.1	22.5	23.7
Ashfield 012 - Jacksdale & Underwood	0.9	1.5	2.2	3.1	4.1	5.4	6.9	8.4	10.1	12.0	13.9	15.8	17.5	19.0	20.3	21.3
Ashfield 013 - Hucknall North & East	1.7	2.6	3.8	5.4	7.2	9.5	11.9	14.6	17.4	20.5	23.7	26.8	29.6	32.1	34.2	36.0
Ashfield 014 - Hucknall Town - csv export	1.5	2.3	3.4	4.8	6.4	8.5	10.6	12.9	15.4	18.2	20.9	23.7	26.1	28.3	30.1	31.7
Ashfield 015 - West Hucknall	1.2	1.9	2.7	3.9	5.2	6.8	8.6	10.5	12.6	14.9	17.2	19.4	21.5	23.3	24.8	26.2
Ashfield 016 - Hucknall Westville	1.5	2.3	3.4	4.8	6.4	8.5	10.7	13.2	15.9	18.9	22.0	25.0	27.7	30.1	32.1	33.8
Total ADMD (MW)	**20**	**31**	**46**	**66**	**89**	**117**	**148**	**182**	**219**	**259**	**301**	**343**	**380**	**412**	**440**	**463**
Mansfield 001 - Church Warsop & Meden Vale	1.0	1.6	2.4	3.4	4.6	6.2	7.9	9.9	12.1	14.6	17.1	19.7	21.9	23.9	25.6	26.9
Mansfield 002 - Market Warsop	1.0	1.5	2.2	3.1	4.1	5.4	6.7	8.1	9.7	11.3	12.9	14.6	16.0	17.3	18.4	19.4
Mansfield 003 - Manor, Hornby & Peafields	1.2	1.9	2.9	4.0	5.5	7.3	9.2	11.4	13.8	16.4	19.1	21.8	24.2	26.3	28.1	29.6
Mansfield 004 - Woodhouse	1.3	2.0	3.0	4.2	5.6	7.4	9.4	11.5	13.8	16.4	19.0	21.5	23.8	25.8	27.6	29.0
Mansfield 005 - Yeoman Hill & Maun Valley	0.9	1.5	2.2	3.1	4.3	5.7	7.2	8.9	10.9	13.0	15.2	17.4	19.3	21.0	22.5	23.7
Mansfield 006 - Abbott Road & Pleasley Hill	1.4	2.2	3.2	4.5	6.1	8.0	10.0	12.1	14.5	17.0	19.5	22.0	24.3	26.3	28.0	29.5
Mansfield 007 - Forest Town & Newlands	1.8	2.7	3.9	5.5	7.3	9.5	11.7	14.1	16.5	19.1	21.7	24.2	26.4	28.5	30.2	31.8
Mansfield 008 - Mansfield Town Centre & Broomhill	1.6	2.6	3.9	5.6	7.8	10.5	13.5	17.1	21.2	25.8	30.7	35.5	39.8	43.5	46.6	49.1
Mansfield 009 - Newgate & Carr Bank	1.3	2.1	3.1	4.3	5.8	7.7	9.7	12.0	14.4	17.1	19.8	22.5	24.9	27.1	28.9	30.4
Mansfield 010 - Grange Farm & Ladybrook	1.7	2.6	3.8	5.3	7.0	9.2	11.4	13.7	16.2	18.9	21.5	24.1	26.5	28.6	30.4	32.0
Mansfield 011_Eakring & Ling Forest	1.0	1.6	2.4	3.3	4.5	6.0	7.5	9.3	11.2	13.3	15.4	17.5	19.5	21.1	22.5	23.7
Mansfield 012 - Oak Tree & Ransom	1.0	1.6	2.3	3.3	4.4	5.9	7.4	9.1	11.0	13.1	15.3	17.4	19.3	21.0	22.4	23.6
Mansfield 013 - King's Walk, Berry Hill & Oakham	2.1	3.2	4.8	6.7	9.1	12.0	15.1	18.5	22.2	26.2	30.4	34.5	38.2	41.4	44.1	46.5
Total ADMD (MW)	**17**	**27**	**40**	**56**	**76**	**100**	**127**	**156**	**187**	**222**	**258**	**293**	**324**	**352**	**375**	**395**

Figure 11.7 above illustrates the additional increase in demand from low-carbon technologies (LCT) across each MSOA on an annual basis. If technologies are deployed at the scale and pace outlined in the LAEP, the secondary substations in most MSOA areas are projected to exceed their current capacity by 2030. It is important to note that secondary substation areas do not perfectly align with MSOA boundaries; therefore, this calculation represents a high-level estimation based on the closest overlaps between secondary substation and MSOA boundaries.

This model presents a strong case for proactive investment in distribution network upgrades, as any net zero-compliant scenario is expected to significantly increase ADMD beyond the capacity of the current infrastructure. Without timely reinforcement, substations may face breaches of headroom, leading to delays in new connections and limiting the pace of electrification and decarbonisation across the districts.

11.2.1 Impact of Negative Headroom on Net Zero

As demonstrated in the previous section, any net zero compliant scenario for Ashfield and Mansfield results in '**negative headroom'** at the substation level. This means that the projected ADMD exceeds the available network capacity, indicating that the existing infrastructure is no longer sufficient to accommodate future load growth.

A breach of headroom signals the need for reinforcement measures, such as substation upgrades or the deployment of flexibility solutions, to avoid constraints, maintain reliability, and support continued connections to the electricity network. These constraints directly affect how quickly and affordably new connections, whether domestic, commercial, or related to LCTs, can be made. In constrained areas, connection requests may be delayed or queued until reinforcement works are completed, potentially slowing the pace of electrification, decarbonisation, and urban development.

From a financial perspective, a breach at a substation can trigger the need for infrastructure upgrades, such as new transformers, expanded substation capacity, or reinforced feeder circuits. Under the current regulatory framework, new customers are liable only for costs at the point of connection, while upstream reinforcement costs are covered by the DNO and recovered through fixed daily charges applied to all consumers. For example, if a large industrial site in Ashfield or Mansfield applies for additional capacity to decarbonise its operations, and this causes a breach at the primary substation, the customer would only pay for the direct connection. The DNO would manage and fund any upstream upgrades, although delays may still occur depending on network availability and planning timelines.

In areas with persistent constraints, alternative approaches such as flexibility services, energy storage, or demand-side management may be considered to defer or reduce the need for capital investment. However, these solutions require coordination, digital infrastructure, and regulatory support to be effective. The results shown in the LAEP should be reviewed in detail by NGED and NESO to enable proactive, system-level planning. This would help ensure that individual customers do not bear disproportionate costs or face delays, and that the electrical network infrastructure keeps pace with decarbonisation and growth in both districts.

11.3 Storage and Demand Side Response

Demand Side Response (DSR) refers to the strategic adjustment of electricity consumption patterns by end users in response to signals from the network operator. These signals may include price incentives, time-of-use tariffs, or direct requests to reduce or shift demand during peak periods. DSR enables the electricity system to operate more flexibly by aligning demand with available supply, particularly during times of network stress or limited capacity.

In Ashfield and Mansfield, the implementation of DSR alongside stationary energy storage, especially when integrated with solar PV systems, offers a practical mechanism for managing grid constraints and enhancing local energy resilience. Solar PV allows sites to generate electricity locally, while battery storage captures surplus generation for later use. This stored energy can be discharged during peak demand periods, aligning on-site consumption with grid needs and reducing pressure on the network.

This coordinated flexibility helps lower peak demand during periods of increased consumption, mitigating breaches of headroom and deferring the need for costly infrastructure upgrades such as transformer replacements or feeder circuit expansions. By enabling the generation and use of low-carbon, locally produced energy, the combined use of DSR and storage contributes to a more affordable, secure, and sustainable energy system.

While the financial benefits of DSR and storage will vary depending on market conditions, technology costs, and consumer participation, their coordinated use presents a viable

opportunity to reduce peak demand, defer infrastructure upgrades, and unlock new value streams for energy users. The feasibility of this opportunity in Ashfield and Mansfield will depend on factors such as digital infrastructure readiness, regulatory support, and collaboration between DNOs, aggregators, and end users.

12 Economic Assessment

12.1 Overview of economic assessment

The high-level assessment of costs and benefits for decarbonising the area under the two transition scenarios, 2040 and 2050, indicates that investment in the local energy transition could deliver significant benefits relative to the 'Do Nothing' scenario. Although the required investment is substantial and the pace of transition will depend on sustained policy and grant support, it is expected to generate benefits through lower energy bills, carbon reduction, improved air quality, and employment stimulation in the local economy.

This analysis estimates indicative capital expenditure (capex) and cash and non-cash costs and benefits[67] for the interventions within scope. This reflects the strategic, early-stage nature of the LAEP and aligns with other LAEPs developed across the UK. If this capex is spent, then significant benefits can be realised, summarised in Table 12.1 for both scenarios.

- **Total estimated capex to 2050 in both scenarios is £3.7 billion in 2025 values, before the impact of discounting.** This is the gross cost without considering the contribution from government subsidy programmes, therefore the cost of investment to the local economy is likely to be significantly lower given existing grant support and national government commitment enshrined in law to achieve Net Zero by 2050. The success of the transition under current market conditions is dependent on sustained grant support, which will strongly influence the scale and pace of action.
- **Deep fabric retrofit and domestic and non-domestic air source heat pumps account for 57% of the total investment (£2.1 billion**). This investment is expected to be funded through a combination of public sector support and household/organisation contributions.
- Benefit estimates from deploying technologies in the two net zero scenarios include:
- **Carbon savings:** £1.3 billion for 2040 and £1.0 billion for 2050 (discounted) in carbon reduction driven primarily driven by the installation of domestic air source heat pumps.
- **Air quality improvements:** £21 million for 2040 and £15 million for 2050 (discounted) of benefits to human health, productivity, wellbeing, and the environment due to improvements in air quality.
- **Impact on bills:** £670 million for 2040 and £662 million for 2050 (discounted) of savings from utility bills which are a result of self-generation (rooftop solar), fuel switching to lower-cost technologies, and reduced energy demand through retrofit measures. Sensitivity analysis suggestions this could vary to savings between £506 million and £970 million under the 2050 scenario, depending on energy price trends.
- **Substantial economic activity could be generated from the transition.** Assuming installation and fitting of these technologies are carried out by workers, the average economic contribution per year could be £56 million to £59 million, with an aggregate impact of £1.5 billion to 2050.
- **Transition to EVs enabled by charging infrastructure could generate significantly greater benefits,** most notably additional £608 million - £715 million of carbon reduction benefits. These enabled benefits are always shown separately in the subsequent analysis.

[67] Cash benefits reduce actual expenditure or release cash that can be reallocated elsewhere such as direct financial savings, revenue generation, and avoided costs.

non-cash benefits do not result in direct financial savings but still contribute to public or social value – for example carbon savings.

Table 12.1: Estimated capex and associated benefits, vs Do Nothing, £' m

£m (2025)	2040 (£' m)	2050 (£' m)
Discounted values		
Capex (discounted)	2,806	2,478
Carbon savings	1,308	1,000
Air quality improvements	21	15
Impact on bills (ex VAT)	670	662
Capex (financial)	3,661	3,661
Average annual economic contribution (GVA)	59	56
Aggregated economic contribution (GVA) to 2050	**1,539**	**1,454**

Source: Mott MacDonald

12.2 Approach to analysis and key considerations

For the two transition scenarios (2040 and 2050), costs and benefits from the scenarios are estimated. These cover capital expenditure (both undiscounted and discounted) and welfare enhancing benefits and economic contribution, which are derived from the following core inputs:

- Modelled installation volumes for net-zero technologies
- Modelled changes in gas and electricity consumption
- Unit costs for technology purchase and installation, based on published sources (e.g., Department of Energy Security and Net Zero (DESNZ)), as well as internal data from Mott MacDonald cost consultants.
- Published assumptions on carbon appraisal values, air quality damage costs, and the economic value of net zero transition activities.

This assessment quantifies and presents capital expenditure (CAPEX) to 2050 - both discounted and undiscounted - for net zero technologies deployed under two scenarios: delivery by 2040 and delivery 2050, each assessed relative to a 'do minimum' counterfactual.

Undiscounted CAPEX is provided to show the total financial outlay required to 2050, in 2025 prices, without adjustments for risk, inflation or the time value of money.

Discounted CAPEX is presented to show the adjusted CAPEX value reflecting the time value of money, for economic analysis and in line with HM Treasury Green Book best practice. This applies the Green Book social time preference of money.

In addition to capital costs, the analysis considers associated cash and noncash benefits, including carbon savings, air quality improvements. In addition, a high-level estimate of economic contribution from employment associated with capex is presented.



CAPEX (cash)



Valuation of carbon impacts (non-cash)



Impact on bills (cash)



Improvement in air quality (non-cash)



Valuation of economic contribution (non-cash)

When interpreting the analysis, several key considerations should be considered around:

- The scope of analysis
- Price base, discounting and appraisal period
- Cost base assumptions
- Bill impacts
- Benefits associated with EV charger deployment
- Assumptions and sources.

12.2.1 Scope of the analysis

While we have estimated capex and outlined indicative benefits that might result from investment, some costs and benefits fall outside the scope of this exercise (e.g., operational expenditure). Accordingly, this is not a full Cost Benefit Analysis (CBA) and the analysis is not presented as an aggregate Net Present Social Value (NPSV).

However, the analysis provides a clear foundation for understanding capital investment requirements and associated benefits. A comprehensive assessment capturing operating expenditure and wider societal benefits to derive a Net Present Social Value would be a valuable next step.

12.2.2 Price base, discounting and time horizon

All costs and benefits are presented in constant 2025 prices (real terms). Historic and nominal inputs are converted to 2025 using the Office for Budget Responsibility (OBR) GDP deflator. Discounting follows the HM Treasury Green Book (2026) social discounting schedule to convert future streams into present values, reflecting time preference. To capture the full operational lifespan of all assets, the model extends beyond 2050 by the longest asset life.

12.2.3 Cost base assumptions

Capital costs in this assessment are based on unit costs derived from Mott MacDonald's internal cost benchmarking, supplemented by published sources such as DESNZ and other relevant industry data. To reflect uncertainty at this stage of appraisal, the Association for the Advancement of Cost Engineering (AACE) Class 4 accuracy ranges (–20% to +50%) are applied to show possible ranges, which are appropriate for early-stage, high-level estimates. This approach ensures the cost base is robust, transparent, and aligned with best practice for strategic economic assessment.

12.2.4 Bill impacts

Bill impacts reflect changes in energy consumption gas and grid electricity, only. Household expenditure on maintenance, servicing, or replacement is excluded. Bill impacts are presented in economic appraisal terms (net of tax, and discounted).

12.2.5 Benefits associated with EV ChargePoint investment

EV charge points have the potential to generate benefits through enabling the displacement of Internal Combustion Engine (ICE) vehicles, thereby generating reductions in carbon emissions, improvements in air quality, and lower energy bills. However, the extent to which the provision of charge points directly drives EV uptake is highly uncertain. As a result, the potential benefits associated with enabling EV adoption are not included in the core assessment.

12.2.6 Treatment of gross value added (GVA)

High level estimates of the potential economic contribution from the direct creation of jobs associated with fitting and installation of decarbonisation measures is estimated based on publicly sourced type 1 multipliers[68], assuming that there is no leakage i.e. those employed to support the transition are locally employed. This is a high level estimate of Gross Value Added (GVA).

12.2.7 Scenarios

Three scenarios are modelled in this appraisal: the Do Nothing, 2040, and 2050. The results are presented with the 2040 and 2050 in comparison to the Do Nothing to show the relative costs and benefits versus a minimum/baseline scenario.

12.3 Assumptions

12.3.1 Use of published sources

Where available, assumptions from HM Treasury's Green Book (2026) have been applied including for the discount rate, forecast energy retail price movements, and carbon emission factors. All inputs are set to 2025 prices using the Office for Budget Responsibility's (OBR) GDP Deflator[69], to reflect the 2025 base year of the model for benefits and costs. All benefits and costs are measured in millions of pounds (£m). Key assumptions used in this analysis are set out in Table 12.2.

12.3.2 Key assumptions

Table 12.2 lists the key assumptions used in the Economic appraisal.

Table 12.2: Key assumptions used in the Economic appraisal

Assumption	Description
Discount rate	A social time preference discount rate of 3.5% and a health discount rate of 1.5% per the HM Treasury's Green Book (2026).
Carbon price	The HM Treasury's Green Book (2026) 'Medium' carbon price profile escalated to 2025 values using OBR's GDP deflator.
Domestic utility prices (electric, gas)	Ofgem energy price cap with future prices aligned to HM Treasury's Green Book (2026) price forecast escalated to 2025 values using OBR's GDP deflator.
Non-domestic utility prices (electric, gas)	HM Treasury's Green Book (2026) long run variable cost (LRVC) price forecast escalated to 2025 values using OBR's GDP deflator.
Road fuel prices	The HM Treasury's Green Book (2026) 'Medium' road fuel price Long Run Variable Cost profile escalated to 2025 values using OBR's GDP deflator.

[68] Sustainable Transition Effects on Labor Market, Sustainable Development Solutions Network, Available at: https://www.jstor.org/stable/pdf/resrep29195.3.pdf

Assumption	Description
Carbon emission factors	The HM Treasury's Green Book (2026) long run marginal carbon emission factors.
Gross value added (GVA)	**Output per job figure for the construction industry provided by ONS escalated to 2025 values using OBR's GDP deflator.**

Source: UK GOV, Ofgem, ONS, OBR

12.4 Detailed results

12.4.1 Capital expenditure

Capital expenditure (capex) is presented in two ways:

- Undiscounted capex is provided to show the total financial outlay required to 2050 in today's prices, without adjustments for risk or the time value of money.
- **Discounted capex is presented to show the adjusted capex value reflecting the time value of money**, for economic analysis and in line with HM Treasury Green Book best practice. This applies the Green Book social time preference of money discount rate.

All capex is presented as the additional spend above the Do Nothing scenario, which assumes minimum building fabric improvements to achieve MEES EPC compliance and minimal levels of electric vehicle uptake.

12.4.2 Undiscounted capex

Undiscounted capex informs how much might be needed to be invested in today's prices, without reducing future spend for the time value of money (discounting) or increasing for inflation. These values are referenced in the Funding and Finance section below. Table 12.3 below shows the total undiscounted capex, which is identical between the two scenarios.

- **£3.7 bn in today's prices is required** to deliver both net-zero scenarios.
- All capex figures are shown as incremental to the Do Nothing scenario, representing the additional investment required over and above a baseline.
- **The only difference between the two scenarios is the timing of the installations:** while the total number of installations remains the same, the 2040 scenario assumes significantly earlier installations. This will require rapid scale up of supply chains, high levels of consumer adoption and ongoing policy support.
- **The largest areas of expenditure are deep fabric retrofit and air source heat pumps:** These account for nearly 60% of total capital expenditure. To achieve this level of investment the benefits of these measures must be clearly articulated and supported by continued government grants.

Table 12.3: Undiscounted capex vs Do Nothing, £' m (2025, undiscounted)

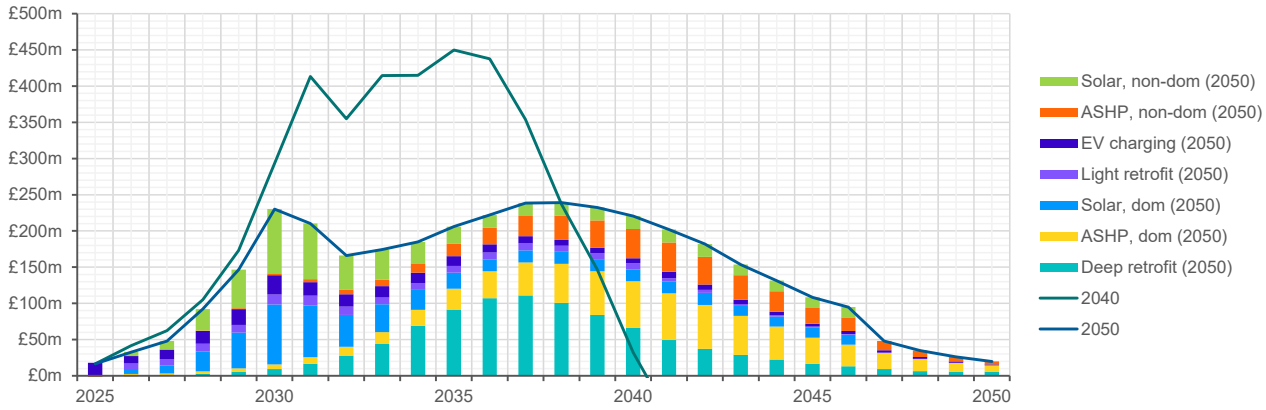
	2040 (£' m)	2050 (£' m)	% of total (2050)
Light fabric retrofit	166	166	**5%**
Deep fabric retrofit	932	932	**25%**
Domestic solar PV	552	552	**15%**
Non-domestic solar PV	593	593	**16%**
Domestic air source heat pumps	717	717	**20%**

	2040 (£' m)	2050 (£' m)	% of total (2050)
Non-domestic air source heat pumps	426	426	**12%**
EV chargers	275	275	**8%**
Total	**3,661**	**3,661**	**100%**

Figure 12.1 illustrates the capex timing profiles for the 2040 and 2050 scenarios. In the 2050 scenario, capital expenditure is broken down by intervention, showing the deployment timeline for each technology. This allows for a direct comparison with the 2040 scenario, which is presented as a single aggregated capex curve.

- **The 2040 scenario assumes much faster deployment rates:** all investment is concluded by 2040, compared to 2050. This assumes all investment over the next 14 years, rather than the next 24 years.
- **The acceleration and peak of investment is much greater in the 2040 scenario:** to achieve the earlier targets, the 2040 scenario assumes rapid scale up of investment with a peak at £450m per year, compared to a slower scale up and peak at £239m a year in the 2050 scenario.
- **Solar and EV chargers lead investment in early years** under both scenarios, with retrofit and ASHP gathering momentum through the 2030s.
- **Achievement of the 2040 scenario relies on accelerating investment in ASHPs and retrofit:** this will be aided by sustained grant support, reduction in electricity prices, and supply chain maturity.

Figure 12.1: Capex, £' m, real, 2025, undiscounted

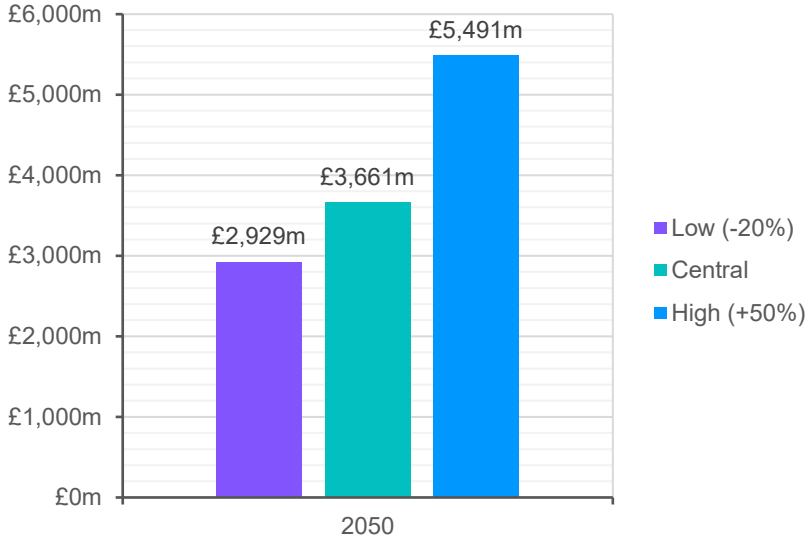


Early strategic assessments have uncertainty over future costs, therefore interval ranges have been applied to illustrate a possible range of investment, reflecting the AACE Class 4 expected accuracy ranges:

- **An upper confidence interval of +50%**, reflecting the potential for cost escalation due to unforeseen scope changes, market volatility, or design evolution.
- **A lower confidence interval of -20%**, accounting for potential cost efficiencies or scope reductions.

The total additional Capex required for the 2050 scenario, compared to the Do Nothing scenario, is outlined below in Figure 12.2.

Figure 12.2: 2050 Capex, vs Do Nothing with confidence intervals, £' m, real, undiscounted, 2025



12.4.3 Discounted capex

Discounted capex illustrates how timing impacts the value of capex and should be considered when appraising capital costs against other costs and benefits. The further the spend occurs in the future, the lower its valuation for the purposes of economic appraisal. This is presented in Table 12.4.

The effect of discounting reduces the present value of capital expenditure to £2.8 bn (2040) and £2.5 bn (2050). This is the relevant basis for comparing to other discounted of costs and benefits.

While the 2050 capital expenditure is lower, the potential benefits from this spend will also be valued lower due to the impact of discounting.

The slower pace of investment in the 2050 scenario reduces the valuation of capital costs by 12%, with slower deployment in all categories resulting in a lower valuation of cost.

Table 12.4: Discounted capex, vs Do Nothing £' m (2025, discounted)

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Light fabric retrofit	137	125	5%
Deep fabric retrofit	681	607	25%
Domestic solar PV	430	412	17%
Non-domestic solar PV	462	442	18%
Domestic air source heat pumps	555	430	17%
Non-domestic air source heat pumps	307	252	10%
EV chargers	234	210	8%
Total	**2,806**	**2,478**	**100%**

12.4.4 Carbon impacts

The value of carbon savings is calculated by multiplying the value of carbon saved per intervention by carbon valuation rates per tonne of CO2e per the HM Treasury Green Book[70]. Both scenarios deliver over £1.0 billion of carbon savings compared to the counterfactual. These are presented in Table 12.5 and Figure 12.3, with the following key findings:

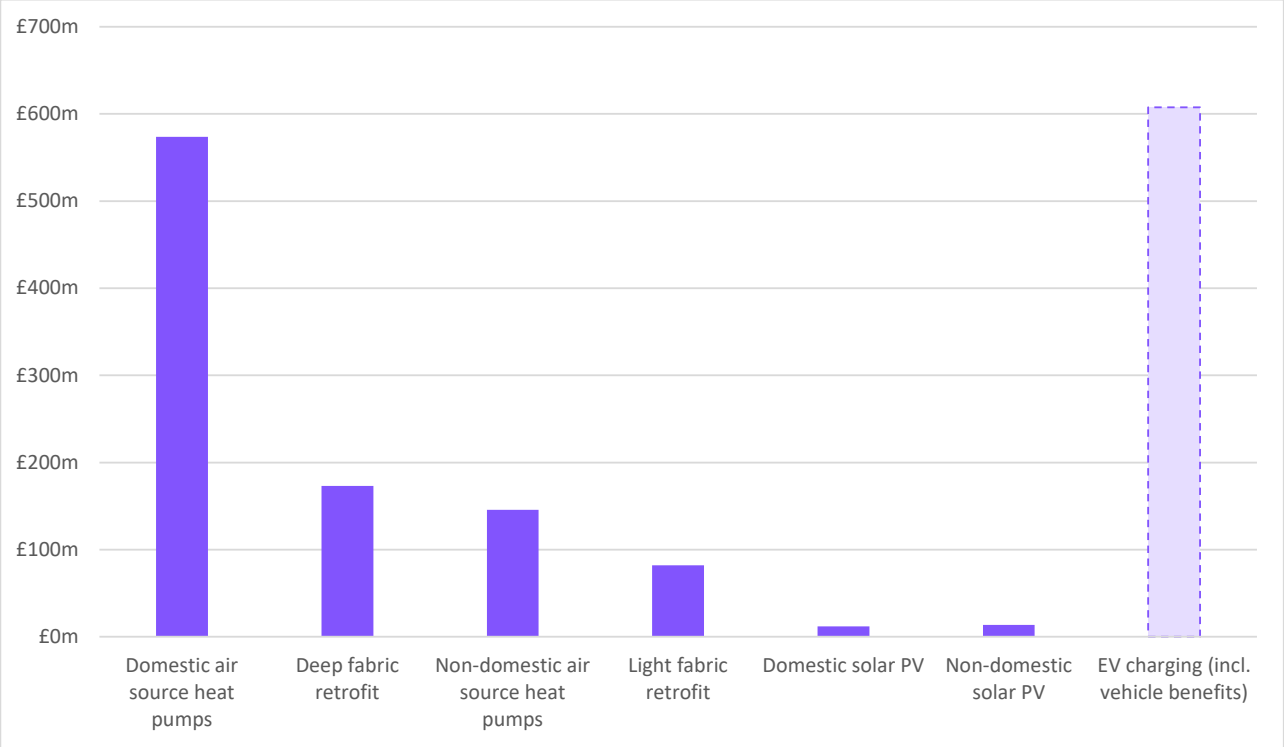
- **Early action drives greater carbon savings.** The 2040 scenario delivers greater carbon savings than the 2050 scenario (approximately £1.3 billion versus £1.0 billion), largely due to earlier deployment of key technologies like air source heat pumps and deep fabric retrofit. This means that accelerating implementation can yield stronger environmental benefits.
- **Domestic and non-domestic air source heat pumps are the most impactful intervention:** heat pumps are responsible for 72-77% of carbon savings in both scenarios, contributing between £719 million and £1,003 million in benefits.
- **EV charging could enable substantial carbon savings.** Even though installation of chargers does not directly create carbon savings, the vehicle emission reductions that could be enabled are very significant. When vehicle benefits are included, EV charging could become one of the largest contributors to carbon savings (£715 million in 2040 and £608 million in 2050).
- **Solar PV has very low impact on carbon reduction,** as the electricity grid is assumed to decarbonise through the coming decade. The benefits of PV will come through impact on bills and energy security, not through carbon reduction.

Table 12.5: Carbon impacts, vs Do Nothing £m (2025, discounted)

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Light fabric retrofit	88	82	8%
Deep fabric retrofit	189	173	17%
Domestic solar PV	13	12	1%
Non-domestic solar PV	15	14	1%
Domestic air source heat pumps	800	574	57%
Non-domestic air source heat pumps	203	146	15%
EV charging (excl. vehicle benefits)	-	-	-
Total	1,308	1,000	100%
EV charging (incl. vehicle benefits)	**715**	**608**	

[70] Department for Energy Security and Net Zero, 2023, Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal available at: Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK

Figure 12.3: Valuation of carbon benefits, 2050 scenario vs Do Nothing, £' m (2025, real, discounted)



12.4.5 Air quality improvements

Air quality improvements are assessed considering the change from fossil fuel heating and transport to electric sources. The change in fuel use is valued as an air quality improvement applying HM Treasury indices for air quality[71]. Air quality improvements carry less significant benefits for both scenarios compared to other types of impacts. These are shown in Table 12.6.

- **Air source heat pumps deliver small air quality gains:** air source heat pumps improve air quality a modest amount, with improvements increasing the earlier ASHPs are installed.
- **Enabling EV uptake could stimulate further air quality improvements.** Although EV charging infrastructure does not directly cause EV displacement of ICE vehicles, the vehicles supported could create benefits of a further £38 million to £45 million in improvement in air quality.
- **Many of the technologies were not assessed for air quality improvements**, as their impact on local emissions is negligible, as their installation does not directly impact human exposure to airborne pollutants, in the LAEP area. For instance, rooftop solar PV replaces grid electricity, which is often generated outside the region. As a result, any potential air quality benefits would not directly apply to the area.

Table 12.6: Air quality improvements, vs Do Nothing £m (2025, discounted)

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Light fabric retrofit	N/A	N/A	N/A

[71] Department for Energy Security and Net Zero, 2023, Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal available at: Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Deep fabric retrofit	N/A	N/A	N/A
Domestic solar PV	N/A	N/A	N/A
Non-domestic solar PV	N/A	N/A	N/A
Domestic air source heat pumps	17	12	80%
Non-domestic air source heat pumps	4	3	20%
EV charging (excl. vehicle benefits)	N/A	N/A	N/A
Total	21	15	100%
EV charging (incl. vehicle benefits)	**45**	**38**	

12.4.6 Impact on bills

Substantial energy bill savings could result from the transition. Discounted values are presented in Table 12.7, excluding VAT and tax.

The 2040 scenario delivers a slightly greater reduction in bills (£670 million) compared to the 2050 scenario (£662 million) due to the timing of asset installations. While there are lower savings from generation in the 2050 scenario, there are also lower additional costs from ASHPs.

- **Generation technologies deliver significant bill savings:** Rooftop solar PV installations are projected to deliver bill savings of £321 million for domestic and £269 million for non-domestic. These savings represent the avoided purchase of electricity from the grid.
- **Heating technologies risk increasing bills:** if consumers switch to ASHPs with flat rate tariffs at current average and forecast prices, they risk increasing energy bills on aggregate because the cost of electricity over gas outweighs efficiency gains. These are shown as a bill increase in the table below.
- **Air source heat pump bills can be reduced by use of bespoke tariffs** linked to the hours of use (time-of-use tariffs). This impact is not reflected below but is a key enabler to make the case for the adoption of ASHPs, alongside pairing with renewable generation.
- **Cost of EV charging is sensitive to tax impacts and method of purchase of fuel:** adoption of electric vehicles enabled by public infrastructure yields higher bills valued at £74 million to £87 million. However, this cost is likely to change into a saving if the impact of the significant taxes on petrol and diesel fuel is also considered. These are excluded in this analysis, to reflect Green Book guidance on economic benefits valuation.

Table 12.7: Impact on bills, vs Do Nothing, £m (2025, discounted)

Note – figures in black are a bill saving. Figures in (red) are a bill increase.

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Light fabric retrofit	49	45	7%
Deep fabric retrofit	95	85	13%
Domestic solar PV	336	321	48%
Non-domestic solar PV	280	269	41%
Domestic air source heat pumps	(75)	(48)	(7%)
Non-domestic air source heat pumps	(15)	(10)	(1%)
EV charging (excl. vehicle benefits)	-	-	-

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Total	**670**	**662**	**100%**
EV charging (incl. vehicle benefits)	(87)	(74)	

12.4.6.1 Impact on bills sensitivity analysis

Sensitivity analysis assesses the impact of energy price volatility, which is an important consideration given the unpredictable nature of energy markets. The analysis involves adjusting gas and grid electricity prices using the low, medium, and high trajectories outlined in HM Treasury's Green Book. Two scenarios are assessed, and presented in Table 12.8, negative figures are again shown in red.

- **Favourable scenario (A):** High gas price, and a low grid electricity price
- **Unfavourable scenario (B):** Low gas price, and a high grid electricity price

Results

- **The favourable scenario leads to further bill savings of £307m** (+47%) for the 2050 scenario. Under this scenario, total savings reach £970 million.
- Under the favourable scenario, ASHPs and EV chargers now save bills, due to lower electricity prices.
- **Under the favourable scenario, solar PV savings are lower,** as savings vs retail prices are lower. However, these reductions are offset by the bill savings from ASHPs.
- **The unfavourable scenario leads to lower bill savings, by £156m** (-24%) for the 2050 scenario. Total savings are still positive, but lower at £506 million.
- **In the unfavourable scenario, the dynamics reversed.** A high electricity price made rooftop solar PV more beneficial. However, air source heat pumps suffered a significant decline in performance due to both higher running costs and the reduced benefit of offsetting now cheaper gas.

Table 12.8: Impact on bills sensitivity analysis, 2050 vs Do Nothing, £m (2025, discounted)

Intervention	Impact on bills (£' m)			Variance to central assumptions (£' m)	
	Central	A	B	A	B
Light fabric retrofit	45	71	32	+26	(13)
Deep fabric retrofit	85	133	59	+48	(26)
Domestic solar PV	321	302	342	(19)	+21
Non-domestic solar PV	269	254	293	(15)	+25
Domestic air source heat pumps	(48)	149	(166)	+197	(118)
Non-domestic air source heat pumps	(10)	62	(53)	+72	(44)
EV charging (excl. vehicle benefits)	-	-	-	-	-
Total	**662**	**970**	**506**	**+307**	**(156)**

Intervention			Impact on bills (£' m)	Variance to central assumptions (£' m)	
EV charging (incl. vehicle benefits)	(74)	(45)	(120)	+29	(46)

12.4.7 Employment contribution – Gross Value Added (GVA)

The creation of employment from investment delivers substantial benefits across both scenarios. These figures are indicative for the benefit across the economy as a whole. Results are presented in Table 12.9 and key findings include:

- Economic contribution has an average annual value of £56 million to £59 million, with aggregated figures to 2050 of £1.5 billion
- **The 2040 scenario generates slightly more benefit due to the earlier installation of assets.** As these assets require ongoing maintenance and eventual replacement up to 2050, the overall volume of installation and upkeep activity is higher, resulting in increased job creation.
- **The assets that require the most investment generate the greatest employment contribution**: deep fabric retrofit and heat pumps account for 62% of employment contribution benefits, which mirrors the similar proportion of investment required for these assets.

Table **12.9: Cumulative value of employment contribution, vs Do Nothing, £'m (2025, undiscounted)**

	2040 (£' m)	2050 (£' m)	% total (2050 scenario)
Light fabric retrofit	57	57	9%
Deep fabric retrofit	321	321	22%
Domestic solar PV	177	177	12%
Non-domestic solar PV	190	190	13%
Domestic air source heat pumps	420	372	26%
Non-domestic air source heat pumps	233	212	15%
EV charging	141	124	9%
Total	1,539	1,454	100%
Average per year (2025 – 2050)	**59**	**56**	

12.5 Capex - who might pay?

This section provides a view of how different capital interventions could be financed or funded to indicate where the cost of delivery may be borne by mapping interventions to funding mechanisms. The information provided is illustrative, based upon typical project examples and market dynamics.

Table 12.10 outlines the capital interventions identified by funding type and intervention category. It summarises probable sources of finance whether private capital, self-funding by residents or building owners, or reliance on government grants.

Table 12.10: Potential funding and financing sources

Who pays	Undiscounted capex[72]	Net zero measure /technology	Potential funding/financing mechanisms
Private developers	£275m	EV Chargers (shared public)	Cost borne by private investment based on commercial viability
Self-funded, residents	£552m	Rooftop solar PV, domestic Private EV chargers	Self-funded Smart Export Guarantee (SEG) EV chargepoint grant Warm Homes Plan
Grant-reliant, residents	£1,816m	Light fabric retrofit Deep fabric retrofit Air source heat pumps, domestic	Boiler Upgrade Scheme (BUS) Warm Homes Plan (ECO4)
Self-funded, public and private building owners	£593m	Rooftop solar PV, non-domestic	Self-funded Smart Export Guarantee (SEG) Local Power Plan
Grant-reliant, public and private estates	£426m	Air source heat pumps, non-domestic	Local authority and regional grants
Total	**£3,661m**		

The categorisation above is based upon experience of current market conditions and typical project performance. The categories are expanded on below for the relevant interventions:

Private developers

These technologies are assumed to be commercially viable for private developers and offer a sufficient profit incentive to attract investment. Investment is expected to come from energy developers, infrastructure funds, and private sector partnerships, with planning and grid coordination supported by local authorities.

Self-funded, residents

These interventions are considered financially viable at the household level, with market evidence that residents are investing their own capital. This is supported currently by zero VAT on solar panels and batteries, access to Smart Export Guarantee tariffs and actions for reduced capital installation costs. The financial resources available to residents is variable, (e.g. variation in household income), therefore additional support in the form of grants is likely required for some households.

Grant-reliant, residents

These interventions are considered reliant on existing grants for residents to install the intervention, as the payback is either uncertain or not significant enough to justify the capital. Existing grants could cover full or partial costs of insulation upgrades and low-carbon heating systems. Depending on the intervention, grant eligibility can be based on income, benefits, and property energy performance.

Self-funded, public and private building owners

These interventions are considered financially viable, with evidence that the public sector and businesses are investing their own capital. Rooftop solar PV installations on non-domestic

[72] Undiscounted capex refers to the net capex required under the 2040 and 2050 scenario vs the counterfactual. Undiscounted capex has been used to reflect the real-world cost of the intervention.

buildings including commercial premises, industrial facilities, and public sector assets could be self-funded by the building owners or operators.

Grant-reliant, public and private estates

These interventions are considered reliant on existing grants for residents to install the intervention, as the payback is either uncertain or not significant enough to justify the capital. Funding is expected to come from national schemes. These measures are capital-intensive and often not commercially viable without subsidy, particularly in older or energy-intensive buildings.

12.6 Funding and financing

This section explores the mechanisms available to cover upfront and ongoing costs, from non-repayable grants that reduce capital burdens to repayable finance options that leverage future revenues, as well as models that transfer risk and responsibility to third parties. It also considers the role councils can play in enabling businesses and residents to invest their own capital, ensuring that local energy projects are financially viable, equitable, and aligned with net zero objectives.

12.6.1 Non-repayable funding sources for project costs

Non-repayable funding mechanisms are typically used when projects face financial barriers that make traditional debt or equity financing impractical. They help reduce overall capital costs, making projects more affordable and attractive to investors or communities. These funds are also critical for projects where the expected financial return cannot cover full life-cycle costs, ensuring essential low-carbon or social value initiatives can proceed. Additionally, they provide upfront capital to avoid drawing heavily on reserves or savings, enabling local authorities, businesses, and residents to launch projects without compromising financial stability.

Non-repayable sources of funding are presented below, split by those available to local authorities, and businesses and residents.

12.6.1.1 Local authority

Community Infrastructure Levy (CIL)[73]

The CIL is a planning charge by local authorities in England and Wales on new developments to fund infrastructure such as transport, schools, parks, and public amenities. CIL funds can only be used for infrastructure supporting development and must comply with strict statutory regulations.

Section 106 (S106)[74]

S106 agreements are legally binding planning obligations between developers and local authorities, used to mitigate the impact of new developments by funding infrastructure, affordable housing, or community facilities. Unlike CIL, S106 is negotiated case-by-case, subject to meeting statutory tests, and can include both financial contributions and in-kind provisions tied to specific planning permissions. They remain a key tool for delivering site-specific benefits and ensuring developments are sustainable and aligned with local needs.

[73] Community Infrastructure Levy, GOV.UK, available at: Community Infrastructure Levy - GOV.UK
[74] Section 106, GOV.UK, available at: Planning obligations - GOV.UK

Great British Energy Community Fund (GBECF)[75]

The GBECF is a £5 million UK government-backed grant scheme by regional Net Zero Hubs to support feasibility and development costs for community-owned renewable energy projects. It offers up to £40,000 for Stage 1 feasibility studies and up to £100,000 for Stage 2 development work. Proposals require at least 50% community ownership and generating local benefit. The scheme was extended in 2025 for one year, and while funds are likely now allocated, it is possible that the scheme will be extended with further grant available in future years.

Public Works Loan Board (PWLB)

The PWLB is a UK government facility that provides low-cost loans to local authorities for capital projects, funded through the National Loans Fund, repayable from the overall council budget but not from the project. Councils use PWLB borrowing to finance infrastructure such as housing, transport, and regeneration, with rates typically linked to gilt yields plus a margin. It offers flexible repayment terms but requires compliance with prudential borrowing rules and restrictions on debt-for-profit activities.

Offsetting/insetting[76]

Retrofit Credits allow organisations to offset their emissions by funding energy-efficiency upgrades in social housing, generating verified carbon credits. For councils, this offers two opportunities: they can purchase credits to compensate for residual emissions and meet net zero targets, or, if they own housing stock, they can implement retrofit projects, generate credits, and sell them to corporates. The revenue can then be reinvested into further retrofits, creating an insetting effect and accelerating decarbonisation of their own assets.

12.6.1.2 Businesses and residents

Warm Home Plan[77]

The Warm Home Plan is a UK government initiative announced in 2025 to accelerate home energy efficiency and heat decarbonisation, backed by £13.2 billion of funding. It focuses on upgrading insulation, installing low-carbon heating systems, and supporting vulnerable households to reduce energy bills and emissions. The plan complements existing schemes like the BUS and ECO, aiming to deliver large-scale retrofits.

Local Power Plan[78]

The UK Government's Local Power Plan, announced in 2026, outlines £1 billion of investment for community owned energy projects through grants, loans and advice. This support is being delivered by DESNZ, Great British Energy and the National Wealth Fund through to 2030, with the purpose to support community energy groups to develop energy generation and storage projects that deliver benefits to the local area.

Great British Energy Community Fund (GBECF)

Refer to above.

[75] Great British Energy Community Fund, Community Energy England, available at: Great British Energy Community Fund - Community Energy England

[76] Retrofit Credits, Housing Associations' Charitable Trust, available at: Retrofit Credits - HACT

[77] Warm Homes Plan, GOV.UK, available at: Apply for the Warm Homes: Local Grant to improve a home - GOV.UK

[78] Local Power Plan, GOV.UK, available at: Local Power Plan

Boiler Upgrade Scheme (BUS)[79]

The BUS is a government grant program in England and Wales that offers households and small businesses up to £7,500 toward replacing fossil fuel heating systems with low-carbon alternatives like air-source heat pumps. It aims to accelerate heat decarbonisation by reducing upfront costs, with installers applying on behalf of customers and funding available until March 2028. The end date of this scheme poses a risk to the sustained uptake of heat pumps, and a replacement scheme or change in the capex and running costs of heat pumps is required for continued rates of adoption.

Electric Vehicle Chargepoint Grant[80]

The EV Chargepoint Grant, available to March 2027, is a UK government scheme that provides funding for installing electric vehicle chargepoints at homes and workplaces. For homeowners and renters with off-street parking as well as households with on-street parking, the grant provides up to £500 towards the cost of installing a chargepoint. Businesses, workplaces and landlords can access grants for multiple chargepoints up to a limit of £500 per socket. Under the Workplace Charging Scheme businesses can apply for grants for up to 40 sockets across all their sites with landlords able to apply for grants for up to 200 sockets across all their sites. A separate Workplace Charging Scheme is also outlined for state-funded education institutions, with grants of up to £2,000 available per chargepoint socket.

12.6.2 Repayable funding sources for upfront project costs

Repayable funding mechanisms are used when projects have a clear revenue stream but need capital upfront to bridge the gap between construction costs and future income. They provide financing where the project's financial return is sufficient to cover third-party finance costs, making them suitable for commercially viable schemes. This approach is common when the organisation retains ownership and operational responsibility for assets, ensuring control while leveraging external capital to deliver net zero infrastructure without delaying implementation.

12.6.2.1 Local authority

National Wealth Fund (NWF)[81]

The NWF is a UK government investment vehicle launched in 2024 to accelerate the transition to a green economy and boost economic growth. It channels public and private capital into strategic sectors such as clean energy, green steel, carbon capture, and advanced manufacturing, aiming to crowd in private investment and create high-quality jobs. Managed by the UK Infrastructure Bank, the fund supports projects that align with net zero goals and regional development priorities.

Local Climate Bonds[82]

Local Climate Bonds are a UK municipal investment mechanism that allows councils to raise funds for local net zero and climate projects by issuing bonds to residents and investors. They offer a low-risk, fixed-return investment, and proceeds are earmarked for projects such as renewable energy, EV infrastructure, and building retrofits. This approach promotes community engagement in climate action while providing councils with affordable finance for sustainability initiatives.

[79] Boiler Upgrade Scheme, GOV.UK, available at: Apply for the Boiler Upgrade Scheme: Overview - GOV.UK
[80] Electric Vehicle Chargepoint Grant, GOV.UK, available at: Electric vehicle chargepoint grants - GOV.UK
[81] National Wealth Fund, available at: National Wealth Fund | National Wealth Fund
[82] Local Climate Bonds, Green Finance Institute, available at: Green Finance Institute

Green Bonds[83]

Green bonds are fixed-income instruments issued to raise capital specifically for projects with environmental benefits, such as renewable energy, energy efficiency, or sustainable transport. They work like traditional bonds but are earmarked for green projects. This financing tool helps governments, companies, and institutions attract investors committed to sustainability while supporting the transition to a low-carbon economy.

UK Municipal Bonds Agency (UKMBA)[84]

The UKMBA is a financing platform created to help local authorities access cheaper borrowing by issuing bonds collectively rather than individually. It pools councils' borrowing needs to achieve economies of scale and better rates compared to traditional sources like the PWLB. This approach aims to diversify funding options for infrastructure and regeneration projects while reducing reliance on central government lending.

12.6.2.2 Business and residents

Community share offers

Community share offers are a way for local people to invest in and own a stake in community-led projects, such as renewable energy, local services, or social enterprises. They raise capital by selling shares directly to individuals, often with modest financial returns and strong social or environmental benefits. This model promotes democratic ownership and keeps profits within the community while funding projects that deliver local impact.

12.6.3 Financing through third party delivery

Financing through third-party delivery is used when a private or external organisation takes responsibility for developing, funding, and operating an asset on behalf of the public or community sector. This approach transfers the need for upfront project finance and shifts operational and financial performance risks away from the commissioning body to the third party.

12.6.3.1 Local authority

Service or Concession Agreement

A service or concession agreement typically allows a private provider to finance, install, and operate low-carbon infrastructure. Examples include heat networks, EV charging hubs, or renewable generation under a long-term contract with a public authority. The provider recovers costs through user tariffs or availability payments, while the authority sets performance standards to ensure carbon reduction goals are met.

Heat as a Service (Haas)[85]

HaaS is an emerging business pilot model where customers pay for the outcome including warmth and comfort, rather than for units of energy like gas or electricity. It typically involves smart controls and service agreements that guarantee a set temperature or heating schedule, enabling providers to optimize energy use and integrate low-carbon technologies. This approach shifts incentives toward efficiency and decarbonisation, making heating more

[83] Green Bonds, IMCA, available at: green-bonds-principles-june-2018-270520.pdf

[84] UK Municipal Bonds Agency, available at: Home - UK Municipal Bonds Agency - UKMBA

[85] Energy as a Service Pilot Phase Evidence Report, EON, available at: Energy as a Service: final report

affordable and sustainable for households. Models for heat as a service are in development for both domestic and non-domestic sectors.

12.6.3.2 Businesses and residents

Heat as a Service (Haas)[86]

As above.

Pay As You Save (PAYS)[87]

PAYS is a financing model that enables households or businesses to install energy efficiency or low-carbon technologies such as insulation, heat pumps, or solar panels without paying upfront. The cost is repaid over time through a charge on the energy bill, with repayments designed to be lower than the savings achieved, so customers see immediate net benefits.

12.6.4 Council actions to enable business and resident investment

To help businesses and residents invest their own capital in local energy projects, councils can play a vital enabling role by reducing barriers and creating confidence in returns. This often involves providing clear information on opportunities, offering technical guidance, and facilitating access to trusted suppliers or installers. Councils can also support through measures such as aggregating demand, coordinating bulk purchasing, and promoting financial incentives or accreditation schemes, all of which make investment more attractive and lower perceived risk for individuals and businesses.

Group purchase

A group purchase scheme is a collective buying model where residents/organisations pool demand for clean solutions like solar or heat pumps to secure lower costs and accelerate adoption. It reduces upfront barriers and sends strong market signals to scale decarbonisation.

The leading scheme, Switch Together, previously known as Solar Together, has recently extended from solar to also include heat pumps. Switch Together is a group purchasing scheme, coordinated by local authorities, which enables residents to install technologies at reduced rates. Suppliers compete in a reverse auction to offer the lowest price, and participating households benefit from costs typically lower than those available individually. At present, Switch Together is the only established provider of this model, but similar group purchasing approaches could be explored for other technologies such as heat pumps or battery storage.

Revolving Loan funds[88]

Revolving loan funds allow councils to provide low-cost loans for energy efficiency and renewable projects, using an upfront capital pool that is replenished as loans are repaid. These funds are typically administered by third parties such as community finance institutions or banks. While arrears are around 1%, risk can be mitigated through affordability checks and legal safeguards, making this a viable option for councils to support the able-to-pay market.

Accredited supplier lists

The council could seek to collect and publish a list of known suppliers with suitable accreditation.

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[86] Energy as a Service Pilot Phase Evidence Report, EON, available at: Energy as a Service: final report

[87] Pay As You Save, UK Green Building Council, available at: Microsoft Word - GBC PAYS exec sum FINAL.doc

[88] Lendology, available at: Accessible Finance for Home Energy Improvements

Facilitate events and forums for suppliers and interested parties

The council could seek to facilitate events and forums where residents and businesses could meet with potential suppliers. The council could maintain a neutral stance by allowing all suppliers to attend who meet certain accreditation levels.

Innovation mechanisms

Council can run pilots/support innovation mechanisms such as blended finance.

12.7 Next Steps

This chapter provides a high-level assessment of the economic implications of decarbonising the area, focusing on capital investment, benefits, and funding pathways across two transition scenarios. The analysis offers a foundation for understanding the scale and impact of net-zero interventions.

To build on this work for deeper strategic decision-making, we recommend the following next steps:

Expand to a Full Cost-Benefit Analysis (CBA): Building on the current capital expenditure and benefit assessment, the next stage should incorporate operational expenditure (OPEX) and wider societal benefits, enabling calculation of aggregate Net Present Social Value (NPSV). Undertaking a full CBA will provide a more holistic and transparent view of the long-term value and trade-offs associated with net-zero investments, strengthening the evidence base for investment decisions and policy development.

Deep dive on funding and financing pathways: While this chapter sets out funding and finance pathways at a high level, a more detailed review is required. This should include in-depth modelling of funding mechanisms, sources, and delivery models for each intervention. Achieving a clear and actionable approach will require proactive stakeholder engagement working with local authorities, residents, developers, and industry partners to validate assumptions, clarify roles, and co-design effective funding solutions.

These next steps will ensure the economic case for decarbonising the area is robust, comprehensive, and tailored to local needs, providing a strong foundation for future investment and delivery.

13 Prioritisation

This section details the recommended framework for prioritising decarbonisation interventions within the Ashfield and Mansfield LAEP. It identifies projects for short-term and long-term action, outlines key focus zones, and addresses dependencies and uncertainties.

13.1 Prioritisation methodology

Interventions have been prioritised through a structured analysis that integrates both quantitative and qualitative considerations. This process was further strengthened by insights derived from stakeholder engagement sessions, ensuring that the prioritisation reflects not only technical feasibility but also local context and stakeholder aspirations. The combined approach provides clarity on the categorisation of actions into “quick wins,” which deliver immediate and visible benefits, “enablers,” which create the necessary conditions for future progress, and longer-term strategic investments that underpin systemic transformation.

Table 13.1 summarises the core criteria applied in this analysis and how they have been ranked relative to each other by the local authorities and other stakeholders. Overall, near-term implementations have been agreed to focus on the impact to levels of fuel poverty, use of existing funding streams that can be leveraged in the short term, and taking into account the local grid readiness. The system carbon impact of implementations was not considered to be a priority as the measures collectively are set out to achieve net zero, so the feasibility of implementation in the short term was considered to be more relevant in determining short-term actions.

Table 13.1: Summary of Prioritisation Criteria

Core Criteria	Definition	Why it matters	Ranking
Equity and fuel poverty	Extent the measure impacts on levels of fuel poverty.	Supports a just transition by ensuring vulnerable groups benefit from decarbonisation efforts	Higher
Funding Availability	Access to public or private finance for implementation	Determines the likelihood of implementation and scalability, especially in resource-constrained environments.	Higher
Local grid readiness	Likelihood of DNOs being able to facilitate implementation at the local level in the short term	Contributes to stable operation of the electricity network and allows time for DNOs to plan and execute necessary upgrades in constrained areas	Higher
Cost effectiveness (WLC)	Net present value of an intervention, as a proxy for affordability for end users	LAEP requires robust cost inputs and standardised assumptions to identify “most cost-effective combination of options”	Medium
Deliverability & readiness	Consenting, supply chain readiness, ease of installation	Ensures practical feasibility and timely deployment of measures to a high standard of quality	Medium
Local economic & health co-benefits	Job creation and improvements to air quality	Considers wider benefits associated with energy decarbonisation and how these can be realised locally	Lower
Risk & uncertainty exposure	Technology maturity, future-proofing, interoperability	Reduces exposure to technology uncertainty and focusses on long-term viability of investments	Lower
System carbon impact	Carbon abatement potential, including lifetime tCO_2e savings per project	Acknowledges the time-value of emissions by pursuing steep decarbonisation in the early years	Lower

13.2 Dependencies and uncertainties for interventions

Delivery of the interventions identified in the LAEP is influenced by a set of dependencies and uncertainties that shape its feasibility, timing, and overall impact. Dependencies refer to the enabling conditions or prerequisite actions that must be in place for successful delivery. These may include the availability of supporting infrastructure, alignment with regulatory frameworks, readiness of supply chains, and access to skilled labour. For example, the rollout of heat pumps may depend on grid capacity upgrades, installer training programmes, and consumer incentives.

Uncertainties, on the other hand, arise from factors that are difficult to predict or control, such as fluctuations in technology costs, changes in policy direction, market behaviour, and the pace of innovation. These uncertainties can influence both the cost-effectiveness and deliverability of interventions, requiring adaptive planning and risk mitigation strategies. Recognising these dynamics is essential for sequencing actions effectively, as interventions with high dependency or uncertainty may need to be phased later or supported by enabling measures.

Table 13.2 summarises the key dependencies and uncertainties relevant to the successful delivery of this LAEP and provides a clear reference point for understanding the conditions that underpin successful implementation and the risks that must be managed to maintain progress toward long-term objectives.

Table 13.2: Summary of dependencies and uncertainties

Dependency / Uncertainty	Why it matters	Suggested mitigation
Funding	Funding availability is essential for project delivery and scalability	Identify and align with existing funding streams. Coordinate with EMCCA to explore alternative funding mechanisms and partnership opportunities. Explore public-private sector partnerships to enable access to wider expertise and funding, to accelerate delivery.
Electricity network capacity & connection queues	PV, ASHPs, EV projects depend on headroom; connection delays can defer benefits	Ongoing detailed engagement with NGED with regard to the outcomes of this LAEP and with regard to any projects that are taken forward off the back of the LAEP. Ensure targeted grid reinforcement to enable delivery of priority projects.
Energy price volatility	Operating costs (ASHP vs Gas vs Heat network)	Adopt a fabric first approach to minimise demand when switching to lower carbon solutions. Adopt local renewable generation and energy storage systems to help shift demand and reduce exposure to pricing risk. Smart local energy systems can also be considered to help manage this.
Supply chain & skills	Heat pump, insulation, delivery capacity may constrain pace	Policy considerations such as Training programmes, funding and incentives Strategic partnerships between public and private sector.
Public trust & uptake	Public acceptance is essential to drive uptake	Community engagement and communication programmes to share good news stories. Work with community energy groups to support with messaging and delivery. Undertake demonstration/pilot projects to enable delivery of and showcase best practice.
Policy evolution	Changes to boiler phase out, market design or zoning rules could shift the plan.	Ensure policy tracking is in place i.e. through a framework to monitor national and regional policy developments and

Dependency / Uncertainty	Why it matters	Suggested mitigation
		regularly review the LAEP or subsequent project to align with these. Engage with or create local energy forums to enable collaborative adaption of plans and projects to policy changes.
Hydrogen availability/cost	The industrial decarbonisation pathway for Ashfield and Mansfield is highly sensitive to hydrogen price, electricity grid carbon intensity, and technology costs. If hydrogen remains expensive, switching high-temperature processes may be delayed or limited.	Detailed engagement with key stakeholders in this space such as East Midland Hydrogen to advise on potential hydrogen needs in the area. Maintain focus on hard-to-treat high temperature loads with more readily available technologies utilised for wider decarbonisation.

13.3 Focus zones

Given the large scale of interventions required to achieve a net zero energy system at the local level, it is important to determine where to start the roll-out. Based on the priorities set out, 'focus zones' can be identified that will meet the criteria for short-term implementations. Within these focus zones, specific schemes can then be developed by the local authorities to move towards delivery.

13.3.1 Areas With High Fuel Poverty

Fuel poverty remains a significant challenge for Ashfield and Mansfield, both areas reporting a higher proportion of fuel poor households compared to the Nottinghamshire, East Midlands and national averages, as outlined in Section 6.

The Low-Income Low Energy Efficiency (LILEE) definition of fuel poverty was introduced in 2019. Before this, a home was classified as fuel poor if it spent more than 10% of its annual income on space heating and energy services. This is far more likely in a home rated EPC E or below due to lack of insulation and poor thermal retention capability.

Fuel poverty currently contributes to around 155 excess winter deaths across EMCCA annually. Retrofitting homes can have a huge impact on this, alongside reducing health inequalities and reducing absences from school and work arising from damp and cold air related illnesses.

The spatial distribution of fuel poverty within Ashfield and Mansfield is uneven, illustrated per MSOA in Figure 13.1, with certain neighbourhoods experiencing disproportionately high rates. This disparity underscores the urgent need for targeted interventions that address energy affordability and thermal comfort. Analysis of the most recent UK Government data on fuel poverty[89], highlights the MSOAs with the highest proportion of households in fuel poverty in each local authority area, which are set out in Table 13.3.

[89] Fuel Poverty in England: sub-regional - data.gov.uk

Figure 13.1 Average household risk of fuel poverty per MSOA

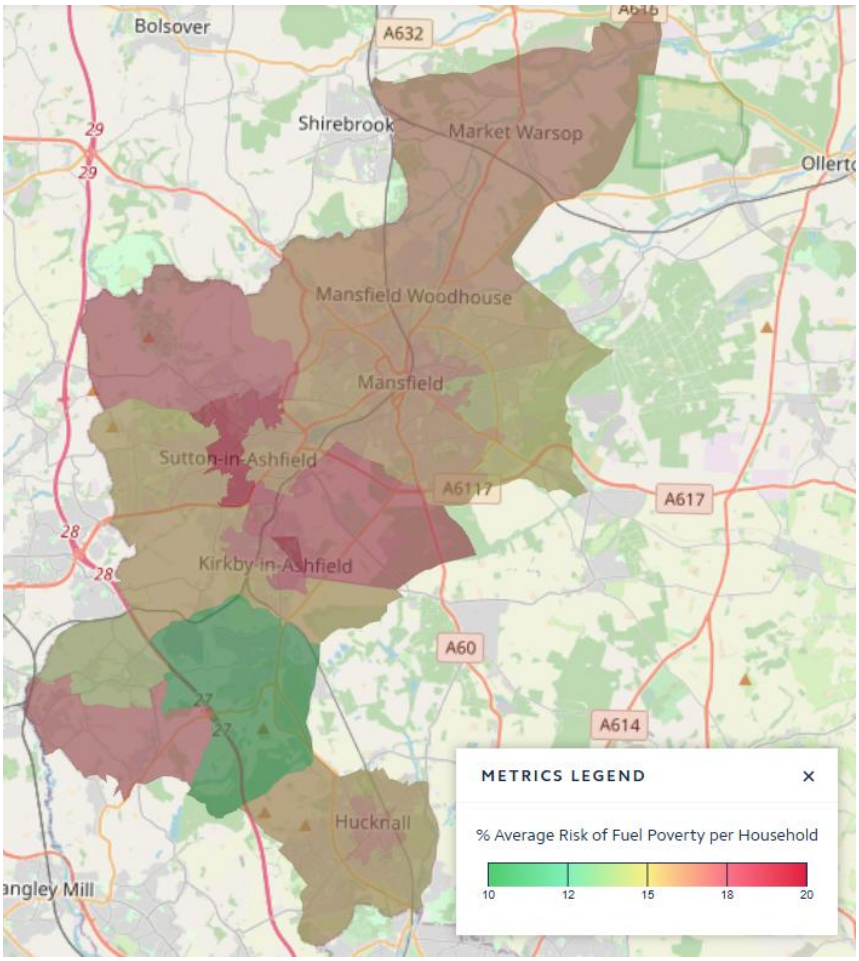


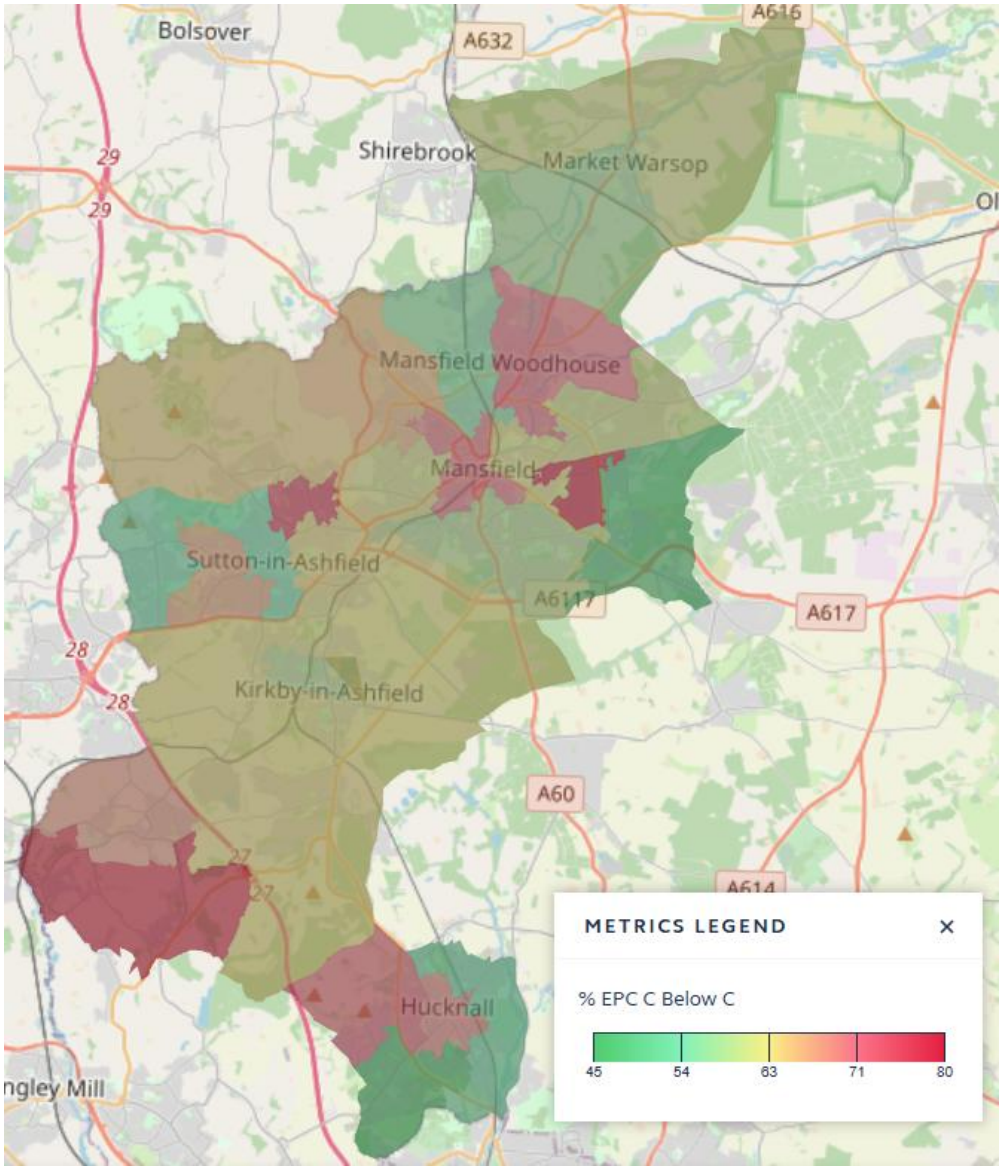
Table 13.3: UK Government Fuel Poverty Data per MSOA

Local Authority	MSOA	Total Number of Fuel Poor Households	Proportion of Fuel Poor Households
Ashfield	Sutton Central & Leamington	579	16.8%
	Kirkby Central	461	16.7%
	Sutton Forest Side & New Cross	721	16.0%
	Hucknall Town	710	15.8%
Mansfield	Mansfield Town Centre & Broomhill	958	19.9%
	Newgate & Carr Bank	672	16.7%
	Church Warsop & Meden Vale	407	14.7%

Focusing retrofit programmes on these zones offers significant benefits. Fabric-first measures, including improved insulation, airtightness, and glazing upgrades, can substantially reduce heat loss, lower energy bills, and improve indoor comfort. Beyond carbon reduction, these interventions deliver critical social co-benefits: alleviating fuel poverty, improving health outcomes, and reducing financial stress for vulnerable households.

Within the areas of high fuel poverty, implementation can be further focussed on properties with an EPC rating below C. The spatial distribution of these properties across the area is shown in Figure 13.2.

Figure 13.2: Proportion of homes below EPC C by MSOA



The number of these properties within each of the MSOAs is shown in Table 13.4. Within these identified properties, the local authorities can have the most influence over housing association properties. The LAEP modelling has identified the number of properties that are occupied as social housing, and those properties suitable for light and deep fabric retrofit.

Through combining these characteristics, we can determine the number of social housing properties in each MSOA that are suitable for a “light + deep” retrofit package, and those that are suitable for a light retrofit only. This can highlight MSOAs that may be suitable as a retrofit ‘focus zone’ and are summarised in Table 13.4 below.

Table 13.4: EPC rating, tenure, and retrofit suitability per MSOA.

MSOA	Number of homes below EPC C (1)	Of (1), number occupied for social housing (2)	Of (2), number suitable for light retrofit only	Of (2), number suitable for light + deep retrofit
Sutton Central & Leamington	1,620	327	148	93
Kirkby Central	1,560	261	114	71
Sutton Forest Side & New Cross	2,636	205	75	56
Hucknall Town	2,678	138	43	21
Ashfield focus zones total	8,494	931	380	241
Mansfield Town Centre & Broomhill	3,005	155	15	60
Newgate & Carr Bank	2,183	294	50	141
Church Warsop & Meden Vale	1,664	147	79	12
Mansfield focus zones total	6,852	596	144	213

In addition, a majority of the social housing properties in these focus zones have been identified as suitable for ASHP, which could be implemented at the same time, in a ‘touch the property once’ approach. It should be noted, though, that in order to achieve the fuel poverty alleviation benefits of ASHP in these properties, education of the residents on how to realise the benefits through appropriate electricity tariffs and operation of the system is likely to be required to avoid unintended outcomes.

13.3.2 Electricity Headroom Pockets

Electricity network capacity is a key determinant of where electrification measures, such as heat pump deployment and EV charging, and electricity generation, can be accelerated. Analysis of grid utilisation across Ashfield & Mansfield, in Section 10, identifies pockets of available headroom for both demand and generation, where additional electrical systems can be accommodated without immediate reinforcement. These areas represent prime opportunities for early roll out of ASHP, PV and EV charging, as they are likely to be able to be delivered with minimal infrastructure upgrades, reducing cost and complexity.

Demand Headroom

Analysis in Section 11 indicates that demand headroom at the primary substation level is mostly in Kirkby Larwood & Kingsway (Ashfield) and Church Warsop & Meden Vale (Mansfield) in the near term. Based on this, focus zones for the early roll-out of ASHP would be Kirkby Larwood & Kingsway and Church Warsop & Meden Vale, with EV charging focus zones in the more urban areas with headroom, such as The Dales & South Skegby and Eakring & Ling Forest.

Areas with high grid utilisation require a different approach. In these zones, demand-side response (DSR) strategies should be prioritised to manage peak loads and defer costly reinforcements. DSR measures may include PV paired with battery systems, or leveraging vehicle-to-grid technology. These interventions enhance flexibility, as we prepare the network for future electrification. Sutton Forest Side & New Cross in Ashfield and Yeoman Hill & Maun Valley currently have the highest utilisation, with less than 33% and 32% headroom available, respectively.

Further detailed engagement with NGED will be required to determine viable timescales for delivery as projects are developed in more detail, ensuring that planned interventions align with network reinforcement schedules and operational constraints and support a coordinated and efficient rollout of electrification measures.

Table 13.5: MSOA headroom prioritisation

MSOAs with highest headroom	Number of homes above EPC D (1)	Of (1), number occupied for social housing (2)	Of (2), number suitable for ASHP	Of (1), number suitable for ASHP
Kirkby Larwood & Kingsway	1,663	186	182	1,532
Hucknall Westville	2,290	476	462	2,226
Stanton Hill & Skegby	1,250	190	179	1,165
Ashfield focus zones total	5,203	852	823	4,926
Church Warsop & Meden Vale	1107	177	173	1059
Abbott Road & Pleasley Hill	1453	298	288	1383
Mansfield Town Centre & Broomhill	1844	143	140	1561
Mansfield focus zones total	4407	618	601	4,003

13.3.3 Heat Network Zones

Potential heat network zones have been identified, clustering around key anchor loads and off-takers that provide a strong foundation for network viability. Developing these zones as a priority intervention offers multiple benefits: it alleviates grid constraints in surrounding areas by reducing reliance on electricity for heating, supports rapid decarbonisation at scale, and delivers lower-cost, and potentially lower-carbon, heat compared to the alternative scenario of widespread ASHP deployment in these zones.

This approach leverages existing infrastructure and demand clusters to create a strategic, cost-effective pathway for heat decarbonisation. The identified areas are set out in Section 7.3.

13.4 Quick win projects

Quick wins represent a category of interventions that can be implemented immediately with minimal complexity and high confidence in successful delivery. These actions are often described as “no regrets” because they rely on existing evidence, proven technologies, and established funding routes, making them low-risk and highly practical. They deliver immediate carbon savings, are highly cost-effective, and offer visible progress that builds momentum for more complex programmes. Quick wins also generate wider benefits such as reduced operational costs, improved system efficiency, and enhanced social and economic outcomes. Their prioritisation is underpinned by high scores for system carbon impact, cost-effectiveness, and deliverability, while also addressing equity and co-benefits where possible.

13.4.1 Rooftop Solar PV on Public Estate Buildings

Installing rooftop solar PV systems on suitable public buildings, such as libraries, schools, and community centres, paired with battery storage where viable, presents an immediate opportunity

to decarbonise public sector operations. This intervention focuses on sites with consistent daytime energy loads, making effective use of existing roof space for on-site renewable generation. By reducing grid dependency and lowering operational costs for public services, it delivers strong technical and economic benefits. The measure scores highly on carbon impact, cost-effectiveness, and deliverability, while also performing well on network impact by optimising grid flexibility. In addition, it offers local economic co-benefits through job creation in installation and maintenance and demonstrates visible leadership that can encourage wider adoption. The numbers of different types of public buildings, and their current electrical demand, are set out in Table 13.6 below.

Table 13.6: Summary of Public Estate Buildings with estimated baseline electricity demand

Local Authority	Primary Use Type	Number	Total Electricity demand Baseline (MWh)
Mansfield	Community Centre	9	611
	Primary Schools, Nurseries and Childcare	170	4,666
	Public Administration Building	68	7,203
	Secondary School	11	1,694
Ashfield	Community Centre	12	868
	Primary Schools, Nurseries and Childcare	177	5,362
	Public Administration Building	52	1,908
	Secondary School	8	625

13.4.2 Fuel poverty led social housing retrofit

Targeting fuel-poor households through social housing retrofit programmes, such as the Warm Homes Social Housing Fund, supports both climate and social equity objectives. These initiatives focus on areas of greatest need by improving building fabric and thermal efficiency. This intervention not only reduces emissions but also improves energy affordability, lowers household bills, and enhances health outcomes for vulnerable residents. Areas such as Sutton Central & Leamington, Kirkby Central, Sutton Forest Side & New Cross and Hucknall Town in Ashfield and Mansfield Town Centre & Broomhill, Newgate & Carr Bank and Church Warsop & Meden Vale in Mansfield have the highest concentration of households at risk of fuel poverty, as shown in Table 13.7 below.

Table 13.7: Identified implementations of fuel poverty led social housing retrofit

MSOA	Number of properties identified	Light Retrofit CAPEX	Deep Retrofit CAPEX (£)	Estimated Annual Carbon Savings Light Retrofit (tCO_2e)	Estimated Annual Carbon Savings Deep Retrofit (tCO_2e)
Sutton Central & Leamington	327	544,500	£2,852,270	53	79
Kirkby Central	261	329,257	£2,042,752	22	54
Sutton Forest Side & New Cross	205	333,796	£1,940,787	21	51
Hucknall Town	138	134,805	£1,164,870	7	35
Ashfield focus zones total	**931**	**1,042,358**	**£8,000,697**	**103**	**219**
Mansfield Town Centre & Broomhill	155	184,514	£4,920,131	6	89
Newgate & Carr Bank	294	400,032	£2,933,890	26	94
Church Warsop & Meden Vale	147	357,511	£1,431,911	10	33
Mansfield focus zones Total	**596**	**942,057**	**£9,285,932**	**42**	**216**

13.4.3 Light retrofit measures

Light retrofit measures, including cavity wall insulation and loft insulation top-ups, represent low-cost, high-deliverability actions that can be implemented relatively quickly across the able-to-pay market. These measures improve energy efficiency, reduce running costs, and create immediate co-benefits such as improved comfort and lower energy bills. However, the speed of rollout depends on addressing common barriers such as homeowner awareness, upfront costs, and trust in installers. While these measures are technically straightforward, homeowners and landlords may choose not to invest without clear incentives or support.

To enable rapid uptake, the council can play a proactive role in creating an environment that encourages action. This could include launching targeted awareness campaigns to highlight the benefits of retrofit and the availability of funding or incentive schemes, as well as providing a centralised one-stop shop for advice and guidance on retrofit options, costs, and potential savings. Establishing and promoting a list of council-approved installers would help build consumer confidence and reduce perceived risks associated with quality and reliability. In addition, signposting to financing options such as grants, low-interest loans, or national schemes can help overcome concerns about upfront costs. A summary of the modelled light retrofit results for different tenure types is outlined below in Table 13.8.

Table 13.8: Estimated Light Retrofit Investment and Carbon Savings by Housing Tenure Type

Tenure Type	Count of Properties	Estimate CAPEX (£)	Annual Carbon Savings (tCO_2e)
Mansfield			
Housing Association	310	£1,361,040	95
Local Authority	922	£3,860,331	264
Owner Occupied	15,408	£81,509,565	5,707
Privately Rented	2,791	£11,188,172	811
Ashfield			
Housing Association	280	£1,014,801	48
Local Authority	1,202	£4,134,800	296
Owner Occupied	16,712	£78,936,700	5,457
Privately Rented	2,731	£9,881498	643

13.4.4 Small roof-mounted PV and Battery storage installs on suitable homes

Small roof-mounted PV installations on suitable homes offer a scalable solution for household-level renewable generation. The uptake and estimated costs of these systems were modelled alongside domestic battery storage, assessing their potential contribution to local energy generation and flexibility.

This measure empowers residents to participate in the energy transition, reducing reliance on fossil fuels and enhancing energy resilience. It performs strongly on system carbon impact and cost-effectiveness and deliverability. Co-benefits include increased energy independence and potential local economic gains through installation activity.

As with other homeowner-led measures, uptake depends on motivation and overcoming barriers such as upfront costs, lack of awareness, and trust in installers. The example enabling actions outlined in 13.4.3, including council-led awareness campaigns, a one-stop shop for retrofit advice, and maintaining a list of approved installers, are also relevant here. These can be complemented by PV-specific initiatives such as signposting funding schemes and exploring group-buying or community solar programs to reduce costs and increase participation. Table 13.9 outlines the maximum potential Capex, annual generation and annual carbon savings for domestic solar PV in Ashfield and Mansfield.

Table 13.9: Estimated Solar PV Investment and Carbon Savings by Property Type

Property Type	Estimated Capex (£)	Annual Yield (MWh)	Annual Carbon Savings (tCO_2e)
Mansfield			
Multi Dwelling	£10,536,631	4,275	884
Single Dwelling	£199,047,790	76,080	15,748
Non-Domestic Multi Unit	£61,369,953	25,070	5,189
Non-Domestic Single Unit	£114,186,799	46,647	9,656

Property Type	Estimated Capex (£)	Annual Yield (MWh)	Annual Carbon Savings (tCO_2e)
Ashfield			
Multi Dwelling	£10,996,843	4,074	843
Single Dwelling	£203,804,329	79,016	16,356
Non-Domestic Multi Unit	£33,881,503	13,841	2,865
Non-Domestic Single Unit	£70,918,145	28,971	5,997

13.5 Enabling Actions

Enabling actions are interventions that do not deliver assets but are critical for unlocking future opportunities and accelerating the transition at scale. These actions create the foundational conditions required for the successful deployment at scale of the physical interventions.

Unlike quick wins, which focus on immediate and visible benefits, enablers are strategic investments in capability, infrastructure, and market readiness, or actions to address systemic barriers. By resolving these issues early, enabler projects reduce uncertainty and dependency risks for subsequent interventions, ensuring that future programmes can be delivered efficiently and cost-effectively.

These actions often require collaboration across multiple stakeholders, including local authorities, industry partners, and community organisations, to align priorities and secure long-term commitment. In many cases, enabler projects will require coordination with Distribution Network Operators (DNOs), regional authorities such as the East Midlands Combined County Authority, and private sector actors to ensure that technical, regulatory, and financial conditions are met.

13.5.1 Electricity grid capacity outlook

Targeted grid reinforcements are a fundamental enabler for the large-scale deployment of electrification technologies and distributed renewable generation. As electricity demand rises due to the adoption of heat pumps, electric vehicles, and rooftop solar PV, grid capacity constraints present a significant barrier to progress. Strategic reinforcement in areas with minimal existing constraints ensures that upgrades are delivered efficiently, cost-effectively, and in alignment with future demand growth.

In order to best approach this, the local authorities can play a convening role in ensuring stakeholders have access to the information required to manage current capacity and plan for the future. For the big picture, the local authorities should submit the LAEP to NGED for consideration in both the next regulatory submission planning and longer-term forecasts.

For short-term projects, particularly in focus zones, a ‘Connections Surgery’ should be held with NGED in the immediate future in order to verify the feasibility of connections required for the identified interventions at the neighbourhood level. This could also be used as an opportunity to identify other areas of network capacity to identify next-stage implementations and neighbourhoods for targeted uptake offers of certain interventions.

13.5.2 Education and Demonstrator Projects

The successful delivery of the LAEP will depend on building public understanding and confidence in low-carbon technologies and retrofit measures. Education and demonstrator projects are essential to achieve this. The council can lead targeted educational initiatives that

explain the benefits of energy efficiency, renewable generation, and electrification, while addressing common concerns about cost, disruption, and reliability.

One approach to this would be for each local authority to develop an online ‘hub’ for the LAEP and associated resources, which can become a single point of reference for local residents and businesses looking to benefit from the energy transition. This could also be coordinated at the regional level by EMCCA to drive consistency and scale. Noting the resource constraints of local authorities, this does not necessarily require the creation of significant content, but rather to leverage existing information and analysis already available from other trusted sources.

To supplement this, targeted education programmes may be required alongside rollout of measures in focus zones, in order to increase uptake and to maximise benefits to the recipients of interventions.

Alongside education, demonstrator projects will provide visible examples of best practice and allow residents to see successful implementations first-hand. These projects might include retrofit exemplars in council-owned housing, pilot schemes for technologies such as heat pumps and solar PV, and open-home events where early adopters share their experiences. Demonstrator projects not only help overcome scepticism but also provide valuable data and insights to inform wider rollout. Some wider initiatives, such as ‘Visit a heat pump’, can be leveraged here, reducing the level of resource required to provide access to such demonstrators.

13.5.3 Local bulk procurement frameworks

The establishment of local bulk procurement frameworks for retrofit measures, PV and heat pump installations is a strategic enabler that addresses cost, supply chain resilience, and delivery certainty. Aggregating demand across multiple projects and stakeholders unlocks economies of scale, reduces unit costs, and provides suppliers with greater confidence to invest in capacity.

This approach can also help to deliver consistent quality standards, with the right structure, and accelerates market readiness for low-carbon technologies by providing a pipeline of work that local business can use to justify investment in skills and job growth.

Bulk procurement frameworks should be set up to support smaller contractors by providing access to larger programmes, fostering local economic development and job creation. Delivery will require coordinated action between local authorities, housing providers, and private sector partners to design procurement processes that are transparent, efficient, and aligned with long-term decarbonisation objectives.

These frameworks could also support the creation of a list of ‘approved’ suppliers, hosted on the online ‘hub’ that would help to build consumer confidence when making individual decisions. This could help to establish minimum quality standards and leverage learnings from the Nottingham Energy Partnership on the required level of quality control and oversight required to ensure benefits are realised. Other benefits could be targeted through the ‘approvals’ process, such as entry-level jobs and social value delivery.

13.5.4 Workforce training programmes

Workforce training programmes are critical to ensuring that the transition to net zero is supported by a skilled and capable labour force. The scale of retrofit and low-carbon technology deployment required over the coming decade far exceeds current workforce capacity, creating a risk of delivery delays and cost escalation. Investing in training programmes now will build the necessary skills base for installing heat pumps, delivering high-quality retrofits, and integrating renewable energy systems.

These programmes should be developed in partnership with industry bodies, vocational training providers, and regional authorities to ensure alignment with market needs and future demand. Workforce development not only supports decarbonisation objectives but also delivers wider economic benefits through job creation and skills enhancement.

The presence of the East Midlands Institute of Technology and its links to regional universities and the East Midlands Freeport is a great opportunity for Mansfield & Ashfield to proactively engage in establishing the skills and local jobs pipeline. This could be kick-started through creating, or supporting an existing, skills forum between education institutions and local businesses.

13.5.5 Financing mechanisms for low-income households

A key consideration regarding funding mechanisms is starting by maximising uptake of existing central government schemes. Through keeping up to date with central government policy, such as the recent expansion of the Boiler Upgrade Scheme to include air-to-air ASHPs, and taking responsibility for sharing the appropriate information with relevant residents and businesses, uptake of supported interventions could be increased in the near future.

In addition to this, developing innovative financing mechanisms for low-income households is essential to ensure an equitable and inclusive transition. Many households face significant financial barriers to adopting energy efficiency measures or low-carbon technologies, even when long-term savings are substantial. Enabler actions in this area for the local authorities in partnership with other stakeholders include the creation of accessible loan schemes, targeted grant programmes, and blended finance models that reduce upfront costs and spread repayments over time. These mechanisms should complement existing national schemes while addressing local gaps in provision.

13.5.6 Funding opportunities

The suspension of the Public Sector Decarbonisation Scheme (PSDS) has created an urgent need to identify alternative funding streams for public sector organisations. Many local authorities and public institutions operate under severe financial constraints, limiting their ability to invest in energy efficiency and renewable energy projects. An alternative funding model is urgently needed to maintain momentum in public sector decarbonisation. These should prioritise projects that deliver high-impact carbon reductions and operational savings, such as building retrofits, heat decarbonisation and renewable energy installations. Some suggested alternative funding routes have been outlined in Session 12.6.

13.5.7 Industrial Decarbonisation & Hydrogen Readiness

Industrial decarbonisation is essential for achieving Mansfield & Ashfield's net zero objectives while safeguarding productivity and competitiveness. As the level of data available for analysis in this area is significantly lower than for domestic and public properties, and since decarbonisation routes will vary depending on sector and scale, it is important that further attention is given to this area. There are several large emitters that have not been engaged in the LAEP process, despite invitation, which may provide more insight on the likely route forward for significant shares of industrial energy usage.

A starting point could be to establish an industrial electrification 'showcase', enabling local businesses to engage with electrification suppliers. There is a perception that electrification is likely to be more costly, but this is highly dependent on the process and technology. In addition, the British Industrial Supercharger[90] may apply to businesses within the area and could change

[90] The British Industry Supercharger

the short-term viability of electrification for those businesses. Ensuring that businesses are informed about their options and potential benefits will be key to the rate of uptake here. This measure complements a fabric-first and electrification-first approach by preserving optionality for processes that are best suited to low-carbon hydrogen in the medium to long term.

Where electrification is not feasible, hydrogen readiness is an enabling step for hard-to-abate industrial processes. Preparing demand, infrastructure, skills, governance, and finance in a coordinated manner reduces delivery risk, accelerates time to scale, and ensures that hydrogen deployment, when available at the right cost and carbon intensity, can be adopted efficiently.

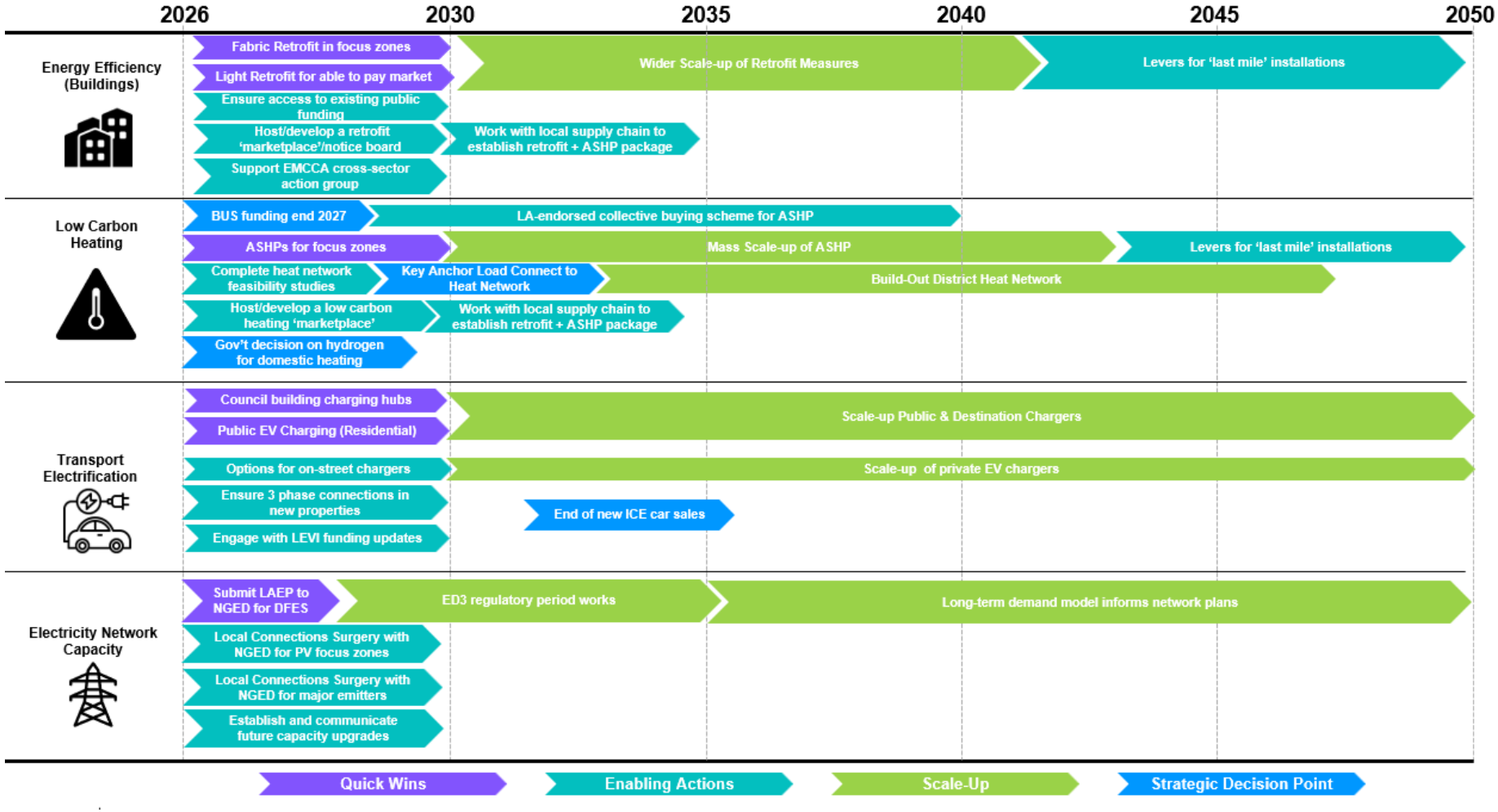
Cadent Gas is pursuing the East Coast Hydrogen project[91], with a view to delivering hydrogen by pipeline into the area in the early-mid 2030s. This provides an anchoring timeline for developing a hydrogen transition plan for relevant businesses. This also complements Cadent Gas' ambition to increase the share of hydrogen and biomethane in the local natural gas network. Keeping up to date on these developments, and supporting the projects and industry initiatives, such as East Midlands Hydrogen, associated with the development of a local hydrogen economy, will help to further understand and detail the expected role of hydrogen in the area.

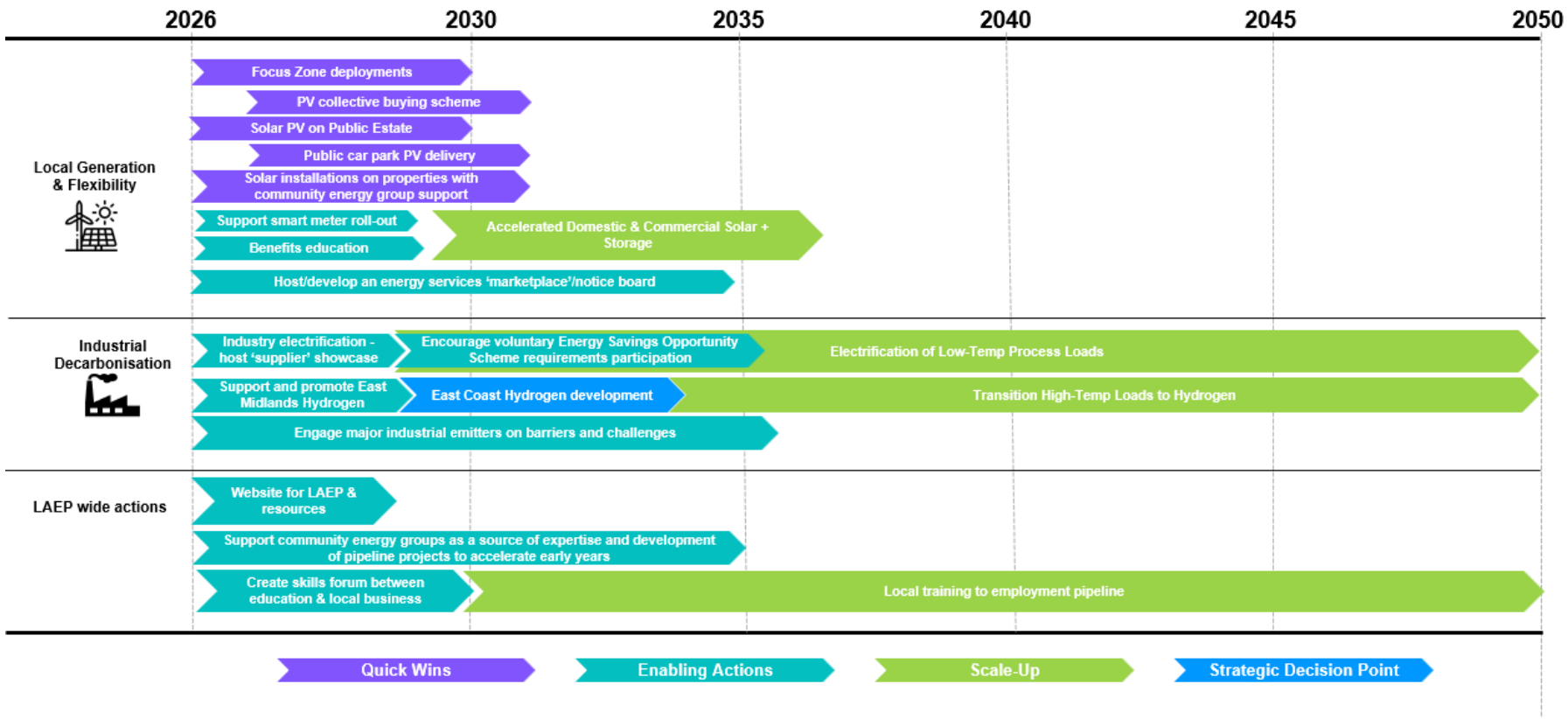
13.6 Phased Pathway

Figure 13.3 below sets out the delivery sequence for Ashfield and Mansfield's net zero interventions. Actions are phased to prioritise "quick wins" and "low regret" measures first, those that are cost-effective, widely supported, and deliver immediate benefits. Enabling actions and demonstrators lay the groundwork for larger-scale roll-out, while strategic decision points and uncertainties are highlighted to ensure the plan remains flexible and responsive as technologies and funding evolve. This approach maximises early impact, manages risk, and builds momentum for long-term transformation.

[91] Homepage - East Coast Hydrogen

Figure 13.3: Ashfield and Mansfield Pathway of actions required to reach a net zero energy system




2026
2030
2035
2040
2045
2050
Local Generation & Flexibility
Focus Zone deployments
PV collective buying scheme
Solar PV on Public Estate
Public car park PV delivery
Solar installations on properties with community energy group support
Support smart meter roll-out
Benefits education
Accelerated Domestic & Commercial Solar + Storage
Host/develop an energy services 'marketplace'/notice board
Industrial Decarbonisation
Industry electrification - host 'supplier' showcase
Encourage voluntary Energy Savings Opportunity Scheme requirements participation
Electrification of Low-Temp Process Loads
Support and promote East Midlands Hydrogen
East Coast Hydrogen development
Transition High-Temp Loads to Hydrogen
Engage major industrial emitters on barriers and challenges
LAEP wide actions
Website for LAEP & resources
Support community energy groups as a source of expertise and development of pipeline projects to accelerate early years
Create skills forum between education & local business
Local training to employment pipeline
Quick Wins
Enabling Actions
Scale-Up
Strategic Decision Point

14 Conclusions and Next Steps

The Ashfield and Mansfield Local Area Energy Plan provides a robust, data-driven, and spatially informed framework for delivering an equitable and economically efficient transition to net zero. It aligns Ashfield and Mansfield's local ambitions with regional and national policy objectives while tailoring interventions to the area's unique socioeconomic, infrastructural, and industrial characteristics.

The analysis presented throughout this plan confirms that Ashfield and Mansfield can significantly decarbonise its energy system by accelerating progress on energy efficiency, heat decarbonisation, and transport electrification while expanding local generation and enhancing system flexibility. The modelling outcomes demonstrate that these interventions, when coordinated effectively, deliver measurable benefits in emissions reductions, cost efficiency, and community well-being.

14.1 Key Outcomes

The modelling and analysis confirm that Ashfield and Mansfield can achieve substantial emission reductions across buildings, transport, and industry by following a sequenced and place-based approach. The emissions reductions are supported by strong co-benefits in fuel poverty alleviation and energy resilience.

Energy efficiency forms the cornerstone of the transition. Retrofit measures particularly in pre-1929 solid-wall homes and poorly insulated estates can significantly reduce space heating demand and operational costs while improving indoor comfort. A fabric-first approach is not only the most immediate means of reducing carbon emissions but also the foundation for cost-effective heat decarbonisation and grid stability. Targeting deep retrofit in focus zones with high fuel poverty risk ensures that the social benefits of net zero are distributed fairly.

Heating system transformation is equally central. The deployment of air-source heat pumps, heat networks, and supporting controls will replace the area's reliance on natural gas. Ensuring access to available funding and appropriate education for residents will be key to realising the benefits, alongside working with local business and skills institutions to establish the supply chain to keep the economic benefits of the installation pipeline in the local area.

Transport electrification presents the single largest emissions reduction potential. The LAEP scenario requires approximately 107,000 electric vehicles by 2050, supported by an accessible charging network. Starting from a low level of charging infrastructure, the area needs to progress this at a fast pace in the early years to avoid long-term impacts from a delayed start. Smart charging integration and uptake of time-of-use tariffs are essential for minimising strain on the grid and unlocking flexibility as well.

Local renewable generation, particularly rooftop solar, stands out as a major economic driver. It delivers net benefits exceeding £400 million and underpins local resilience by reducing exposure to volatile energy prices. The rollout will need to be planned in conjunction with the local electricity distribution network (NGED) in order to deliver in line with changes to network capacity. Integration with storage and smart systems enables households and organisations to participate actively in a flexible, low-carbon energy market.

Economic appraisal indicates that the 2050 Net Zero scenario requires approximately £2.5 billion in additional capital investment. Although this represents a substantial commitment, the system-wide benefits, including around £645 million in bill savings, improved health outcomes,

job creation, and reduced fuel poverty, position the transition as an economically rational long-term investment.

In addition to carbon reduction, the transition pathways identified in the LAEP deliver significant local air quality benefits, particularly through reduced emissions of nitrogen dioxide and fine particulate matter from transport and heating. These improvements support better public health outcomes and contribute to reducing health inequalities across Ashfield and Mansfield.

14.2 Strategic Implications

Delivering the LAEP will require coordinated action, stable policy support, and institutional readiness. The plan identifies the need for a dedicated Ashfield and Mansfield LAEP Delivery Partnership comprising Ashfield District Council, Mansfield District Council, EMCCA, the Distribution Network Operator, local housing providers, industry representatives, and community organisations. This governance structure would ensure that delivery is sequenced, resourced, and monitored effectively across multiple actors.

Funding and finance remain critical enablers. Leveraging national mechanisms such as the Warm Homes Plan, and Great British Energy programmes will be essential. However, innovative local financing models, including community energy investment, public–private partnerships, and aggregated purchase schemes, will also be needed to bridge funding gaps.

Skills and supply chain development represent both a challenge and an opportunity. The transition will require a significant expansion of the local workforce trained in retrofit, and heat pump installation. Collaboration between regional universities, local colleges, and industry partners can help build a resilient regional skills pipeline, ensuring that the economic benefits of the transition remain within the local economy.

Integration with spatial planning and infrastructure investment is also key. Embedding LAEP outputs into the councils' Local Plans and infrastructure pipeline will help ensure that energy considerations shape new housing developments, regeneration projects, and industrial growth corridors. Similarly, early engagement with the DNO will be necessary to align reinforcement schedules with the forecast growth of low-carbon technologies.

Ashfield and Mansfield's transition to net zero is both an environmental necessity and an opportunity to create a fairer, healthier, and more prosperous area. The LAEP demonstrates that with clear priorities, place-based planning, and coordinated governance, it is possible to achieve deep decarbonisation while delivering tangible local benefits.

The next decade will be decisive. By acting early on energy efficiency, low-carbon heat, and electrified transport, Ashfield and Mansfield can capture the economic and social advantages of the transition ahead of national timelines. Regular monitoring, transparent reporting, and adaptive management will ensure that progress remains on track and that interventions continue to deliver value for money.

14.3 Next Steps

To ensure the timely and effective delivery of the LAEP, the following immediate and critical steps are recommended:

- **Establish an Ashfield and Mansfield LAEP Delivery Partnership**: Create a cross-sector partnership chaired by either Ashfield District Council or Mansfield District Council and supported by EMCCA, the Distribution Network Operator, local businesses, housing associations, and community representatives. This body should oversee programme coordination, track progress, and identify funding opportunities

- **Launch Public Uptake and Engagement Programme with online 'hub':** Implement the recommended community engagement and communication strategy with urgency. This programme is vital to build public confidence, share good news stories, and drive the necessary adoption of low-carbon technologies like heat pumps. Priority should be given to demonstration and pilot projects that showcase best practice and real-world results.
- **Develop a Delivery Roadmap and Investment Plan**: Prioritise the short-, medium-, and long-term interventions identified in Chapter 13, including both quick wins and enabling actions.
- **Secure Early-Stage Funding and Demonstrator Projects**: Identify and secure initial funding mechanisms (local, regional, and national) to kick-start demonstrator projects in focus zones that can showcase tangible early benefits and build public support.
- **Hydrogen**: Initiate detailed engagement with key regional hydrogen stakeholders, such as East Midlands Hydrogen and Cadent Gas, to better advise on Ashfield and Mansfield specific industrial demand and the infrastructure development timeline. This will allow for informed decision-making regarding long-term solutions for high-temperature, hard-to-treat loads.
- **Monitor, Review, and Update:** Establish a monitoring framework with key performance indicators (KPIs) aligned to emissions reduction, energy demand, and social outcomes. The LAEP should be reviewed on a five-year cycle to reflect policy developments, technological advances, and local progress.

A. Glossary of Terms

After Diversity Maximum Demand (ADMD)	The estimated peak electrical demand per connection after accounting for diversity (i.e. the fact that not all devices run simultaneously); used by UK distribution network operators to size local network capacity and plan reinforcement for electrification from the installation of new technologies such as EVs and heat pumps
Air Source Heat Pump (ASHP)	An electrically driven heat pump that extracts heat from outside air to provide space heating and hot water; central to UK heat-electrification strategies but requires good insulation and grid planning.
Capital Expenditure (Capex)	One-off investment costs (e.g., buying heat pumps, building solar farms, grid upgrades) that are capitalised and influence project financing and payback.
Coefficient of Performance (COP)	Ratio of useful heat output to electrical input for a heat pump, equivalent to its efficiency when comparing to a typical boiler heating system. A key metric for system efficiency and running-cost/carbon calculations.
Combined Heat and Power (CHP)	Cogeneration that produces electricity and captures usable heat from the same fuel source, typically natural gas in UK installations.
Department for Energy Security and Net Zero (DESNZ)	UK government department responsible for energy security, energy policy and delivering the net-zero transition (policy, regulation, grants, standards).
Distributed Future Energy Scenarios (DFES)	Granular, licence-area forecasts produced by UK distribution system operators (DSOs) that model local uptake of EVs, heat pumps, storage and distributed generation to 2050 for network planning.
Floating Solar	Photovoltaic arrays mounted on water bodies (reservoirs, lakes) offering land-efficient solar deployment, reduced evaporation, and new planning/regulatory considerations in the UK.
Ground Source Heat Pump (GSHP)	Heat pump that extracts heat from the ground via buried loops; typically higher and more stable COP than ASHPs but requires land/groundworks and different planning considerations in the UK.

Gross Value Added (GVA)	Economic measure of the value generated by goods and services (output minus intermediate consumption); used to assess economic impacts of decarbonisation policies and green investment.
Internal Combustion Engine (ICE)	Engine where fuel combustion occurs within the engine (petrol/diesel); ICE vehicles are a primary target for electrification to cut transport emissions in UK net-zero plans.
tCO_2e	One ton of equivalent carbon dioxide emissions. This unit aggregates greenhouse gasses using their Global Warming Potential, and is used to report on emissions at a project, local authority, or national scale. If prefixed with a k then it represents 1000 tonnes.
LULUCF	Land Use, Land-Use Change and Forestry sector covering emissions/removals from land management, afforestation, peatland restoration and land-use change — important for UK carbon accounting and sinks.
Minimum Energy Efficiency Standard (MEES)	UK legal minimum EPC rating for private rented properties (currently enforced thresholds with planned uplifts) to improve building efficiency and reduce emissions from the building stock.
Neso Future Energy Scenarios (FES)	Future Energy Scenarios (FES) published by the National Energy System Operator (formerly ESO/National Grid) — national, system-level pathways to 2050 used alongside DFES for planning and policy.
Operating Expenditure (Opex)	Recurring costs to run assets (energy, maintenance, staffing); critical for lifecycle carbon and cost modelling of low-carbon technologies.
W/m^2K	U-value unit (watts per square metre-kelvin) measuring thermal transmittance of building elements; a lower W/m^2K provides better insulation and lower heating demand. This is central to determining retrofit and heat-pump readiness of a building.

B. Data Types and Validation

Table B.1: List of attributes available from Energy Savings Trust for domestic and non-domestic buildings

Attribute	Domestic	Non-domestic
UPRN	✓	✓
Council Ward	✓	✓
LSOA	✓	×
Postcode	✓	✓
Address	✓	✓
Property Type	✓	×
Property Tenure	✓	×
Property Age band	✓	×
Number of Storeys	✓	×
Property Class	×	✓
Primary Use	×	✓
Mixed Use	×	✓
Building storey height	×	✓
Asset rating band	×	✓
Listed Building	✓	×
Wall Construction Type	✓	×
Wall Insulated	✓	×
In Conservation Area	✓	×
Flood Risk	✓	×
Floor Construction	✓	×
Floor Insulated	✓	×
Loft Insulation Prediction	✓	×
Glazing Type Prediction	✓	×
Heating System	✓	×
Fuel Type	✓	✓
EPC Rating	✓	×
SAP Score	✓	×
Roof Orientation	✓	×
Off gas grid	✓	×
Probability of fuel poverty	✓	×
ECO funding eligibility	✓	×
LAD funding eligibility	✓	×

C. Non-domestic top gas users

Table C.1: Ashfield and Mansfield Non-Domestic Top Gas Users

Local Authority	Process Load categorisation	Annual Gas consumption (GWh)	Buildings Electricity Consumption (MWh)	Total Carbon Emission ($ktCO_2e$)
Ashfield	High	24	9	8
Ashfield	Low	122	14	2
Mansfield	High	30	9	2
Mansfield	Low	116	3	3

D. Buildings interventions by MSOA

D.1 Mansfield

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
Mansfield 001 - Church Warsop & Meden Vale					
	Light Retrofit	1,407			138
	Deep Retrofit	2,132			418
	Domestic ASHP		29,852		
	Non-Domestic ASHP				
	Domestic Solar PV			4,859	1,006
	Non-Domestic Solar PV			515	107
Mansfield 002 - Market Warsop					
	Light Retrofit	2,416			468
	Deep Retrofit	2,951			577
	Domestic ASHP		27,425		
	Non-Domestic ASHP				
	Domestic Solar PV			4,807	995
	Non-Domestic Solar PV			1,397	289
Mansfield 003 - Manor, Hornby & Peafields					
	Light Retrofit	2,729			531
	Deep Retrofit	3,108			614
	Domestic ASHP		37,261		

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
	Non-Domestic ASHP				
	Domestic Solar PV			5,863	1,214
	Non-Domestic Solar PV			441	91
Mansfield 004 - Woodhouse	Light Retrofit	2,438			475
	Deep Retrofit	5,490			1,052
	Domestic ASHP		29,995		
	Non-Domestic ASHP				
	Domestic Solar PV			6,269	1,298
	Non-Domestic Solar PV			3,172	657
Mansfield 005 - Yeoman Hill & Maun Valley	Light Retrofit	2,182			427
	Deep Retrofit	5,314			1,047
	Domestic ASHP		25,258		
	Non-Domestic ASHP				
	Domestic Solar PV			4,727	979
	Non-Domestic Solar PV			1,149	238
Mansfield 006 - Abbott Road & Pleasley Hill	Light Retrofit	3,102			618
	Deep Retrofit	6,538			1,301
	Domestic ASHP		33,664		
	Non-Domestic ASHP				
	Domestic Solar PV			6,871	1,422
	Non-Domestic Solar PV			2,886	597

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
Mansfield 007 - Forest Town & Newlands	Light Retrofit	3,184			603
	Deep Retrofit	3,894			758
	Domestic ASHP		46,247		
	Non-Domestic ASHP				
	Domestic Solar PV			9,520	1,971
	Non-Domestic Solar PV			4,159	861
Mansfield 008 - Mansfield Town Centre & Broomhill	Light Retrofit	2,140			426
	Deep Retrofit	11,739			2,337
	Domestic ASHP		61,067		
	Non-Domestic ASHP				
	Domestic Solar PV			7,028	1,455
	Non-Domestic Solar PV			11,753	2,433
Mansfield 009 - Newgate & Carr Bank	Light Retrofit	1,983			384
	Deep Retrofit	8,805			1,732
	Domestic ASHP		30,792		
	Non-Domestic ASHP				
	Domestic Solar PV			5,509	1,140
	Non-Domestic Solar PV			2,291	474
Mansfield 010 - Grange Farm & Ladybrook	Light Retrofit	3,751			744
	Deep Retrofit	4,008			783
	Domestic ASHP		41,693		
	Non-Domestic ASHP				

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
	Domestic Solar PV			7,208	1,492
	Non-Domestic Solar PV			1,409	292
Mansfield 011 - Eakring & Ling Forest					
	Light Retrofit	3,367			664
	Deep Retrofit	5,074			529
	Domestic ASHP		26,691		
	Non-Domestic ASHP				
	Domestic Solar PV			4,750	983
	Non-Domestic Solar PV			1,179	244
Mansfield 012 - Oak Tree & Ransom					
	Light Retrofit	1,861			361
	Deep Retrofit	2,699			1,317
	Domestic ASHP		30,248		
	Non-Domestic ASHP				
	Domestic Solar PV			4,040	836
	Non-Domestic Solar PV			4,579	948
Mansfield 013 - King's Walk, Berry Hill & Oakham					
	Light Retrofit	5,220			1,037
	Deep Retrofit	12,821			2,552
	Domestic ASHP		64,875		
	Non-Domestic ASHP				
	Domestic Solar PV			11,639	2,409
	Non-Domestic Solar PV			7,882	1,632

D.2 Ashfield

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
Ashfield 001 - Stanton Hill & Skegby					
	Light Retrofit	2,048			418
	Deep Retrofit	4,824			960
	Domestic ASHP		25,150		
	Non-Domestic ASHP				
	Domestic Solar PV			4,173	864
	Non-Domestic Solar PV			376	78
Ashfield 002 - The Dales & South Skegby					
	Light Retrofit	2,026			401
	Deep Retrofit	16,520			3,290
	Domestic ASHP		32,725		
	Non-Domestic ASHP				
	Domestic Solar PV			5,362	1,110
	Non-Domestic Solar PV			3,993	826
Ashfield 003 - Huthwaite					
	Light Retrofit	1,240			243
	Deep Retrofit	6,461			1,303
	Domestic ASHP		25,131		
	Non-Domestic ASHP				
	Domestic Solar PV			5,524	1,144
	Non-Domestic Solar PV			931	193

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
Ashfield 004 - Sutton Forest Side & New Cross	Light Retrofit	2,652			432
	Deep Retrofit	6,679			1,325
	Domestic ASHP		28,263		
	Non-Domestic ASHP				
	Domestic Solar PV			5,425	1,123
	Non-Domestic Solar PV			2,669	553
Ashfield 005 - Stton Central & Leamington					
	Light Retrofit	1,997			399
	Deep Retrofit	10,938			2,182
	Domestic ASHP		28,185		
	Non-Domestic ASHP				
	Domestic Solar PV			4,814	996
	Non-Domestic Solar PV			2,719	563
Ashfield 006 - Sutton St Mary's & Ashfields					
	Light Retrofit	2,771			548
	Deep Retrofit	662			132
	Domestic ASHP		23,683		
	Non-Domestic ASHP				
	Domestic Solar PV			4,107	850
	Non-Domestic Solar PV			256	53
Ashfield 007 - East Kirkby					
	Light Retrofit	2,094			421
	Deep Retrofit	10,117			2,024
	Domestic ASHP		33,002		
	Non-Domestic ASHP				

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
	Domestic Solar PV			6,777	1,403
	Non-Domestic Solar PV			2,294	475
Ashfield 008 - Kirkby Central					
	Light Retrofit	1,313			254
	Deep Retrofit	5,235			1,042
	Domestic ASHP		30,634		
	Non-Domestic ASHP				
	Domestic Solar PV			5,932	1,228
	Non-Domestic Solar PV			412	85
Ashfield 009 - Kirkby Larwood & Kingsway					
	Light Retrofit	2,082			413
	Deep Retrofit	11,107			2,221
	Domestic ASHP		28,950		
	Non-Domestic ASHP				
	Domestic Solar PV			4,842	1,002
	Non-Domestic Solar PV			1,321	273
Ashfield 010 - Annesley & Kirkby Woodhouse					
	Light Retrofit	2,284			450
	Deep Retrofit	8,023			1,603
	Domestic ASHP		30,469		
	Non-Domestic ASHP				
	Domestic Solar PV			6,239	1,291
	Non-Domestic Solar PV			317	66
Ashfield 011 - Selston					
	Light Retrofit	1,873			372

MSOA	Intervention	Annual Energy Savings (MWh/y)	Annual Gas Displacement (MWh/yr)	Annual Electricity Generation (MWh/yr)	Annual Carbon Savings (tCO_2e)
	Deep Retrofit	12,857			2,570
	Domestic ASHP		20,884		
	Non-Domestic ASHP				
	Domestic Solar PV			3,213	665
	Non-Domestic Solar PV			4,120	853
Ashfield 012 - Jacksdale & Underwood	Light Retrofit	2,050			407
	Deep Retrofit	6,606			1,317
	Domestic ASHP		24,446		
	Non-Domestic ASHP				
	Domestic Solar PV			4,716	976
	Non-Domestic Solar PV			820	170
Ashfield 013 - Hucknall North & East	Light Retrofit	2,658			531
	Deep Retrofit	12,187			2,433
	Domestic ASHP		32,737		
	Non-Domestic ASHP				
	Domestic Solar PV			7,297	1,510
	Non-Domestic Solar PV			2,577	533

