WILTSHIRE COUNTY REPORT

Wiltshire Carbon Emissions Baselines and Reduction Pathways

March 2022

Anthesis

Wiltshire Council

Anthesis

Anthesis is the Sustainability Activator.

We are the largest group of dedicated sustainability experts in the world: a team of 500+ people, working across seventeen countries, to serve more than 800 clients. We exist to shape a more productive and resilient world by helping organisations transition to new models of sustainable performance. Our team combines broad and deep sustainability expertise with the commercial and operational capabilities it takes to conceive and deliver real change.

Our work with local authorities

Anthesis has significant experience supporting local authorities who have declared a climate emergency and are working towards net zero. Our work includes:

SCATTER: We are the developers of the SCATTER tool (Setting City Area Targets and Trajectories for Emissions Reduction), a free to use tool for UK local authorities. This provides a current GHG baseline for area-wide emissions and models different trajectories for emissions reduction to 2050.

Project Carbon Impact Assessment Tool: Anthesis, in partnership with two local authorities, has developed an assessment tool to measure the emissions reductions associated with different low-carbon projects. This helps quantify the carbon impact of both capital and revenue projects and helps better embed the financial cost of carbon within decision-making.

Authority Based Insetting: Anthesis is leading a consortium of local authorities to develop a framework supporting the implementation of carbon-saving projects locally. This will help local authorities meet their net-zero targets, stimulate greater investment in the borough, and increase collaboration between stakeholders.

EXECUTIVE SUMMARY

Wiltshire's Climate Change Commitment

In February 2019, Wiltshire Council acknowledged the climate emergency and committed to seek to make Wiltshire Carbon Neutral by 2030. Action has already been taken to reduce emissions across Wiltshire. Published in early 2022, the 2022-2027 Climate Strategy sets out a framework for reducing emissions over the next 5 years. This encapsulates several action areas: Transport, Homes and Built Environment, Natural Environment, Energy, Green Economy and Waste.

Emissions Profile

In 2018 (data published June 2020), Wiltshire was responsible for net emissions totalling **3,992.6 $ktCO_2e$.** The majority resulted from **on-road transport (33.2%) and residential (domestic) buildings (23.1%)**, seen below in Figure a. Land use provides a negative emission figure by sequestering carbon from the atmosphere and acting as a carbon sink for the area.

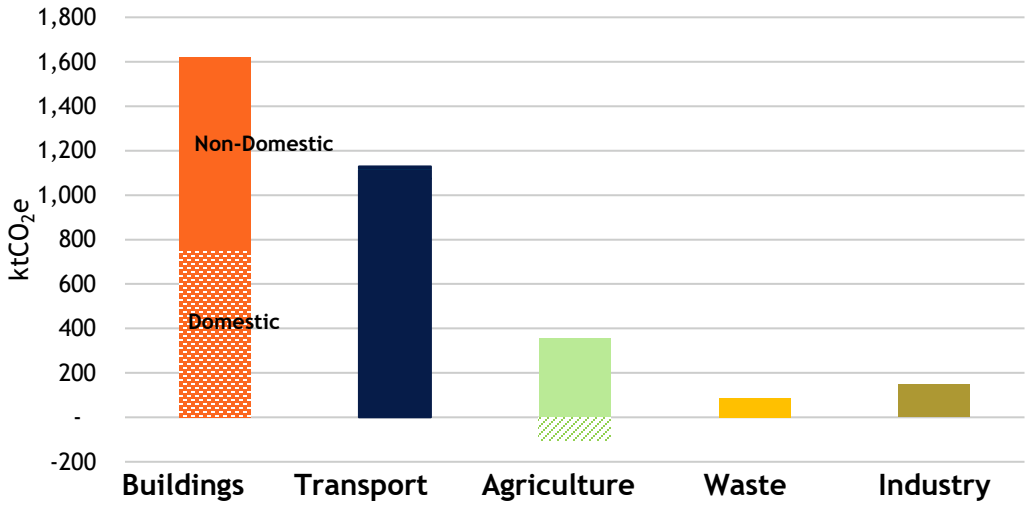


Figure a: SCATTER 2018 inventory for Wiltshire's Scope 1 & 2 emissions, shown by sector. Dotted buildings emissions indicate residential buildings. Crosshatched Agricultural emissions indicate carbon sequestration through land use.

Emissions Reduction Pathways

Emissions reduction pathways can demonstrate how Wiltshire's carbon emissions may change over time depending on local and national action. Figure b below shows four possible future emissions pathways for Wiltshire as modelled by the SCATTER Pathways Tool, for differing levels of ambition. This is compared against the reductions required by the Paris Agreement. The High Ambition pathway is an illustration of the maximum feasible climate action, notwithstanding any challenges arising from funding, skills and other constraints.

It should be noted that the High Ambition Pathway does not achieve Wiltshire's carbon neutrality ambition by 2030. Even with the most ambitious interventions, 1,247 $ktCO_2e$ emissions remain in the energy system by 2030. This signals the need for radical action, focussing on the interventions outlined in SCATTER, but also going beyond. Carbon offsetting may also be explored.

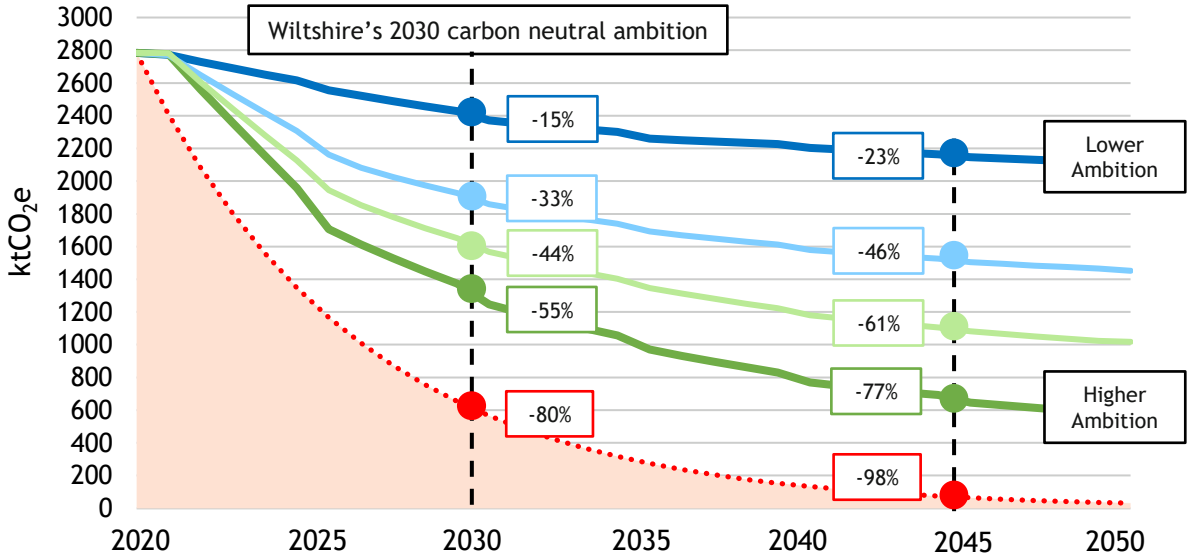


Figure b: Possible percentage reductions in emissions for Wiltshire along the pathways compared to 2019 levels. Red dotted line indicates Paris Agreement aligned reductions.

EXECUTIVE SUMMARY

Carbon Reduction Measures

The plan sets out recommendations for action across several areas:

Buildings

1.1 Improving energy efficiency
1.2 Reducing gas heating systems
1.3 Low carbon and energy efficient cooking, lighting and appliances

Industry

4.1 Shifting away from fossil fuels
4.2 More efficient processes

Transport

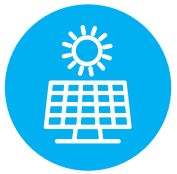
2.1 Travelling shorter distances
2.2 Driving less
2.3 Switching to electric vehicles
2.4 Improving freight emissions

Natural Environment

5.1 Increased tree coverage & tree planting
5.2 Land use management
5.3 Livestock management

Waste

3.1 Reducing the quantity of waste
3.2 Increasing the recycling rate



Energy Supply

6.1 Increase solar photovoltaic (PV) capacity
6.2 Increase the capacity of other renewable technologies

For each sector and its interventions, **indicators**, **carbon savings**, **costings** and an assessment of the **level of influence** Wiltshire Council has over each intervention are provided. The indicators are intended to demonstrate the maximum achievable level of action, which may not provide a realistic level of action when considering limitations of Wiltshire Council's influence.

The council cannot deliver carbon neutrality alone. Success is only possible if the council, residents, businesses, and national government each work to reduce emissions. Depending on the emissions source, the council may be better equipped either to take direct action, or to take a role in influencing or convening others.

Achieving SCATTER's High Ambition pathway:

CARBON SAVINGS TO 2030
7,083 $ktCO_2e$

CARBON SAVINGS TO 2045
27,197 $ktCO_2e$

COSTS TO 2030
Capital: £2,441m
Revenue Savings: -£494m

COSTS TO 2045
Capital: £5,321m
Revenue Savings: -£4,541m

Carbon Offsetting

Carbon offsetting refers to the purchase of a tradeable unit, representing emissions rights or emissions reductions, to balance the climate impact of an organisation, activity or individual, and could be applied to address any emissions not tackled through the measures outlined. This may include nature-based solutions or other technologies such as carbon capture and storage (CCS). Adopting carbon offsetting measures within Wiltshire's boundary, also known as carbon insetting, is recommended over market-based carbon credits due to their associated challenges. Climate mitigation actions should always be maximised first before carbon offsetting is explored.

Recommendations

It is recommended that the council and partners refer to the interventions outlined to guide planning for carbon reduction action across Wiltshire, in line with the council's ambition of a carbon neutral county. If, due to resource constraints, the council is required to prioritise action, it is recommended that both the potential carbon impact, and the ability of stakeholders in Wiltshire to influence the emissions, are key considerations. However, work across all impact areas is vital. The council should also explore "Crosscutting" actions to increase its ability to drive action in the area, such as lobbying national government and engaging with residents and businesses.

CONTENTS

01 Background & Context

1. BACKGROUND & CONTEXT
INTRODUCTION

Overview & Scope

In 2019, Wiltshire Council confirmed its ambition to seek to achieve carbon neutrality across Wiltshire by 2030.

This report has been commissioned by the council to provide a roadmap towards carbon neutrality, helping everyone in Wiltshire understand the scale of action required and providing indication of the technological interventions required to achieve this.

- **Chapter 1** introduces the work, and the key contexts
- **Chapter 2** outlines the key greenhouse gas emissions sources in Wiltshire
- **Chapter 3** outlines Wiltshire's carbon budget
- **Chapter 4** details carbon reduction pathways associated with differing levels of climate ambition on the county
- **Chapter 5** explores carbon reduction measures associated with the most ambitious level of action modelled in SCATTER, across 6 key themes: Buildings, Transport, Waste, Industry, Energy Supply, and the Natural Environment
- **Chapter 6** contains our conclusions, including recommendations on how to identify priority areas for action

Engagement

Anthesis engaged stakeholders at Wiltshire council at several milestones during the research process, including through a data request form, and in workshops, to build a more complete picture of local factors. Partners in the NHS and Landmarc services were also engaged through data request forms.

Objectives of this report

- Set out the current baseline of emissions in Wiltshire, and a pathway to carbon neutrality in line with a highly ambitious level of action
- Give indication of the nature and scale of technological interventions needed in Wiltshire in order to achieve this pathway, and the associated carbon savings
- Contextualise these milestones with additional detail on the cost of action, potential co-benefits of action, and other considerations on the ability of the council to influence each area
- Based on the above, give recommendations on how the council can identify priority areas for action

The data provided in this report is indicative and highlights the scale and speed of change needed across Wiltshire to achieve carbon neutrality.

This will help the council by:

- Providing an evidence base against which the council can set goals for climate action in Wiltshire
- Give guidance on how to identify priority areas for action, informing a full carbon neutral delivery plan for Wiltshire
- Giving an indication of the potential financial costs and savings, and co-benefits of action, further informing planning

1. BACKGROUND & CONTEXT
A CALL TO ACTION

A Growing Consensus

It is widely agreed that climate change poses an unprecedented threat, and that action is required across all aspects of society. Most recently, this was communicated by the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report, which states that 1.5ºC of warming is now unavoidable, but that strong action can still limit climate change, and with radical action, temperatures could stabilise in 20-30 years. The recognition of urgency is no longer just a message from environmental groups, but is being reiterated across a variety of sectors:

- **UK Local Authorities:** The majority of Local Authorities in the UK have now declared a climate emergency or a motion on climate change. 85% of councils now have a climate plan. Wiltshire's commitments are explored overleaf.
- **National Governments:** At 2021's UN Conference of Parties (COP) meeting in Glasgow, governments made pledges to strengthen their action, and better align with the reductions targeted in the Paris Agreement.
- **Environmental Groups:** The Wiltshire Climate Alliance is an umbrella group looking to accelerate climate action in the county. Its membership includes community climate groups, campaign groups and community energy organisations. Climate protests have occurred in Wiltshire, driven by pressure groups such as Extinction Rebellion.
- **Businesses:** 1,000 companies globally are setting Science Based Targets.

Dangerous Impacts

Under a range of scenarios described in the CCC's 2021 Risk Assessment, it is expected that average winter precipitation will increase, both in terms of the intensity of the rainfall, and in terms of the number of wet days. Summers are expected to get drier, but the intensity of summer precipitation (when it does occur) will increase. More properties will face the risk of flooding, and areas already at risk will face more frequent flooding. Current flood defences will be subject to additional pressure which imposes risk for further flooding events. Climate change is expected to increase the risk of flooding across all sources in the future.

Local Action

The above impacts further underscore the urgency with which action needs to be taken. In the 2018 Emissions Gap Report, the UN identified local action as a key driver for change: *"…non-state and subnational action plays an important role in delivering national pledges. Emission reduction potential from non-state and subnational action could ultimately be significant, allowing countries to raise ambition."*

On the next page, we further explore Wiltshire's climate commitment, contextualised within the national context.

1. BACKGROUND & CONTEXT
CONTEXT AND COMMITMENTS

Contextualizing this report

In February 2019, Wiltshire Council acknowledged the climate emergency and committed to seek to make the county of Wiltshire Carbon Neutral by 2030. Action has already been taken to reduce emissions across Wiltshire. Published in early 2022, the 2022-2027 Climate Strategy sets out a framework for reducing emissions over the next 5 years. This encapsulates several action areas: Transport, Homes and Built Environment, Natural Environment, Energy, Green Economy and Waste.

In recognition of the climate emergency, the council is undertaking several immediate carbon mitigation actions to address these topics. Looking further ahead, the strategy cites a need for further technical studies to inform more detailed delivery plans. This study will provide that evidence base for further action, by modelling a pathway to carbon neutrality which illustrates what types of action **need to happen in the county**. The outputs of our pathways modelling address all the themes above. We also explore the application of carbon offsets in addressing any emissions remaining after ambitious avoidance and reduction action has been taken. The council can also use these outputs as a basis to explore future Net Zero targets (which would exclude most forms of offsets), as a "stretch" goal.

A Carbon Neutral Council

The council has also set out actions in line with its goal of achieving carbon neutrality across the council's own operations by 2030 and requires a similar pathway to carbon neutrality for this scope. This is delivered in Anthesis' report "Wiltshire Council Carbon Emissions Baseline and Reduction Pathways".

National, Regional and Local Commitments

Commitments have been made and targets have been set at all levels of government in response to the growing momentum around climate action:

The Paris Agreement set the international target to limit global temperature rise to well below 2°C with the aim of 1.5°C above pre-industrial levels. The IPCC's follow up report stated that this requires a global reduction in GHG emissions of 45% by 2030. Governments strengthened their commitments at the COP meeting in Glasgow in 2021.

The Climate Change Act 2008 introduced a legally binding target for the UK to reduce GHG emissions by 80% by 2050. In June 2019, the target was updated to reach net zero by 2050. This was further enhanced in June 2021 when the UK government committed to reducing emissions by 78% by 2035 compared to 1990 levels.

Wiltshire Council has committed to seek to make Wiltshire a carbon neutral county by 2030 and has committed to making the council a carbon neutral organisation by 2030. Several other council plans and policies hold relevance to these commitments. Within Chapter 5, overviews of key policies as they apply to each action theme are provided.

02 Wiltshire's Emissions Baseline

2. WILTSHIRE'S EMISSIONS BASELINE
INTRODUCTION TO SCATTER

SCATTER Overview

The emissions modelling in this report has been achieved through the application of Anthesis' SCATTER Inventory and Pathways Tool.

The SCATTER Tool is an information source designed to help local authorities understand their emissions profile and inform priorities for emissions reduction. The tool was developed by Anthesis in partnership with the Department for Business Energy & Industrial Strategy, The Tyndall Centre for Climate Change Research, Nottingham City Council and others and it has been used by over 300 local authorities to date. The tool offers:

- **Emissions Inventories:** The tool provides an exportable greenhouse gas emissions inventory for any local authority in the country, covering Scope 1 and Scope 2 emissions (i.e. Wiltshire's territorial emissions)
- **Emissions Pathways:** The tool provides a range of visual, easy to understand emissions scenarios up to 2050. This is explored further in Chapter 4.

What is the difference between Scope 1, 2 and 3 emissions?

- **Scope 1** describes emissions associated with direct in-boundary consumption of fossil fuels, such as tailpipe emissions from on-road transport.
- **Scope 2** describes emissions from the use of grid-supplied electricity. The national energy grid mix is supplied by a variety of sources; natural gas, solar PV, wind and nuclear etc. The carbon impact of burning gas to create electricity is captured and recorded as scope 2 emissions.
- **Scope 3** describes emissions which occur outside of the local authority but are a result of activities or consumption within the boundary of Wiltshire. For example, transportation for goods and services to Wiltshire, delivered from outside the boundary.

Basic principles of SCATTER

Sir David MacKay's "Sustainable Energy - Without Hot Air (2009)" provides the basis for the pathways modelling. As a scientific advisor to the Department for Energy & Climate Change (DECC),[1] MacKay's work led to the development of the 2050 Pathways Calculator.

Two key modifications were made by Anthesis:

1) We scaled it down for sub-national regions: Scaling assumptions and localised data sets were built into the tool so that results were representative of cities and local authority regions, rather than the UK as a whole.

2) We pushed ambition further: Technologies within the tool were reviewed and updated where judged to be out of date and constraining ambition. Given that almost a decade had passed between MacKay's publication and the release of the 2050 Pathways Tool, we sought the counsel of a technical panel to make these updates.

Many other sector specific aspects of modelling treatment and assumptions have required consideration and interpretation as we have applied the model to various cities and local authorities.

Please be aware that SCATTER Pathways applies a calculated electricity factor based on renewable energy generated within the local boundary, which is not applied in the calculation of your area's inventory. This means that **the modelled SCATTER Pathways start from 2019, whereas the SCATTER baseline inventory represents data from 2018.** Full details of the Inventory and Pathways methodologies are available on SCATTER.

[1] DECC responsibilities were reformed into BEIS in 2016

2. WILTSHIRE'S EMISSIONS BASELINE
SCATTER EMISSIONS PROFILE

In 2018, Wiltshire was responsible for net emissions totalling 3,992.6 $ktCO_2e$. The majority resulted from on-road transport (33.2%) and residential buildings (23.1%).

The current emissions profile for the area administered by Wiltshire Council is shown opposite, based on the SCATTER Tool. This covers three greenhouse gases: carbon dioxide, nitrous oxide and methane and relates to the 2018 reporting year. Throughout this report, emissions are given as a single figure measured in kilotonnes of carbon dioxide equivalent (kt CO_2e) and this accounts for other greenhouse gases based on a global warming potential.

The emissions profile covers emissions generated within the county boundary (i.e. based on a territorial approach) for activities associated with Scope 1 and 2 emissions. Not all subsectors can be neatly summarised as a "slice" of this chart. Land acts as a carbon sink for the region by sequestering carbon from the atmosphere, so its "slice" represents the percentage of emissions it absorbs relative to the other sub-sectors.

Considering the Footprint Boundary

The SCATTER emissions inventory is aligned to global reporting standards set out by the Global Protocol for City-wide (GPC) Greenhouse Gas Emissions. A selected range of scope 3 emissions sources are included within the SCATTER Tool (in line with the BASIC+ emissions reporting principle), and these notably include emissions from aviation and freight. These are omitted from this analysis to reflect the lack of local authority influence over these emissions and to treat them as 'national overheads'.

Continuous Improvement

The SCATTER tool has been enhanced this year to offer the council greater visibility of emissions sources associated with the area. The council's emissions baseline data should be continually revisited and revised as is appropriate, allowing the council to track progress against its commitments.

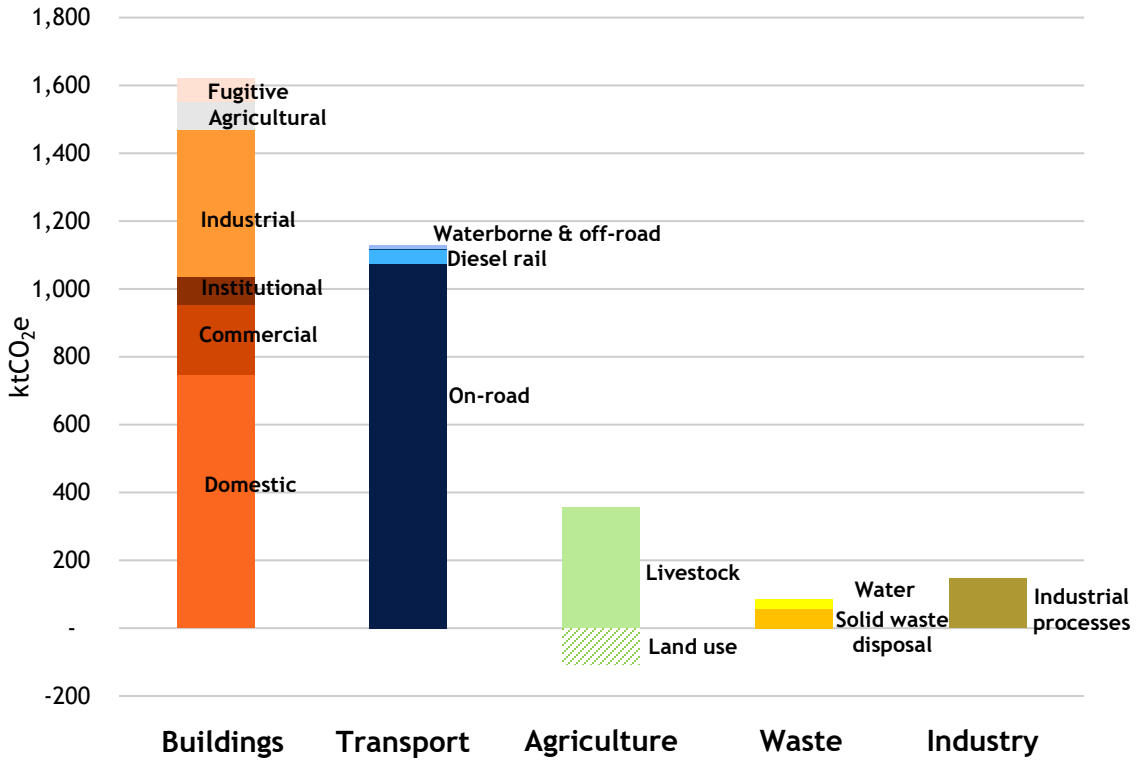


Figure 2.1: SCATTER 2018 inventory for Wiltshire's Scope 1 & 2 emissions, shown by sub-sector. This is broken down further overleaf.

3. WILTSHIRE'S EMISSIONS BASELINE
SCATTER EMISSIONS SUBSECTORS

Building on the data given on the prior page, these tables demonstrate the profile of each emissions sector and explain the sources of emissions included in each. Further breakdowns are provided in Section 5, along with commentary on key local factors contributing to the emissions profile.

50.1% of emissions in Wiltshire come from buildings

- **Residential buildings (23.1%):** Households of all tenure types.
- **Industrial buildings & facilities (13.4%):** Larger industrial facilities, including factories, warehouses and workshops associated with manufacturing and engineering.
- **Commercial buildings & facilities (6.4%):** Buildings from which commercial businesses operate e.g. shops, shopping centres, offices, restaurants etc.
- **Institutional buildings & facilities (2.5%):** Public sector buildings including schools, colleges and educational buildings, health centres, hospitals, leisure centres, Council buildings etc.
- **Agricultural fuel use (2.5%):** Fuel consumption from static machinery in agricultural facilities. This does not include direct emissions from livestock or fertiliser.
- **Fugitive emissions (2.2%):** Fugitive emissions are leaks and releases of gases from a pressurized containment - such as appliances, storage tanks and pipelines

11% of emissions in Wiltshire come from livestock and land use acts as a net carbon 'sink' of -3.3%

- **Livestock (11%):** Including emissions from both dairy and non-dairy cattle as well as other farm livestock.
- **Land use (-3.3%):** These emissions estimations rely heavily on DEFRA estimations on land use types and include emissions produced as well as sequestration. Only CO_2 is considered for land use, so the figure quoted for sequestration is likely to be an underestimate.

34.9% of emissions in Wiltshire come from transport

- **On-road transport (33.2%):** Emissions from all forms of on-road passenger vehicle, including cars, vans, motorcycles, buses and taxis.
- **Diesel rail (1.3%):** Emissions from diesel-fuelled rail transport. Emissions from electricity consumption within the rail sector are included in the commercial and industrial sectors as it is not possible to separate these emissions.
- **Off-road (0.3%):** A base assumption of 1% of total on-road emissions
- **Waterborne navigation (0.1%):** Emissions from fuel consumption associated with waterborne transportation

2.7% of emissions in Wiltshire come from waste disposal

- **Solid waste disposal (1.8%):** Incorporates various waste streams across commercial, industrial and municipal sources.
- **Wastewater (0.9%):** Scaled directly from national wastewater data by population.
- Emissions from **Incineration** are currently nil. See Appendix 2 for discussion of the Northacre Renewable Energy plant

4.6% of emissions in Wiltshire come from industry

- **Industrial processes (4.6%):** National industrial processing emissions associated with heavy industry, such as iron & steel and chemicals, have been scaled down for Wiltshire

Note: Percentages may not sum to 100% due to rounding.

03 Wiltshire's Carbon Budget

3. WILTSHIRE'S CARBON BUDGET
TYNDALL CENTRE CARBON BUDGET

Considering Carbon Budgets

The emissions profile outlined in Section 2 offers the baseline from which to measure progress towards net zero by 2030. Also important is the fact that once emitted, greenhouse gases such as CO_2 and N_2O can remain in the atmosphere for extended periods of time – up to hundreds of years. This means it is crucial to consider Wiltshire's *cumulative* year-on-year emissions.

The Paris Agreement's aim of remaining *"…well below 2°C"* of warming dictate an upper limit of greenhouse gas emissions that are allowed. We can join these ideas together in the form of a *carbon budget*, a fixed limit of cumulative emissions that are allowed over a given time in order to keep global temperatures within a certain threshold.

The Tyndall Centre for Climate Change Research, based at the University of Manchester, applied this concept to local authorities, assigning a 'carbon budget' for each. There are two key ideas underpinning their research:

- **The carbon budget is a fixed amount:** A global emissions limit represents the total emissions allowed before the 1.5°C threshold for greenhouse gas concentration is crossed. This global "budget" can then be scaled down to a national level, and finally, a regional level. See Appendix 3 for more details on how the Tyndall Centre break down the global carbon budget.
- **Emissions now mean impacts later:** The most crucial element of this approach is understanding the importance of cumulative carbon emissions. Once emitted, carbon dioxide remains in the atmosphere for many years, contributing to increasing the average global temperature. The carbon budget does not reset; it represents a fixed upper limit to emissions.

These two principles mean that the annual reduction rate of emissions becomes very important. Cumulative emissions and the scale and speed of action in the short-term are crucial in meeting the targets of the Paris Agreement.

Emissions covered by the Tyndall carbon budget

The Tyndall Centre carbon budget has a different scope to the emissions profile within SCATTER:

- **This budget can be defined as energy-only** which means that the budget accounts for emissions from within Wiltshire's energy system. In the context of climate change, an energy system has been defined by the IPCC as a "system [that] comprises all components related to the production, conversion, delivery, and use of energy"
- **Land use, land use change and forestry** is not incorporated into this budget analysis.
- **Only CO_2 emissions are assessed** and contributions from all other greenhouse gases, such as methane and nitrous oxide, are excluded.
- **Aviation and shipping emissions are omitted** given the nature of these emissions. Responsibility is not attributed to individual authorities but is instead accounted for at the UK level as a "national overhead". The Tyndall Centre analysis assumes that UK emissions from aviation remain constant up until 2030, followed by a steady reduction towards net zero by 2075. Whilst emissions from aviation in 2020 have been significantly reduced, the extent of a potential "emissions rebound" post-COVID remains uncertain.

3. WILTSHIRE'S CARBON BUDGET
BUDGET MILESTONES

To demonstrate a carbon budget for Wiltshire, the Tyndall Centre recommends an emissions reduction rate of 13.5% per year. This provides a pathway which keeps Wiltshire aligned with the Paris Agreement. Wiltshire's recommended carbon budget for the period 2022 to 2100 is 11,300 $ktCO_2$. Figure 3.1 illustrates carbon budget milestones based on the annual reduction rate for Wiltshire.

Slight differences in scope mean that direct comparisons of this budget with the cumulative emissions from SCATTER Pathways trajectories (detailed in Chapter 4) should be taken as an estimate only.

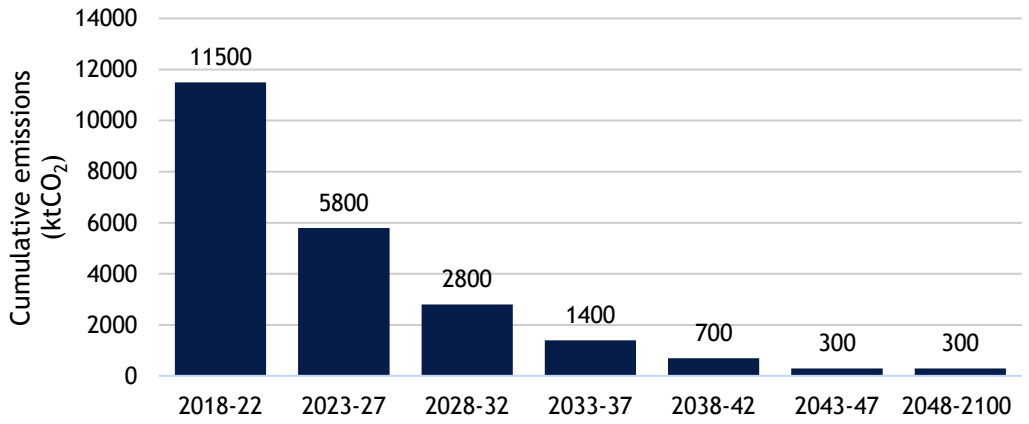


Figure 3.1: The bar chart above describes the carbon budget targets based on the recommended annual reduction rate. These have been broken down into the periods set out in government reporting frameworks.

Key statistics for Wiltshire

To keep Wiltshire aligned with the Paris Agreement, emissions must be reduced by 13.5% per year.

Between 2005 and 2018, the average annual emissions reduction rate in Wiltshire was 3.3%, highlighting the ambitious action required to meet the Paris Agreement targets.

If Wiltshire continue along a business-as-usual scenario, the carbon budget (2022 – 2100) will be exceeded in 2026.

By 2030, 35% of the budget remains provided Wiltshire achieves the recommended annual reduction rate.

04 Wiltshire's Carbon Reduction Pathways

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
SCATTER PATHWAYS MODELLING

Introduction

Whilst the Tyndall Centre's Paris-aligned carbon budget in Chapter 3 describes what the science says must be achieved in terms of emissions reduction, it is necessary to look at tangible intervention-based pathways. This helps us to understand the impact of differing levels of action, or inaction, in relation to goals set, and in the context of macro-factors such as grid decarbonisation and policy.

Presenting the Pathways

As well as the inventory presented in Chapter 3, SCATTER also includes a Pathways model designed to help local authorities inform priorities for emissions reduction. It is intended to show '*what is required*' rather than '*how to get there*'. The pathways show the emissions savings associated with four differing levels of climate action, or "Ambition" in Wiltshire. These are based on a combination of over 30 "interventions" or carbon reduction measures, within which the differing levels of ambition are modelled. The resultant pathways are illustrated on page 20.

The pathways are intended to act as an indicator of what emissions reductions could notionally be achieved in Wiltshire, including the maximum possible level of achievable action, termed the "High Ambition" pathway. This demonstrates the highest level of ambition, notwithstanding any limitations on climate action in Wiltshire brought about by shortages in funding, skills, or policy.

Interpreting this analysis

In Section 5, we provide further detail of *what is required* in Wiltshire in order to achieve the High Ambition pathway. This is explained using a variety of metrics, such as percentage increases, MW capacity installed, or retrofits conducted. The carbon savings associated with action are also presented. These indicators are notional and may not account for local constraints on action in Wiltshire.

The analysis demonstrates the scale of action needed for urgent and deep emissions reduction. We also provide additional commentary on local factors which may impact the feasibility of achieving these interventions, and the council's ability to act. Ultimately, this analysis shows which interventions can best drive the transition to a low carbon economy, helping to guide target-setting and action planning.

It is important to note that SCATTER does not intend to prescribe certain technologies or policies, nor does it intend to discount other means of arriving at similar outcomes just because they do not feature in the model.

In addition, the council is not considered the sole party responsible for the implementation of these actions; these are dependent on action from national government and local actors (see overleaf). The work is intended to serve as an evidence base to help Wiltshire Council understand opportunities for emissions reduction and stimulate discussion as to where the council can help drive action in new, innovative and more ambitious ways.

What is considered in SCATTER?

Considered in SCATTER - *what action is required*

- All current known technologies for emissions reduction
- Measures across all key sectors
- Scale and speed of change needed

Not considered in SCATTER – *potential constraints on action*

- Current political limitations of implementation
- Availability of skills or funding
- New and emerging technologies may also be excluded

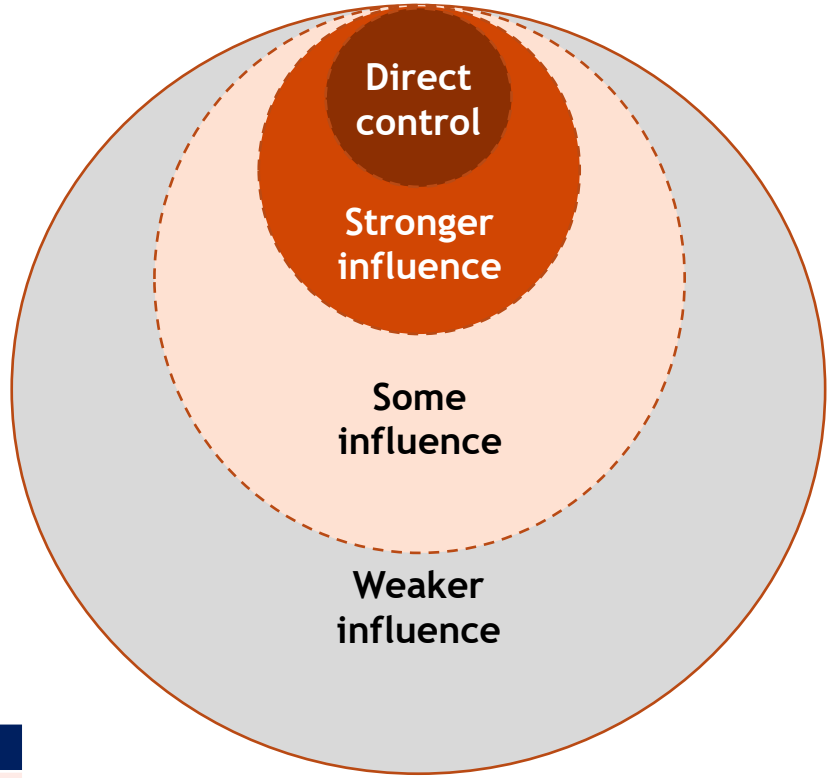
4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
WILTSHIRE COUNCIL'S INFLUENCE

The council cannot deliver a carbon neutral county alone. Success is only possible if the council, residents, businesses and national government each work to reduce emissions. This may involve working to influence and partner with other groups to reduce emissions, particularly where they occur outside of a stakeholder's direct control. The council's ability to influence stakeholders varies across the different emissions sources within Wiltshire. This is illustrated across- the different bandings showing the different levels of **influence over emissions sources** in the county. Depending on the emissions source, and the associated level of influence, the council may be better equipped either to take direct action, or to take a role in influencing or convening others through more "crosscutting" actions, such as lobbying national government.

A degree of influence also extends beyond the county boundary, where Wiltshire's demand (and supply) of goods and services creates emissions in supply chains in other parts of the UK and internationally. These are *consumption-based* emissions and are not considered within the SCATTER tool, which focuses solely on *location-based, or territorial* emissions.

In Chapter 5, we also explore the council's ability to **influence action** in line with each of the SCATTER emissions reduction interventions. The factors impacting the council's ability to drive change in each of these is explored, and a rating on a scale of "High", Medium" or "Low" is provided. This is intended to highlight those interventions where the council is most empowered to make a change, and those areas where action may be needed to increase the council's influence. The ratings use different language to the across because they refer to the councils influence in relation to the interventions, rather than emissions sources themselves.

Influence	Description
Direct control	Emissions sources are directly owned or operationally controlled by the council. The council's Scope 1 and 2 emissions are estimated at 9,368 tCO_2e. This is explored further in the Council pathways report.
Stronger influence	Owners and operators of emissions sources are clearly defined but are not directly owned or operated by the council. For example, some council procured or council led activities.
Some influence	Emissions sources do not relate to council owned/operated assets, procurement or council led activities; however some convening power may exist with specific actors in Wiltshire (e.g., high street businesses).
Weaker influence	Owners and operators of emissions sources are not clearly defined, but still within the county. Influence limited to lobbying central government, NGOs, trade associations and public behaviour (e.g., private vehicle ownership).



[Chart is illustrative only and not to scale]

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
SCATTER PATHWAYS RESULTS

The graph below shows possible future emissions pathways for Wiltshire as modelled by the SCATTER tool (Scopes 1 and 2), compared against the Tyndall Centre's recommended 13.5% annual reduction pathway. Emissions reductions achieved through the High Ambition Pathway at 2027, 2030, 2040 and 2045, in line with interim review dates set by the council, are detailed in Appendix 5.

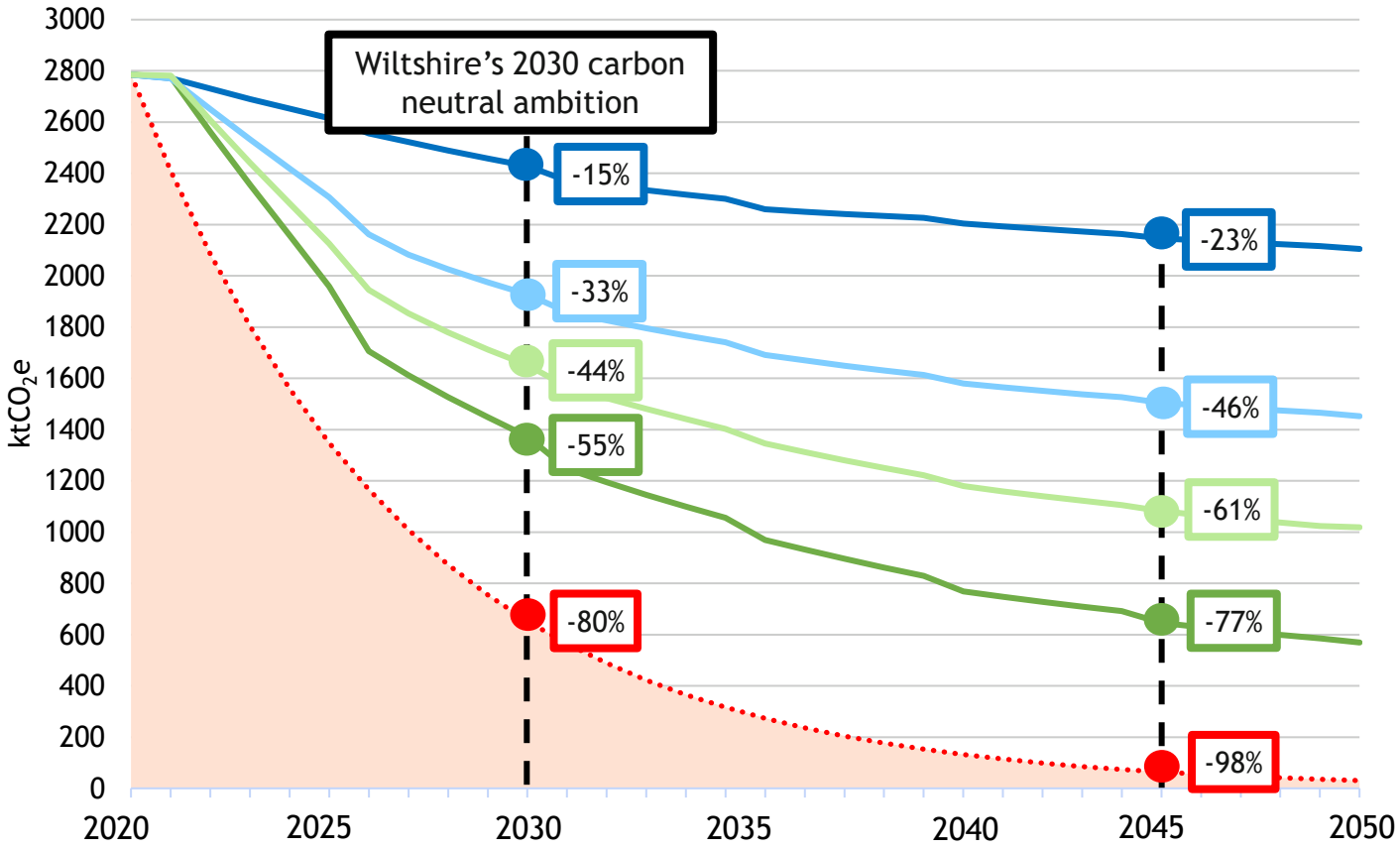


Figure 4.1: Possible percentage reductions in emissions for Wiltshire along the pathways compared to 2019 levels.

Key

SCATTER BAU Pathway: Assumes Wiltshire continues along current "business-as-usual" (BAU) trajectory in terms of nationally-led policy and behavior change. Reductions are largely the result of continued grid decarbonisation.

SCATTER Medium Ambition Pathways: Assumes Wiltshire successfully adopts some SCATTER measures across different areas to reduce emissions. Given limited funding, policy constraints, and other factors, these may be a more realistic outcome, even if the council strives for the High Ambition pathway.

SCATTER High Ambition Pathway: Assumes Wiltshire goes significantly beyond national policy and National Grid assumptions and that action is not hindered by any funding or policy constraints. It is the result of all interventions modelled by SCATTER at maximum ambition levels and provides an indication of the scale of action required in reaching for carbon neutrality.

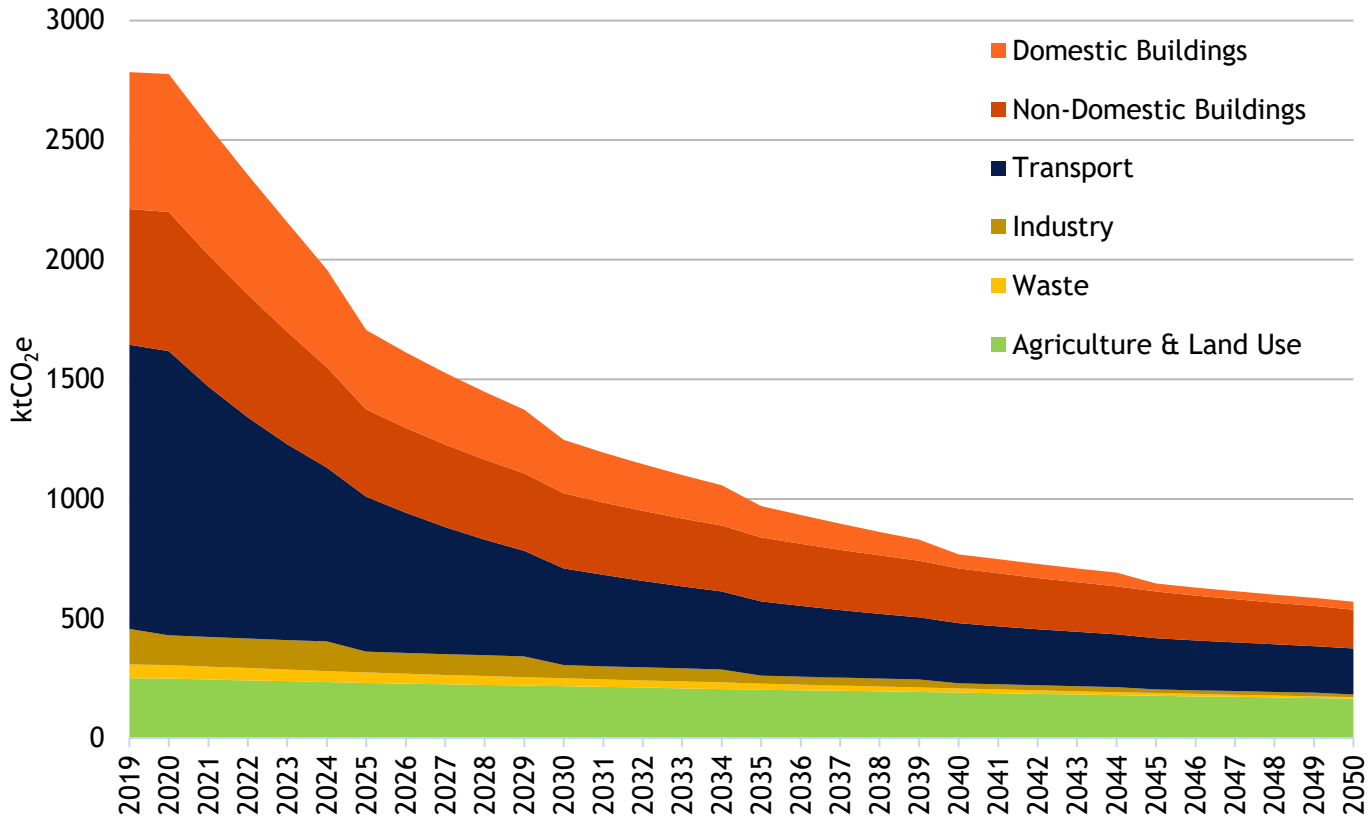
Paris-aligned Reduction Rate: Based on the Tyndall Centre's recommended annual reduction rate of 13.5%. This is not based on tangible policy or implementation, but informs the action required to meet Paris Agreement targets.

Paris-aligned Carbon Budget: A representative area equal to the cumulative emissions budget for Wiltshire, based on research by the Tyndall Centre for Climate Change Research.

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS

WILTSHIRE'S HIGH AMBITION PATHWAY

The graph below shows the breakdown of key emissions sources, by year, under the High Ambition pathway. This shows that the emissions profile for Wiltshire would change substantially under this scenario, and that the volume of emissions associated with some emissions sources will change more than others. A breakdown of the cumulative % emissions saved, by sector, against the 2019 baseline, is presented in Appendix 5. It should be noted that the High Ambition Pathway does not achieve Wiltshire's carbon neutrality ambition by 2030. Even with the most ambitious interventions, 1,247 $ktCO_2e$ emissions remain in the energy system by 2030.



Understanding the High Ambition Pathway

The High Ambition Pathway outlines the maximum level of climate action deemed feasible, not accounting for any challenges due to skills, funding, policy, or other local factors impacting the feasibility of climate action in Wiltshire. It is intended to be notional only, and achieving it would require ambitious and urgent action, both directly, and to address the challenge areas outlined. Collaborative efforts would be required from a range of stakeholders across Wiltshire, and beyond.

Given the urgency of the climate emergency, and the appetite for action locally, the High Ambition pathway is discussed in detail in this report. Chapter 5 defines the interventions required to achieve the pathway and is intended to support the Council in informing any forthcoming targets and climate action.

Interventions can be thought of as falling into two groups; some are focused on reducing energy demand, and others focus on decarbonising energy supply. However, with the advances of technologies such as electrification of cars and smart systems in buildings, future electrical demand is likely to increase. The modelling follows electrification assumptions from the UK's Future Energy Scenarios.

Figure 4.2: Breakdown of key emissions sources, by sector, under SCATTER's High Ambition pathway.

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
THE GAP TO TARGET

How can we go beyond High Ambition?

The High Ambition pathway is a notional illustration of the maximum feasible climate action, notwithstanding any challenges arising from funding, skills and other constraints. Achieving the High Ambition pathway would lead to a significant reduction in carbon emissions but would not achieve carbon neutrality. This "Gap to Target" is illustrated below. Tackling these "residual" will be challenging and will require more ambitious action in some areas.

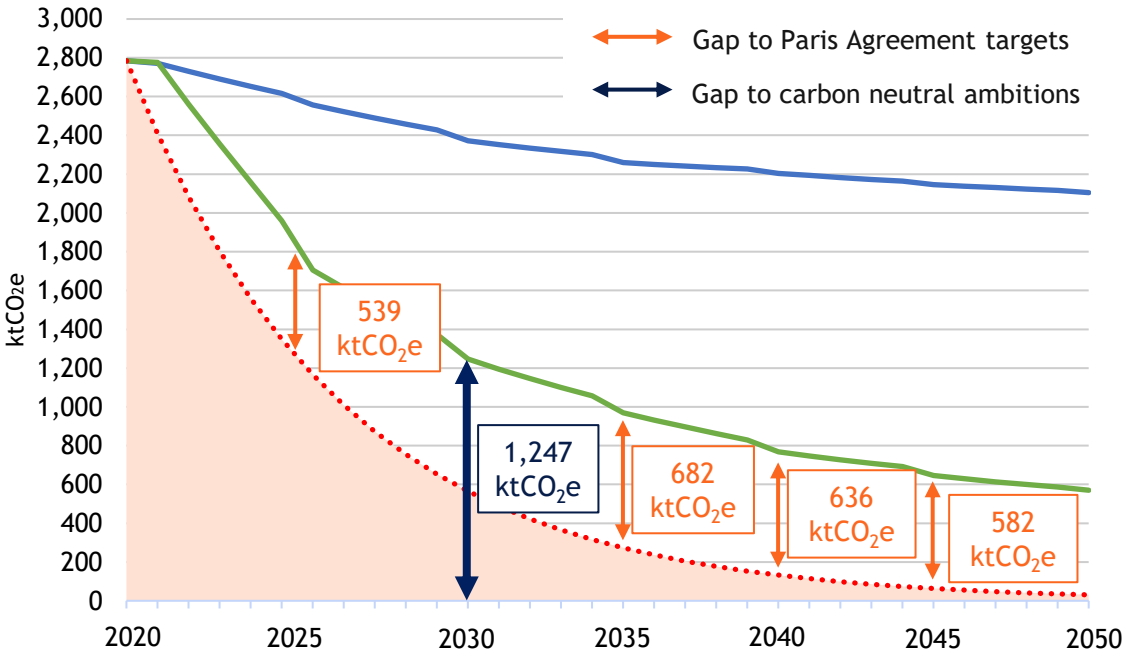


Figure 4.3: Illustration of High Ambition pathway, and associated "Gaps to Target"

How can Wiltshire close the gap to carbon neutrality?

Technological innovation

Improvements in technology and reductions in market costs may dramatically increase the potential reduction in emissions in different sectors. However, improvements are unpredictable and no "silver bullet" technology should be relied upon or anticipated.

Accelerated and increased deployment

Action driving change 'above and beyond' the interventions outlined in Section 5 this report. Actions could also be delivered at an earlier date through increased deployment, increased supply chain capacity, changes in consumer demand, lower costs and changes to government policy. However, it should be noted that the High Ambition pathway is already considered a stretch, so this is unlikely to be an immediate option for any intervention. Aspiring to achieve the High Ambition level of action should be considered first.

Offsetting and Insetting

Any remaining emissions will need to be addressed through other means in order to reach carbon neutrality. In aspiring to **carbon neutrality**, offsetting is an option through which residual emissions can be tackled. If the council wished to explore setting a goal of **net zero** in Wiltshire, there are stricter requirements around how offsets are applied- this is one of several reasons a Net Zero target is more robust and suitable for use as a stretch goal. Offsetting is explored further on the following pages, along with the difference between Carbon Neutrality and Net Zero.

The council can also use carbon **insetting,** a form of offsetting where carbon mitigation projects are run inside the authority's geographic boundary. Insetting demonstrates action against a council's own organisational targets while reducing county wide emissions.

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
UNDERSTANDING OFFSETTING

Considering Offsets

Traditionally, carbon offsetting refers to the purchase of a tradeable unit, representing emissions rights or emissions reductions, to balance the climate impact of an organisation, activity or individual. This may include nature-based solutions, e.g. tree planting and the restoration of other ecosystems, or other technologies such as carbon capture and storage (CCS) and negative emissions technologies (NETs).

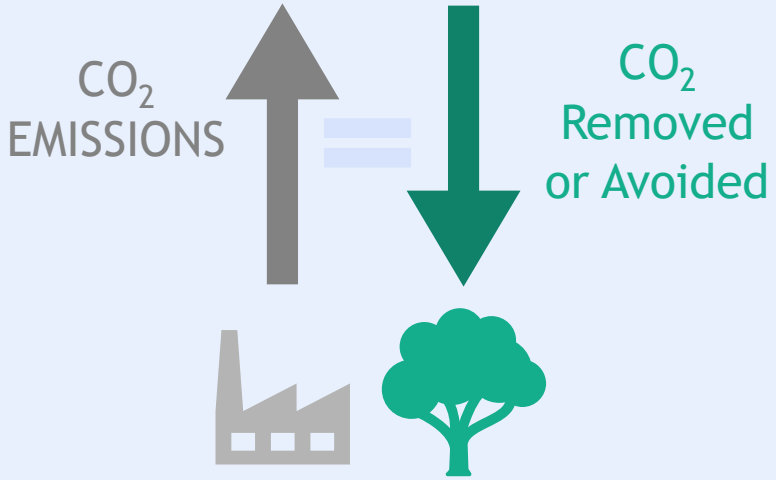
Even if Wiltshire achieved the highly ambitious set of actions outlined in the High Ambition pathway, emissions of 1,247 $ktCO_2e$ would remain at 2030, 769 $ktCO_2e$ at 2040, and 646 $ktCO_2e$ at 2045 (Figure 4.3). Offsetting offers a means through which stakeholders in Wiltshire could address these residual emissions after direct action to reduce emissions has taken place.

Offsetting and SCATTER

It is important to make a distinction between carbon offsetting, and the interventions outlined in this report regarding green space and rural environments. Carbon offsetting is focused on the purchase of tradeable offsetting units. These may relate to projects outside of the county (often in developing countries, where the cost of action is lower), although can also be based locally. These approaches should not be viewed as mutually exclusive- for example, the council could invest in a tree planting initiatives as a way of aspiring to SCATTER's High Ambition trajectory and closing the residual 'gap'. Offsetting in this context would exclusively relate to activities that go above and beyond the actions proposed in Section 5.

Carbon offsetting and Local Authorities

UK Certifiable schemes are available to organisations seeking to offset their emissions, such as the Peatland Code, and Woodland Carbon Code. Offsetting schemes should align with neutrality standards such as PAS 2060 in order to be eligible for consideration against a carbon neutral target. Overleaf, we explore the anticipated cost of the purchase of carbon credits to address Wiltshire's residual emissions. We also assess the land area that would be required for a local tree planting initiative. We have also observed some common challenges and concerns that the public sector face when purchasing 'traditional' market-based offsets- these are discussed on page 25.



4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
VIABILITY OF OFFSETTING

The analysis below examines the cost and potential land area requirements for the council to address its residual emissions using offsets.

Purchasing Credits

It is difficult to predict future prices of the voluntary offset market; therefore a range of estimates, using research by Trove and UCL and the Department of Energy and Climate Change, have been presented in Figure (4.4). The uncertainty of offset prices is a major disadvantage to incorporating purchased credits in any long-term strategy, as Wiltshire will be dependant on their prices for this time period.

From 2030, purchased offsets are estimated to cost around **£47-131m** per year for the 1,247 ktCO2e of residual emissions. As the cost of credits are expected to rise, annual offsetting costs are predicted to increase despite the decrease in emissions required to offset in Figure. The annual cost of offsetting is expected to rise to **£44-156m** per year by 2040. Cumulatively, it could cost up to **£1.7bn** to offset all residual emissions between the period of 2030 and 2040.

In-house tree planting schemes

Figure 4.5 shows the cumulative carbon sequestration needed over time should the council choose to offset the county's residual emissions in 2030 through tree planting alone. The analysis shows that a minimum land area of 170sqkm, roughly half the size of Wiltshire, would be required by 2024. The amount of carbon that can be claimed per year shown by the green stepped line. Given other requirements for land in the county, such as for farming, and protected habitats to promote biodiversity, this would be an extremely challenging task.

Viability of these solutions

The costs and land requirements of purchasing credits and tree planting respectively, mean these solutions do not scale readily to tackle the quantity of residual emissions expected in 2030. Additionally, there are many further challenges with purchased offsets for local authorities, which are presented on the next page. These challenges underscore the need to prioritise rapid emissions reduction activities in Wiltshire; and not rely on offsetting as a solution.

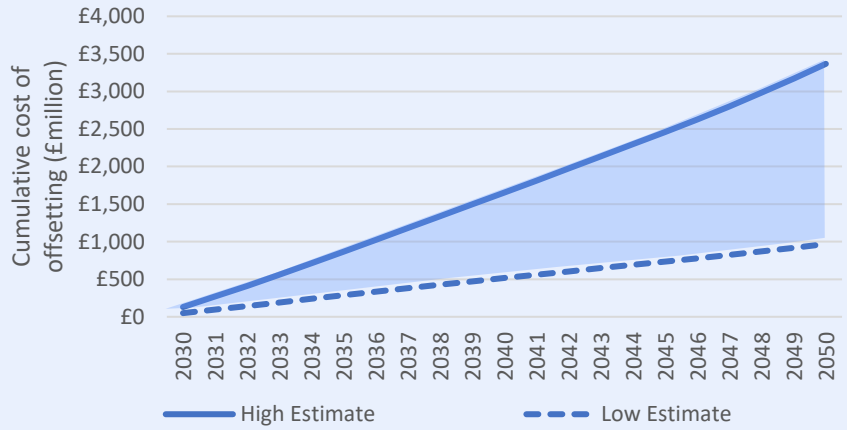


Figure 4.4: Indicative cumulative costs of offsetting residual emissions for the high ambition pathway. Note scale is in £millions.

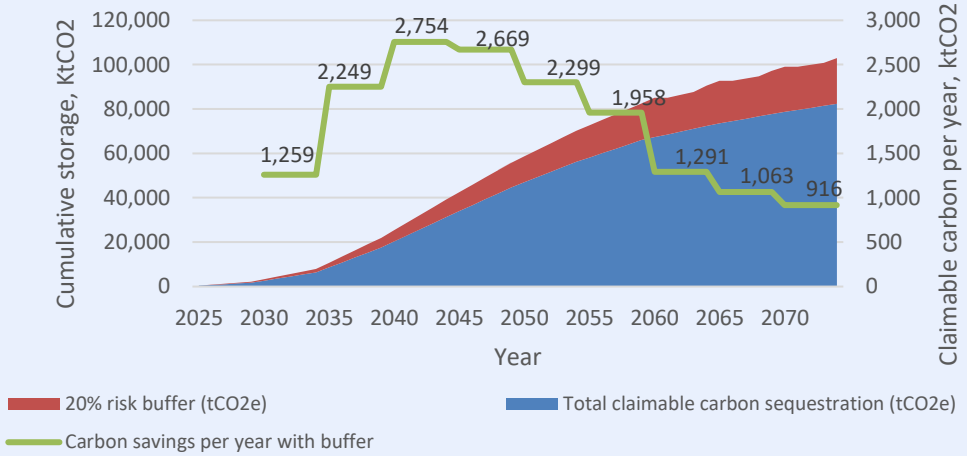


Figure 4.5: Cumulative carbon storage over time for 170sqkm of trees planted in 2024 with the Woodland Carbon code recommended 20% buffer to allow for any uncertainty in the modelled predictions.

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
CHALLENGES IN OFFSETTING

We have observed some common challenges and concerns that the UK public sector face when using 'traditional' market-based offsets. These include:

Increasing public scrutiny: The public is becoming better educated on climate change matters, partly due to the 'mainstreaming' of the climate emergency via school strikes and increased media coverage. This means that issues around quality (including additionality, permanence, and verification) of offsets still exist and are receiving greater scrutiny by the general public than ever before. Combined with the fact that it is taxpayer's money that will be spent, councils' offsetting activity is likely to attract significant public attention.

Difficulty in retaining co-benefits locally: Unlike corporates, local authorities need to demonstrate a social return on money invested, such as an increase in jobs and improved health, within the area that they serve. This is difficult to achieve using existing certified offsetting schemes, as they commonly relate to projects outside of the local authority and/or outside of the UK.

Lack of taxpayer choice: Unlike the consumers of a business's products or services, whose purchasing decision may be influenced based on what type of socio-environmental cause they wish to support, taxpayers do not get a direct choice as to how their money is invested, i.e. people can't choose to not pay council tax based on the council's sustainability credentials.

Lack of international relevance: Many businesses may select an offsetting scheme based on the relevance to their global supply chains, consumer markets or alignment with other unique social values and causes. While councils may still have extended supply chains, their purpose has an inherently local focus, so it is much harder for them to justify diverting socio-economic co-benefits internationally, relative to corporates.

Limited options available in the UK: Limitations in scope of Carbon Neutrality Standards - Existing carbon neutrality standards such as PAS 2060 require 'certified' offsets to be used. However, the range of UK options is currently limited (i.e., the Peatland Code and Woodland Carbon Code). Also, with an increase in demand for UK projects, these schemes are becoming more expensive.

Current certified offsets do not offer a financial return on investment: Most conventional offsetting schemes require an annual investment with no direct financial payback. This contrasts with more 'direct' emissions reduction measures applied within an organisation that can offer a financial return through reduced energy or fuel costs. While insetting projects are slightly further removed than direct, internal projects, they still have the potential to better connect the investor to the beneficiary. This may offer an opportunity for the investor to share some of the financial, reputational and carbon saving benefit.

Limited supply and impact of UK certified options: Current options for certified UK schemes are 'nature based', i.e. tree planting and peatland restoration. While these are tremendously positive activities that offer a raft of co-benefits in addition to carbon removal, it is important to recognise the scale of the carbon reduction challenge still needed across other emissions sectors, such as transport, energy, and buildings. Therefore, even with radical investment in nature-based solutions, there may not be enough projects and savings on offer within the county boundary, and even the UK as a whole, to bridge the 'gap' to neutrality. Therefore, other types of emissions saving projects may still be required.

As a result, many local authorities are now seeking to focus their investments inwardly on more local offsetting initiatives. Carbon Insetting is explored on page 27.

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
CARBON NEUTRAL VS. NET ZERO TARGETS

Wiltshire's Commitment

Wiltshire's climate strategy outlines the intention to "focus on our commitment to being carbon neutral by 2030 (meaning focusing on substantially reducing emissions, before residual emissions being offset or compensated). Beyond 2030 we will aspire to be fully net zero".

The difference between Carbon Neutral and Net Zero is summarised in Table 4.1; this illustrates why a Net Zero target is typically considered more ambitious and may be framed as a "stretch goal" for Wiltshire.

The treatment of offsets is a key difference because it underpins how Wiltshire would be able to address residual emissions. Under a certified Carbon Neutral target, residual emissions can be tacked through the purchase of a range of offset types- including through carbon reductions, efficiencies or sinks (avoidance or removals). This contrasts to Net Zero in line with the SBTi standard, where the only form of offsets permitted are those associated with carbon removals.

The Market for Offsets

The market for offsets is growing as more businesses, local authorities and other stakeholders seek to tackle their residual emissions, ultimately driven by increased climate awareness and legislative pressure. The recently published SBTi Net Zero Standard guidance helps to ensure that Net Zero targets are now consistent and robust. As Net Zero targets only permit offsets associated with removals, this will result in a shift in the type of offsets organisations acquire.

As discussed on the prior page, there is already a limited supply of certified carbon removal offsets in the UK. This further necessitates the exploration of alternative measures and has been part of the impetus for the development of Anthesis' Authority Based Insetting framework.

	Carbon Neutral	Net Zero
Boundary	Must cover Scope 1 & 2 emissions as a minimum requirement, with Scope 3 encouraged.	Must cover Scope 1, 2 & 3 emissions.
Level of ambition	No binding requirement for a company to reduce its emissions on a set trajectory.	Company must reduce its emissions along a 1.5°C trajectory across Scopes 1, 2 & 3, according to the SBTi.
Approach to residual emissions	Residual emissions may be balanced by purchasing carbon offsets that either result in carbon reductions, efficiencies or sinks (avoidance or removals).	Requires the purchase of GHG removals that result in carbon sequestration from the atmosphere only for balancing residual emissions.
Key Standards	PAS 2060 Standard Carbon neutral Global Standard	SBTi Net Zero Standard

Table 4.1: Summary of key differences between Carbon Neutral and Net Zero targets

4. WILTSHIRE'S CARBON REDUCTION PATHWAYS
OFFSETTING AND WILTSHIRE'S EMISSIONS

Carbon Insetting

In a corporate context, carbon insetting refers to offsetting investments targeted within a business's value chain, as opposed to outside it. In a local authority context, the investment boundary is shifted from within the 'supply chain' to the local authority boundary. Insetting is less exposed to the challenges typically experienced by local authorities purchasing offsets.

Offsetting	Insetting
• Projects commonly 'detached' from organisation & supply chain • Tradable on global market • 3rd party broker required for purchase • High dependence on certification schemes • No payback or return on investment (ROI) • Projects readily available	• Projects embedded within an organisation's supply chain • Not tradable • No broker required, can be a simple transaction between 2 parties • No dependence on certification schemes • Potential for payback and ROI • Projects require identification

Insetting is a mechanism for the council to address its own organisational residual emissions through accelerating emission reductions within the county. This allows for the council to claim an amount of carbon saved through insetting and reduce the county wide emissions. Insetting allows for a wide array of project types, including both carbon removal and avoidance projects. For example, projects could include retrofitting buildings, installing renewable energy and reducing emissions from waste.

Insets are not tradable or readily available to purchase. Such opportunities are typically led by grassroots community groups and NGOs, where the presence of funding gaps provides a basis for investment by councils and corporate groups. Anthesis is currently pioneering the development of an Authority Based Insetting mechanism through which local authorities would be better equipped to identify and engage in such partnerships.

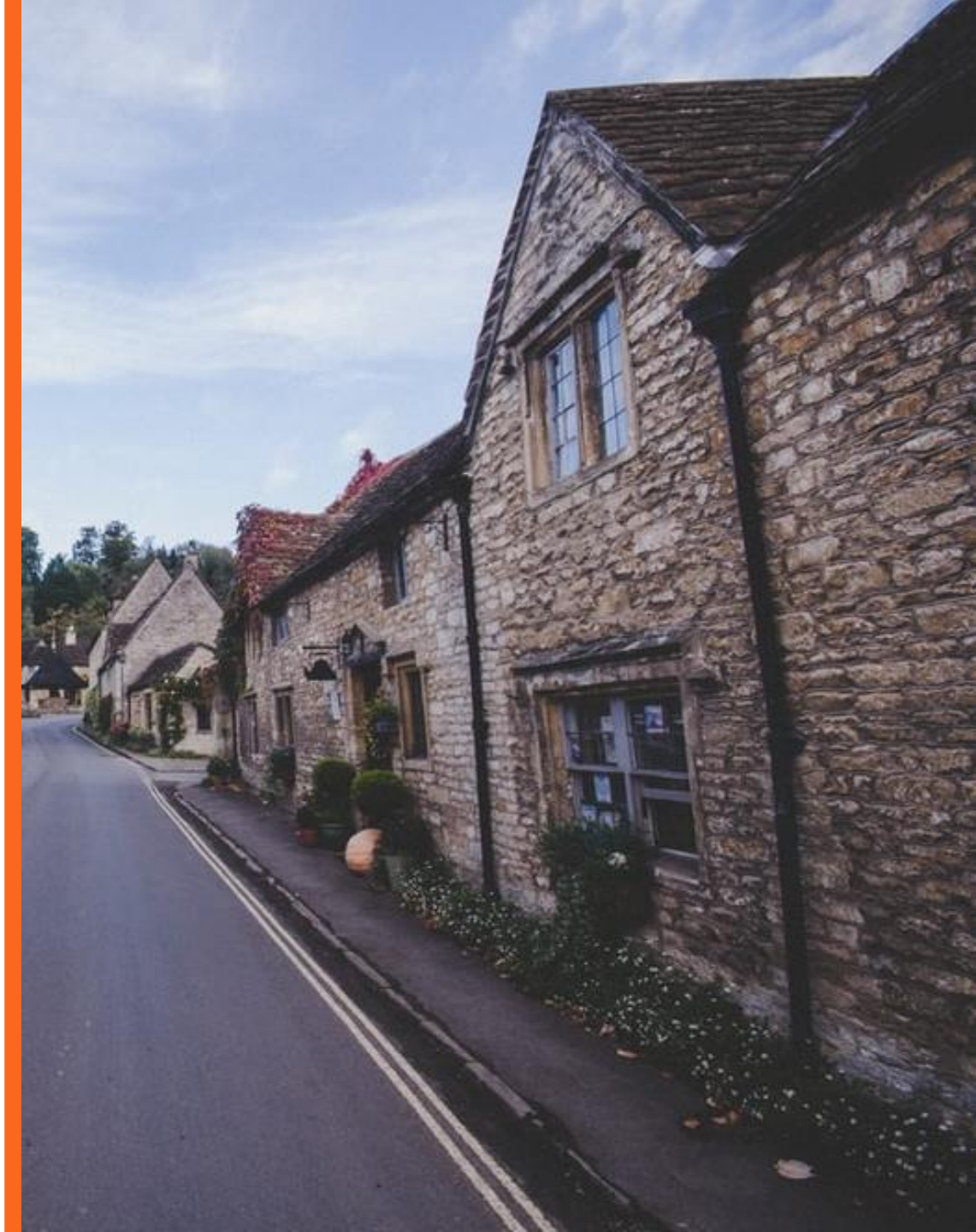
Next steps

In this report, we present SCATTER's High Ambition pathway as a notional indication of the maximum feasible level of climate action that could be achieved in Wiltshire. This gives an indication of the potential *minimum* quantity of emissions which would require offsetting to achieve carbon neutrality, should the High Ambition Pathway be achieved, and none of the other options for tacking the gap to target presented on Page 22 be explored. In practice, achieving the High Ambition pathway is a huge challenge, and efforts may be hindered by a lack of appropriate funding, skills or policy support. At this point, the council may again seek to apply offsets, but for the reasons outlined, this presents its own challenges, and should only be considered as a last resort.

This underscores the need for urgent action to directly reduce or avoid emissions now, in line with the interventions outlined in Chapter 5. Rapid action means emissions savings benefits (both carbon reductions and co-benefits) can be felt for longer, delivering better value for money, helps to avoid the need for more costly offsets later, and reduces associated social costs as a result of climate change.

05 Carbon Reduction Measures

5.1 Buildings



Anthesis

5.1 BUILDINGS

INTRODUCTION

The built environment sector represents 1620 $ktCO_2e$ of Wiltshire's emissions, totaling 50% of baseline emissions. This is then further split into emissions from residential buildings (homes) which represent 23.1% of total emissions, and non-domestic buildings (places of work, schools and hospitals), which account for 26.9% of emissions.

The following interventions relate to domestic households, commercial properties and institutional buildings, as well as industrial property. The interventions consider both decreasing the demand for energy, as well as the effects of electrifying heating systems and appliances. The challenge requires looking at not only improving new-build developments, but also retrofitting and improving efficiency in existing buildings, given that 80% of the homes we will use in 2050 (the UK's net zero target date) already exist.[1]

KEY LOCAL CONTEXT

- Wiltshire Council's ownership of the commercial housing company, Stone Circle, offers an additional area of influence in the local housing market.
- Under the Ministry of Defence's Net Zero Carbon Accommodation Programme, over 30 net zero-carbon buildings will be built at three camps across Wiltshire.
- A small proportion of buildings in Wiltshire are new builds, therefore retrofitting existing buildings is a priority.
- Wiltshire Council has required Registered Providers to consider the climate emergency as part of their renewed housing partnership.
- To date, 60 council homes have been retrofitted using LADS 1b funding, installing measures such as intelligent high heat retention hot water cylinders, solar panels and Quantum high heat retaining storage heaters.
- 19 new affordable homes will be built to a zero-carbon standard under the Council's zero carbon modern methods of construction (MMC) pilot project.
- The heritage buildings and conservation areas in Wiltshire could provide retrofitting challenges.

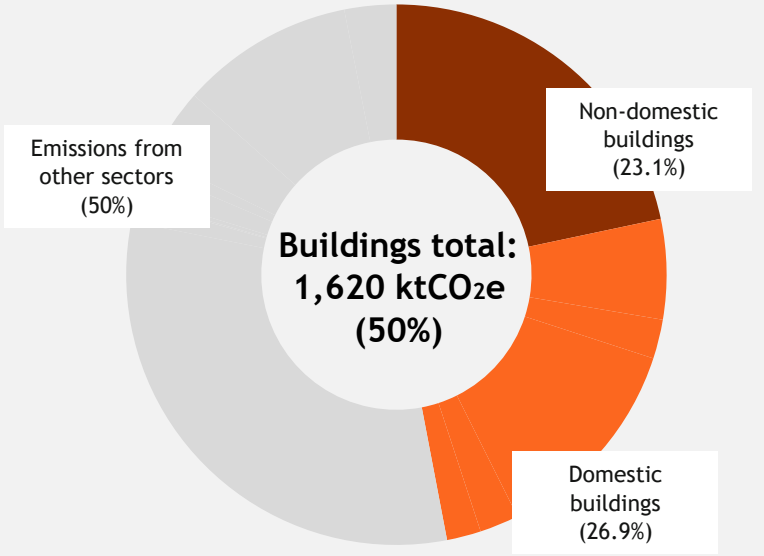


Figure 5.1.1: SCATTER 2018 inventory for the buildings sector in Wiltshire.

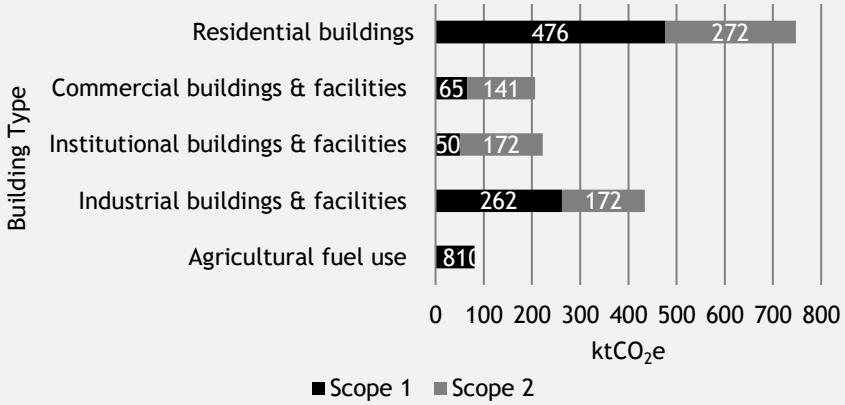


Figure 5.1.2: Scope 1 and 2 emissions in Wiltshire's SCATTER 2018 inventory for the buildings sector.

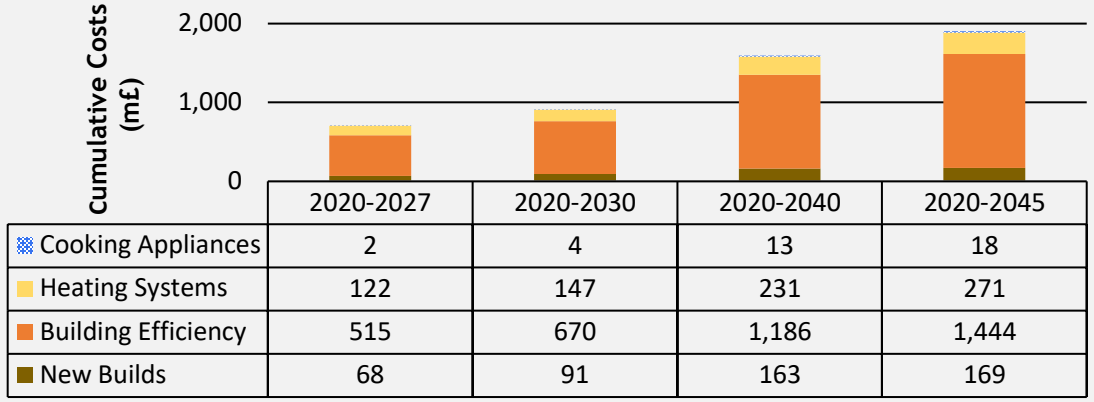
5.1 BUILDINGS
INTERVENTIONS OVERVIEW

1.1 Improving building efficiency: This measure considers changes in the energy demand for heating and cooling our buildings. Retrofit options, energy use practices and the performance of new builds are considered.

1.2 Reducing gas heating systems: Considers the uptake of non-fossil fuel sources for heating within homes and commercial properties, including heat pumps, district heating and combined heat and power networks (CHP). The impact of the fuel mix will be heavily influenced by the increased availability of renewable energy. Hydrogen technology is not modelled in the tool due to the limited availability of large-scale data.

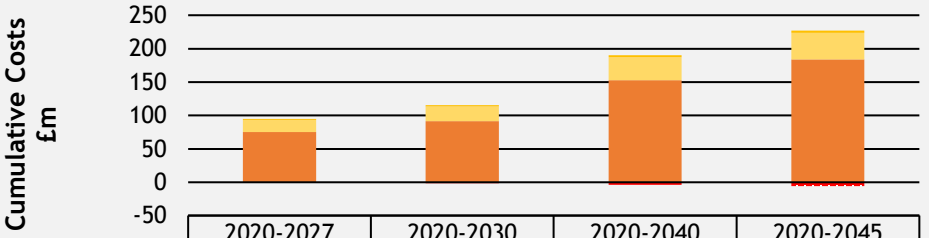
1.3 Low carbon and energy efficient cooking, lighting and appliances: Considers the reduction in energy demand from more efficient domestic and commercial cooking, lighting and appliances, including electrical devices. Additionally, considers the increased uptake in electrical cooking systems.

SCATTER Intervention	Cumulative Emissions Savings ($ktCO_2e$)			
	2021-2027	2021-2030	2021-2040	2021-2045
1. Improving energy efficiency	1,315	2,626	9,132	13,336
2. Reducing gas heating systems	375	701	1,738	2,257
3. Low carbon and energy efficient cooking, lighting and appliances				



	2020-2027	2020-2030	2020-2040	2020-2045
Cooking Appliances	2	4	13	18
Heating Systems	122	147	231	271
Building Efficiency	515	670	1,186	1,444
New Builds	68	91	163	169

Figure 5.1.3 Cumulative domestic buildings costs including both Capital (block) and Revenue (pattern), in £m



	2020-2027	2020-2030	2020-2040	2020-2045
Heating Systems (Revenue)	2	2	3	3
Energy Efficiency (Revenue)	-1	-1	-4	-6
Heating systems (Capital)	18	22	34	40
Energy Efficiency (Capital)	75	91	153	184

Figure 5.1.4 Cumulative non-domestic buildings costs including both Capital (block) and Revenue (pattern), in £m. Revenue costs are seen as negative where savings are made.

Buildings cost estimates are direct indicators of the interventions listed on this page. New builds considers the additional cost of new buildings being built to Passivhaus standard over the Part L standard. A more detailed breakdown of the costing method can be seen in Appendix 7. This analysis does not account for revenue savings associated with insulation, due to variations in potential usage and impact leading to high error margins. To support decision-making, the council could consider typical ROI timeframes in line with these estimated costs. Where possible, site-specific analysis is advised due to variations in impact and consumption.

5.1 BUILDINGS
KEY PLANS AND POLICIES

National

- The Clean Growth Strategy set targets to upgrade as many houses to EPC band C by 2035 (2030 for all fuel-poor households). The Government's preferred target is that non-domestic property owners in the private sector achieve EPC band B ratings by 2030.
- The Future Homes Standard provides an update to Part L of the building regulations and will include the future ban on gas boilers by 2025 (which may be brought forward to 2023 under the recent 10-Point Plan).
- Consultation is currently underway for the fourth phase of the Energy Company Obligation, which will cover the period 1st April 2022 to 31st March 2026.
- The UK Green Building Council was set up in 2013 to investigate and recommend new ways forward to reach zero-carbon buildings.
- Salix Finance offers 100% interest-free capital to deliver energy-saving measures across public sector organisations under the Public Sector Decarbonisation Scheme (PSDS).
- The Heat and Buildings Strategy details the UK Government's approach to decarbonise all heat in UK buildings, including an ambition for industry to reduce heat pump installation costs by 25-50% and to ensure heat pumps are not more expensive than gas boilers by 2030.
- The Net Zero Strategy 2021 details key commitments to ensure that all heating systems used in 2050 are compatible with net zero and to support households with a new £450 million Boiler Upgrade Scheme.

Wiltshire

- The Wiltshire Climate Change Strategy details the Council's objectives for new buildings to be zero carbon, existing buildings to be retrofitted and both new and existing buildings to be adapted to climate change with measures of benefit for the environment.
- The Wiltshire Local Plan is currently being reviewed with the aim to ensure new developments adhere to Net Zero Carbon standards and become climate resilient as soon as possible. In 10 years, the Council also aims to complete its Sheltered Housing Review to increase the EPC ratings of existing housing to a B.
- Wiltshire's ten-year Housing Energy Efficiency Programme (HEEP) plans to retrofit all council homes to minimum Energy Performance Certificate (EPC) B standard.
- The council has been successful in bidding for both a grant of £25,000 from the Southwest Energy Hub, and £5 million from the business, Energy & Industrial Strategy (BEIS)'s Home Upgrade Grant fund, these both allow the council to undertake a housing condition survey to identify, assess and retrofit existing housing stock with energy efficiency measures.

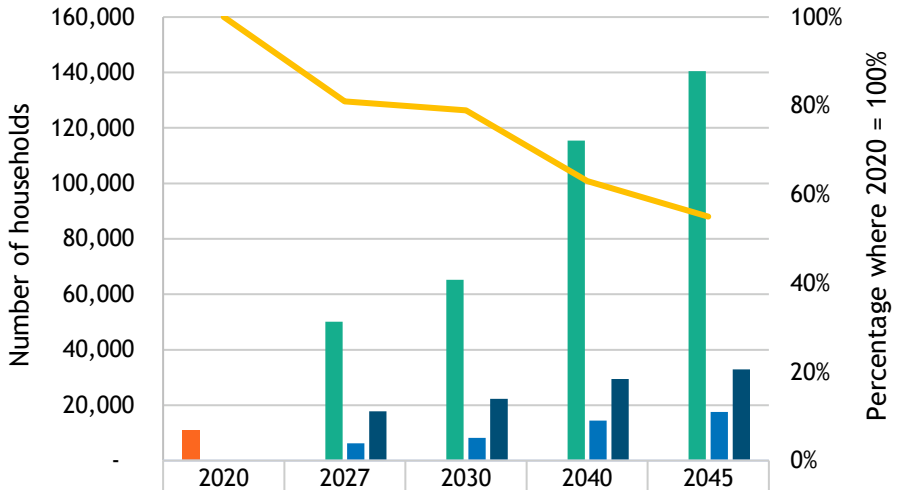
5.1 BUILDINGS
INTERVENTION MILESTONES

1a. Improving building efficiency - Domestic Buildings

This measure considers changes to the energy demand for heating homes, in both existing properties and newly built homes. The aim of retrofit is to drive down the energy demand for heating and hot water in buildings; typical measures include insulation for floors, windows and ceilings, as well as improved ventilation. Currently household retrofit is led largely by government-supported schemes, such as ECO3 retrofit measures and the Domestic Renewable Heat Incentive (RHI). SCATTER models future energy demand based on the uptake of two different retrofit options:

- Medium – a 66% reduction in annual average energy demand through insulation of walls inside homes (no external walls).
- Deep – an 83% reduction in annual average energy demand, through insulating walls inside homes alongside external walls.

New builds –where compatible with local conditions- must also be constructed to high energy performance standards. The Association for Environmentally Conscious Builders (AECB) deems a “high performance” building as requiring 25% of the average energy demand for heating, Passivhaus standards are typically 10% of average demand.



	2020	2027	2030	2040	2045
Households in receipt of ECO measures*	11,020				
"Medium" retrofit		50,140	65,200	115,400	140,500
"Deep" retrofit		6,280	8,200	14,450	17,575
PassivHaus new-build		17,800	22,300	29,400	32,950
Heating and hot water demand reduction	0%	-19%	-21%	-37%	-45%

Figure 5.1.5 : Cumulative retrofit rates and new build standards for Wiltshire. *ECO measures are included as a proxy for comparison, though the average improvements to energy demand fall well short of medium retrofit in practice.

WILTSHIRE COUNCIL’S CURRENT INFLUENCE

Low

Local planning policy provided both opportunities and limitations to the councils influence in this area, particularly due to the number of heritage buildings and conservation areas within Wiltshire. Private rental homes continue to be hard to reach for energy efficiency improvements, but local government can support the uptake of financing schemes through the provision of guidance and enforcing minimum energy efficiency. Targeting the gap in skilled workers suitable for retrofitting in the county can also support uptake. The Council’s influence is, however, high when it comes to council housing, but effectiveness will still be subject to the lag-time between policy and implementation.

Current Statistics	Source
In 2021, 45% of domestic properties were rated Band C or above.	EPC of Housing in England and Wales
In June 2020, 11,020 households had received ECO measures.	Household Energy Statistics
In 2018, 17,540 (8.2%) of households in Wiltshire were classed as fuel poor.	Fuel Poverty Data

5.1 BUILDINGS
INTERVENTION MILESTONES

1b. Improving building efficiency - Non-domestic buildings

This measure describes energy demand reduction for space heating and hot water heating as a result of improvements to building fabric and positive behaviour changes. "Retrofit" in this context refers to insulation, draughtproofing, double glazing etc., as opposed to the installation of renewable energy technologies. The demand-side reductions are focused on changes to the building fabric, which are considered separately to any changes to electrified systems. Whilst not part of the modelling in this report, natural ventilation could also help reduce energy demand.

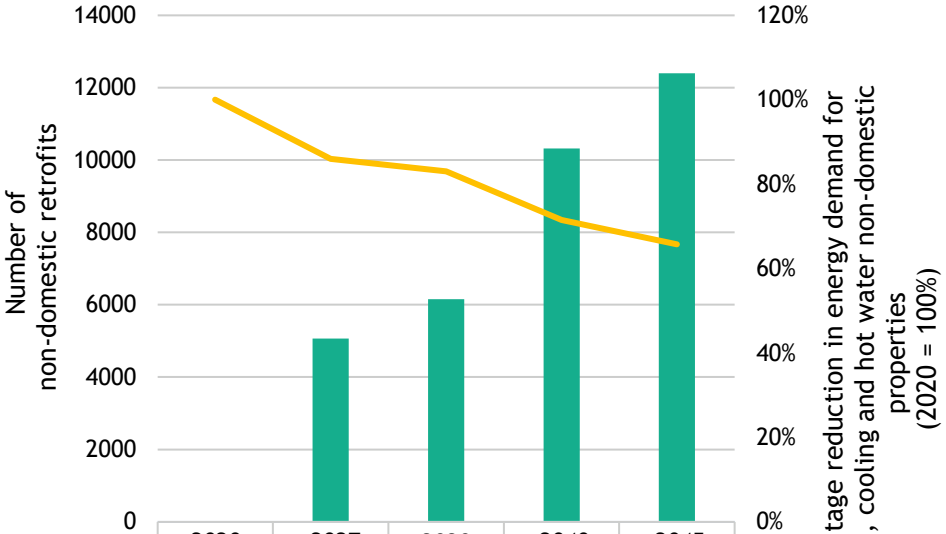
The reductions in emissions modelled by SCATTER:

- Consider improvements to the efficiency of new water heating systems and building fabric retrofitting measures.
- Are calculated in terms of an overall reduction in net energy demand without prescribing specific targets for numbers of buildings to be retrofitted
- Are applied to whatever fuel the building is using i.e., accounting for more efficient gas boilers or electrical heating systems.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Like domestic buildings, local planning policy may limit the council's influence in this area due to the number of heritage buildings and conservation areas within Wiltshire. As many non-domestic buildings in the county are privately owned, the council's role will mainly be an enabling one, taking advantage of opportunities in the planning system, encouraging knowledge sharing and best practice, while highlighting funding opportunities. Improvements in the energy efficiency of these building will largely be driven by cost and national policy requirements, alongside the availability and accessibility of workers with the skills required for retrofit measures.



	2020	2027	2030	2040	2045
Non domestic building retrofits	0	5067	6153	10315	12396
Energy demand reduction for heating cooling & hot water from 2020	0%	-14%	-17%	-22%	-34%

Figure 5.1.6: Modelled changes in energy demand for space heating and hot water relative to a 2020 baseline of 100% and BEES average non-domestic retrofitting potentials. The number of retrofits are cumulative, each value showing the total number of buildings retrofit since 2020.

Current Statistics	Source
From 2009 to 2021, 43% of registered non-domestic EPC certificates were rated C or above.	Non-Domestic EPCs, Ministry of Housing, Communities and Local Government

5.1 BUILDINGS
INTERVENTION MILESTONES

1.2 Reducing gas heating systems

This measure represents a transition from fossil fuel-source heating technologies to less carbon-intensive systems. The technology mix[1] under the High Ambition Pathway includes electric heat pumps and combined heat and power networks (CHP) and offers the most significant emissions reductions.

The impact of this measure on emissions is heavily influenced by the availability of green electricity supplied by renewable energy sources. The transition toward electrified heating brings an added demand for electricity, which will have associated carbon emissions until the national grid does not use fossil fuels and is fully "greened". The more rapidly the grid greens, the greater the impact on reducing emissions as a result of transitioning to electrified heating systems. Gas CHP systems are a low-carbon alternative to individual gas/grid systems since they convert fuel into electricity and heat more efficiently. CHP systems can also be fed by renewable technologies, meaning that they also offer a long-term zero-carbon option for heating systems, similar to electric heat pumps. Switching to an electrified heating system can also often provide incentive to property owners to install renewable energy (such as solar PV).

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Whilst recent national government policies on low carbon heating are not directly considered in this modelling, it is important to note that there may be challenges in scaling up low-carbon heating in rural areas. Additionally, the significant proportion of buildings in Wilshire not connected to the gas network pose different challenges to switching from fossil-fuel based sources to low-carbon alternatives. There are opportunities to decarbonise heating through district heating, however, which may the council has a role in enabling to ensure low-carbon heating opportunities are maximised.

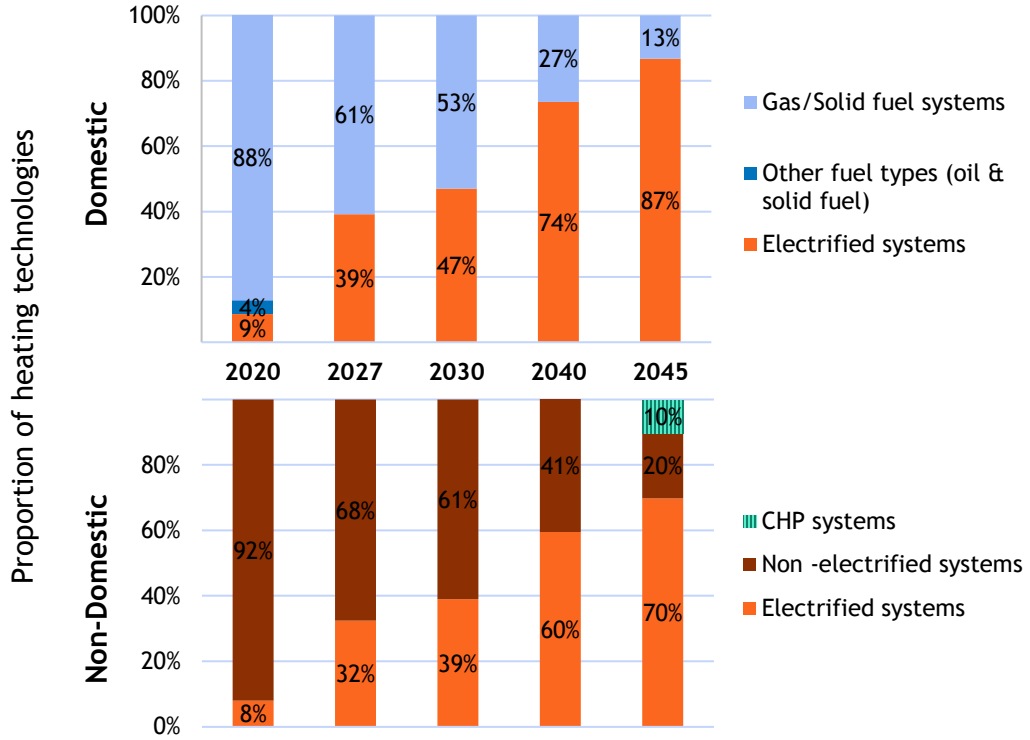


Figure 5.1.7: Modelled changes in the technology mix used for heating domestic and non-domestic buildings.

Current Statistics	Source
It is estimated that in 2019, 30% of domestic buildings in Wiltshire were not connected to the gas network.	MSOA estimates of properties not connected to the gas network, BEIS.
It is estimated that in 2020, 34% of non-domestic buildings were not connected to the gas network.	ND-NEED Geographical Data

[1] Hydrogen technology is not modelled due to the limited availability of large-scale data.

5.1 BUILDINGS
INTERVENTION MILESTONES

1.3 Switch to low carbon and energy efficient cooking, lighting and appliances
a) Shifting to energy efficient lighting and appliances

This objective considers the reduction in energy demand due to the installation of more efficient lighting and appliances, including electrical devices.

Energy demand reductions are applied to whatever fuel the building is using, such as mains electricity or gas-fired CHP. Lighting and appliances along with cooking use approximately 45% of an average building's day to day use energy, heating and hot water use approximately 46% of an average total building's day to day use of energy.[1]

Modelled changes in energy demand (measured in MWh) for lighting and appliances uses the 2018 SCATTER inventory as a baseline value.

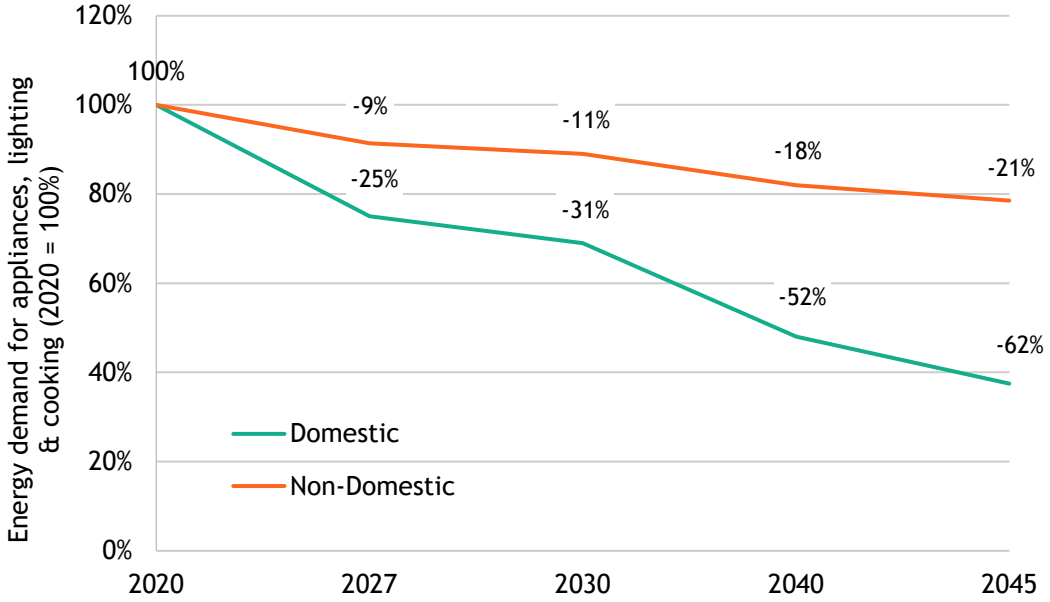


Figure 5.1.8: Modelled energy demand reduction for changes for appliances, lighting and cooking in kWh. Example appliance and lighting energy savings are modelled below. Reduction in demand from cooking is explored on the following page.

Change	Energy Saving (% of household use)
New refrigerator	8% [2]
New washing machine	1.7% [2]
New Television	2% [2]
50W bulbs to LEDs	12% [3]

Current Statistics	Source
In the UK, energy consumption from domestic lighting, cooking and appliances increased by 4% between 2010 and 2020.	Energy Consumption in the UK: End Use Data Tables

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Both behaviour change and shifts in low-carbon appliance and lighting markets will be needed. The council can support this by providing guidance and disseminating information, as markets will largely drive change in this area. The public sector can invest in its own buildings to ensure energy efficient appliances are used, while the council can lead by example and implement low carbon lighting and appliances across its estate.

[1] Per BEIS analysis
[2] Energy Efficient Products
[3] Gov Press Release

5.1 BUILDINGS
INTERVENTION MILESTONES

1.3 Switch to low carbon and energy efficient cooking, lighting and appliances
b) Shifting from gas cooking facilities

This objective describes the uptake of electrical cooking systems and discontinuation of gas cookers. It accounts for a transition to fully electrified systems by 2050. The uptake of electrified cooking systems directly reduces other fossil fuel usage, though this does constitute an overall increase in electricity consumption.

The transition from gas to electric fuel does carry an efficiency saving, however, meaning the overall energy consumption on a per-cooker basis is reduced.

As with the heating systems measure, the projected change towards electric systems delivers emissions savings in tandem with decarbonisation from the grid.

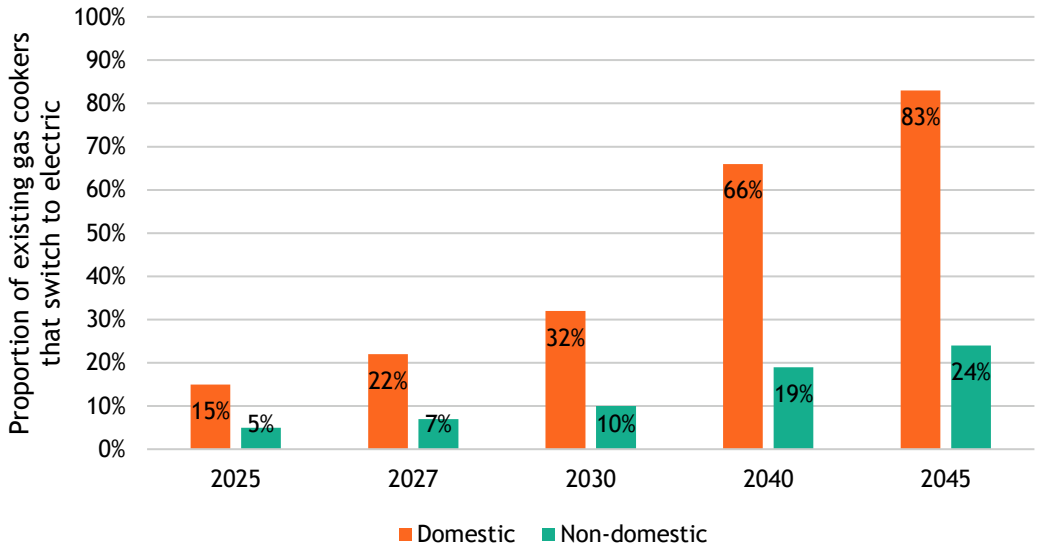


Figure 5.1.9: Modelled changes in fuel usage type for domestic and by 2050, all cookers are electrified. The graph shows the proportion of systems that switch fuels from gas to electricity; systems that are already electrified are assumed to remain so.

Now	2027	2030	2040	2045
	Electric fuel usage for non-domestic cooking			
Nationally in 2016, it was estimated that around 45-50% of domestic cooking was electrified.[1]	+7%	+10%	+19%	+24%
	Electric fuel usage for domestic cooking			
	+22%	+32%	66%	+83%

[1] Based on underlying fuel consumption data within SCATTER

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Both behaviour change and shifts in markets will be needed. The council can support this by providing guidance and disseminating information as markets will largely drive change in this area. Improvements will be also be driven by cost and the design of new-builds, however, given the relatively low number of new-builds in Wiltshire, reducing the cost of replacing existing cooking facilities where possible should be prioritised.

5.1 BUILDINGS
CO-BENEFITS

It is helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of buildings in Wiltshire will offer co-benefits across multiple spheres:

Economy

- Improving the energy efficiency of homes could save £54m a year in energy bills.
- Investing in profitable energy efficiency measures for schools, hospitals, offices, shops and restaurants, could save the county £26m a year in energy bills.

Employment

- Delivering energy efficiency improvements could create 3,055 years of employment in Wiltshire.

Health & Wellbeing

- Better insulated homes reduce the risk of health conditions related to cold/damp living conditions. Children living in inadequately heated homes are more than twice as likely to suffer from conditions such as asthma and bronchitis than those living in warm homes.
- Savings on energy bills help to reduce fuel poverty in a time of increasing energy costs.
- Energy efficiency in commercial buildings can help to improve the health and wellbeing for employees and can decrease employee sick days by up to 40%

Environment

- More sustainable design can help to enhance surrounding natural assets and make better use of nature to enhance building resilience to a changing climate.

5.2 Transport

Anthesis

5.2 TRANSPORT
INTRODUCTION

Emissions from transport represent 33.2% of Wiltshire's emissions profile, making them a key source to target action.

The transport measures in SCATTER consider changes in behaviour around transport, as well as the adoption of more electric vehicles for journeys.

KEY LOCAL CONTEXT

- Wiltshire Council is investigating the potential for alternative fuels for waste management vehicles.
- Under the Future High Streets Fund, projects in Salisbury and Trowbridge will aim to improve active travel measures.
- Wiltshire Council have commissioned a Transport Assessment modelling the impact of new planned development across the area's highway network under carbon reduction scenarios.
- Wiltshire's Climate Strategy has identified transport emissions as the largest emitter in the county, when domestic and non-domestic buildings are considered separately. It was also the most commented upon theme in the strategy consultation, improving public transport and encouraging active travel being the most popular comments.
- The urban/rural geography of Wiltshire, including narrow roads in market towns and heritage assets, can cause challenges in designing public transport and active travel plans.
- There is limited grid capacity in Wiltshire which is currently a barrier to a large transition to Electric Vehicles (EVs).

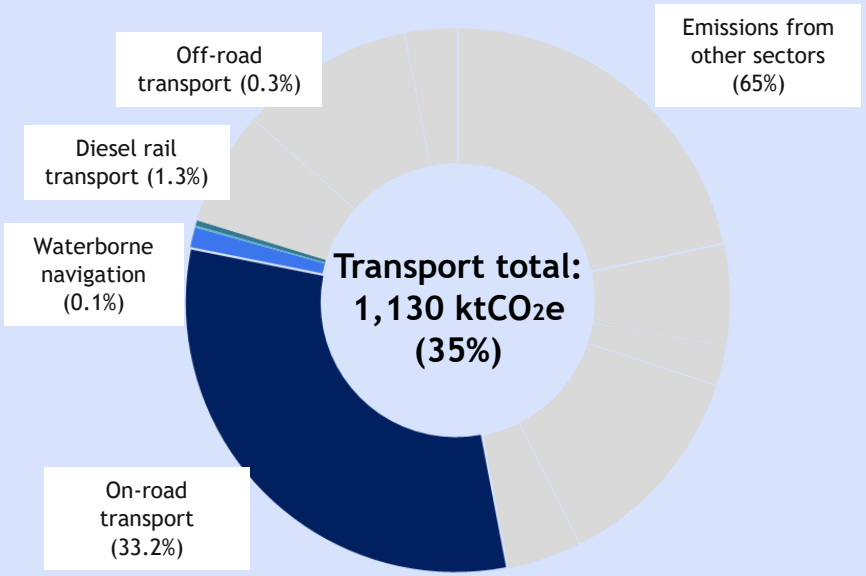


Figure 5.2.1: SCATTER 2018 inventory for the transport sector in Wiltshire.

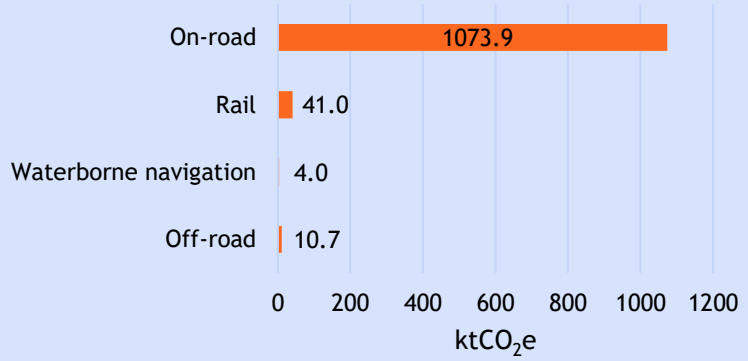


Figure 5.2.2: Scope 1 emissions in Wiltshire's SCATTER 2018 inventory for the transport sector.

5.2 TRANSPORT
KEY PLANS AND POLICIES

National

- The Transport Decarbonisation Plan details the UK Government's ambition to decarbonise the transport network, through a net zero public transport network, the phasing out of all new non-zero emissions road vehicles by 2040, and decarbonising the freight system.
- The Ten Point Plan for a Green Industrial Revolution includes ending the sale of new petrol and diesel cars and vans by 2030 and the The Moving Forward Together strategy commits bus operators to only purchase ultra-low or zero carbon buses from 2025.
- Well Managed Highway Infrastructure – A Code of Practice advocates sustainability through; sustainable consumption and production, climate change and energy, natural resource protection and sustainable communities.
- The Net Zero Strategy 2021 details key commitments to increase average road vehicle occupancy by 2030, increase journeys by public transport or active travel, and provide funding for cycle lanes, low-traffic neighbourhoods, and integrated, frequent bus networks.
- The UK Hydrogen Strategy 2021 outlines hydrogen's potentially fundamental role in net zero transport, with the UK Government providing £23 million for the Hydrogen for Transport Programme.
- The Governments Gear Change policy paper outlines ambitious policy plans for moving as much transport as possible into cycling and walking, in the process significantly cutting emissions and improving air quality. Likewise, the Bus Back Better plan encourages far greater usage of low or zero carbon bus services.

Wiltshire

- The Wiltshire Climate Change Strategy details the Council's objectives to have a zero-emission transport system, provide infrastructure for increased active travel, achieve high-quality public transport and design new developments to reduce the need to travel. Areas of focus include supporting EV infrastructure and using planning powers to reduce the need for travel and explore '20 minute' neighbourhoods.
- Wiltshire Council's bid to the Department for Transport (DfT) for funding to develop a feasibility study for a new station in Corsham, as part of the Restoring Your Railway Ideas Fund, has been approved and is on track to progress to the next stage of the process.
- The Wiltshire Bus Service Improvement Plan was recently adopted and has multiple aims, including decarbonisation of the public transport sector.
- Wiltshire Council is supporting local councils to secure On-street Residential Chargepoint Scheme (ORCS) grant funding.

5.2 TRANSPORT
INTERVENTIONS OVERVIEW

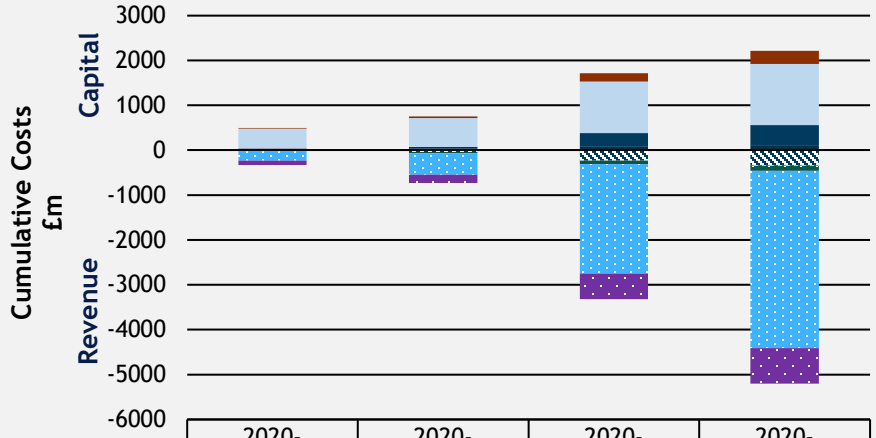
2.1 Travel shorter distances: A change in the overall mileage travelled per passenger across all forms of transport, achieved through reducing the need to travel. Increases in population are also considered in this measure.

2.2 Drive less: Changes to the mode by which passengers travel, defined by miles travelled, switching from private cars to other modes of transport. These are broken down into car (which includes petrol, diesel, hybrid and electric vehicles), active (walking and cycling) and public (train and bus).

2.3 Switch to electric vehicles: Considers the speed of the uptake of electric cars, trains and buses and phasing out of petrol and diesel vehicles. The impact of this measure is influenced by both the demand-side reductions and grid supply from renewable energy supply. The tool does **not** consider hydrogen-fuel vehicles.

2.4 Reduce freight emissions: Considers changes to both the fuel efficiency and mode of travel for freight and commercial journeys.

SCATTER Intervention	Cumulative Emissions Savings			
	2020-2027	2020-2030	2020-2040	2020-2045
1. Travel shorter distances	2,037 $ktCO_2e$	3,356 $ktCO_2e$	7,584 $ktCO_2e$	9,473 $ktCO_2e$
2. Drive Less				
3. Switch to electric vehicles				
4. Reduce freight emissions				



	2020-2027	2020-2030	2020-2040	2020-2045
Infrastructure (Capital)	16	36	187	298
Private Vehicles (Capital)	444	639	1145	1359
Large Private Vehicles (Capital)	22	43	308	466
Rail (Capital)	15	31	76	95
Efficiencies (Revenue)	-98	-187	-570	-794
Private Vehicles (Revenue)	-205	-479	-2435	-3952
Large Private Vehicles (Revenue)	-12	-26	-84	-112
Rail (Revenue)	-15	-42	-229	-348

Figure 5.2.3: Cumulative transport costs including both Capital (block) and Revenue (pattern), in £m. *Revenue costs are seen as negative where savings are made against a BAU scenario.

Figure 5.2.3 demonstrates that the cumulative revenue savings up to 2045 are **greater** than the cumulative capital costs from 2020, particularly from private vehicle savings. The revenue savings may be reduced if not all large vehicles can be electrified and consequently require alternative fuels which are similarly priced.

The costs are categorised by transport modes and key cost points including infrastructure and efficiency gain. These costs are derived from the CCC 6th carbon budget and more details on the method can be seen in appendix 7.

5.2 TRANSPORT
INTERVENTION MILESTONES

2.1 Travel shorter distances

This measure models the reduction in distance of the total travel demand per person, across all transport modes, by increasing local amenities and connectivity. Planning has a key role to play in ensuring that new developments are well situated with nearby amenities, reducing the need for longer journeys.

In addition, the COVID-19 pandemic has encouraged remote home working solutions which has also reduced the need to travel for work for some individuals. The future of office working remains uncertain, as many businesses become receptive to future working patterns which incorporate home-working. Following the introduction of lockdown measures in March 2020, road traffic fell to around one third of pre-pandemic levels on weekdays, however following the re-opening of office spaces and schools in September, this number recovered to approximately 90% of typical levels.[1]

Changes to transport infrastructure, public transport services and traffic management can also drive reductions in the average distance travelled per person. This objective also considers expected increases in population between 2030 and 2050.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Medium

Planning will largely dictate the connectivity of new developments to core services and the possible reduction in required travel distances, through Local Plan site allocations, town centre regeneration, service planning and economic development. Community engagement to improve local places can also contribute. However, longer journeys for leisure may still be taken. For existing infrastructure, the rural nature of some parts of Wiltshire will pose challenges to reducing the overall miles travelled per person.

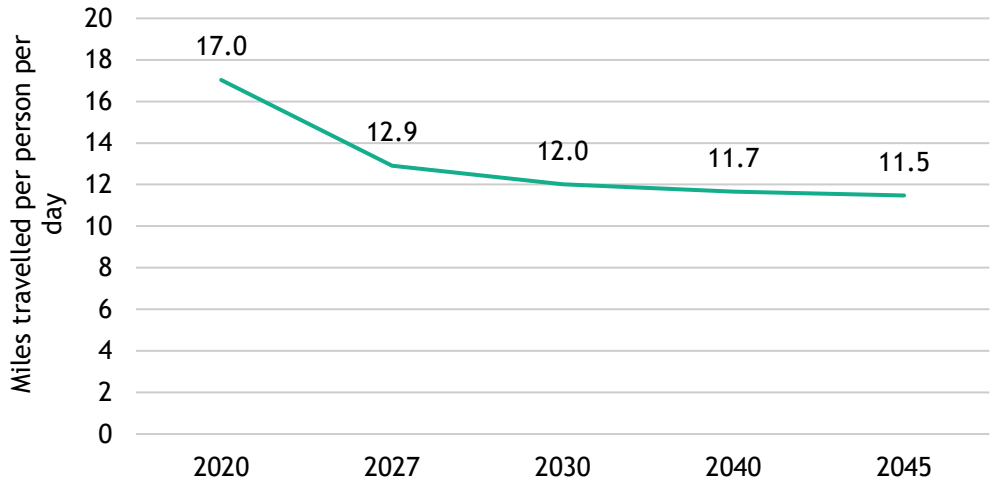


Figure 5.2.4: Modelled miles travelled per person per day by car and taxi in Wiltshire. The reduction rate has been applied to available data for cars and taxis to provide a resident car-owner's perspective. Note that this intervention relates to all modes of transport, not car and taxi exclusively.

Now	2027	2030	2040	2045
Before the COVID-19 pandemic the average distance travelled to work had increased in all regions of England and Wales. In 2011, the average distance travelled to work in Wiltshire was 12 miles.[1]	Average number of passenger miles travelled per person compared to a 2020 base year			
Since the COVID-19 pandemic working from home has increased from 27% to 37% in the UK. Those living in London being most likely to work from home. [2]	-20%	-25%	-25%	-25%

[1] Distance travelled to work, 2011 Census.
[2] Future of homeworking, ONS.

5.2 TRANSPORT
INTERVENTION MILESTONES

2.2 Drive less

This intervention considers changes to the *mode* of travel i.e. the means by which journeys are completed, with a view to promoting **active travel**, and the uptake of **public transport**. SCATTER models journeys in Wiltshire based on 3 categories: 1) Active travel (i.e. walking and cycling), 2) Public (which includes buses and trains) and 3) Private vehicle (i.e. cars). The 2019 split is taken from national travel survey data. Shifting more journeys to active travel and public transport will play a key role in reducing transport emissions. Furthermore, the council is in the process of returning the bus network to a commercial system, which may provide them further opportunities to influence the reduction of emissions. According to the 2011 census data, 6% of people in Wiltshire utilise public transport to get to work, 3% of people cycle to work and 13% walk. [1]

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

During the COVID-19 pandemic, there were increases in funding to local authorities to improve active travel options. We have also seen broad changes in public behaviour, such as increased working from home, and interest in walking for leisure. Rising fuel costs will also disincentivise driving. These factors mean the council is positioned to drive increased active and public transport.

Modal shifts will require behaviour change from the public. The council can enable this through engagement programs to increase the use of low-carbon options for travel. Given the area's high car usage, car clubs should be explored. Improvements to active travel and public transport infrastructure, and the use of traffic reduction measures, also present an opportunity for the council. The perceived high costs of public transport in Wiltshire should also be targeted to encourage uptake. Securing funding to support improvements in public transport infrastructure is a key opportunity for the council in this area.

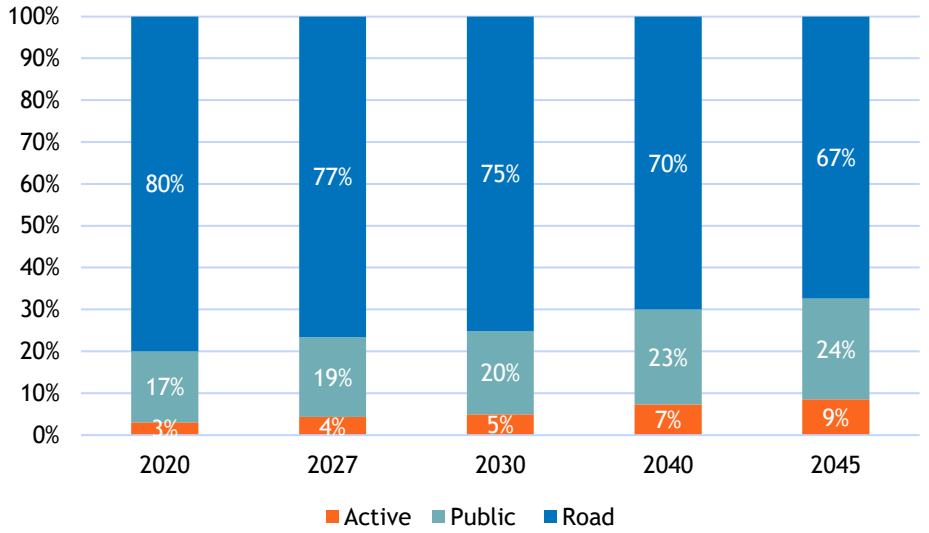


Figure 5.2.5: Modelled changes in mileage share for different modes of transport along the High Ambition Pathway. The data for 2019 is the national average modal share (Source: Modal comparisons, DfT)

Now	2027	2030	2040	2045
In 2011, 65% of commutes to work were by car or van and 16% by active travel (walking and cycling).[1]	Road transport use compared to 2020			
	-4%	-6%	-13%	-16%
	Public transport compared to 2020			
	+12%	+18%	+35%	+41%
	Active travel compared to 2020			
	+33%	+67%	+133%	+200%

[1] Method of travel to work, Census 2011.

5.2 TRANSPORT
INTERVENTION MILESTONES

2.3 Switch to electric vehicles (EV)

One of the most important steps to reducing transport emissions in Wiltshire is the transition to electric vehicles. As with other objectives around electrification, the success of a county-wide switch to EV relies heavily on grid decarbonisation and renewable electricity supply.

Data from the DfT and DVLA indicates that in 2021, 12,387 licensed vehicles across Wiltshire were ULEV, 78% of these are business vehicles.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Installing accessible EV infrastructure can support the uptake of electric vehicles, however, Wiltshire's limited grid capacity will pose challenges - heritage areas may also add another limiting factor. The Council can work in partnership with local businesses to help identify opportunities to collaborate on charging infrastructure, however, lack of sufficient government incentives and funding will hamper progress. Other policies such as the electrification of public transport will be reliant on increased government spending.

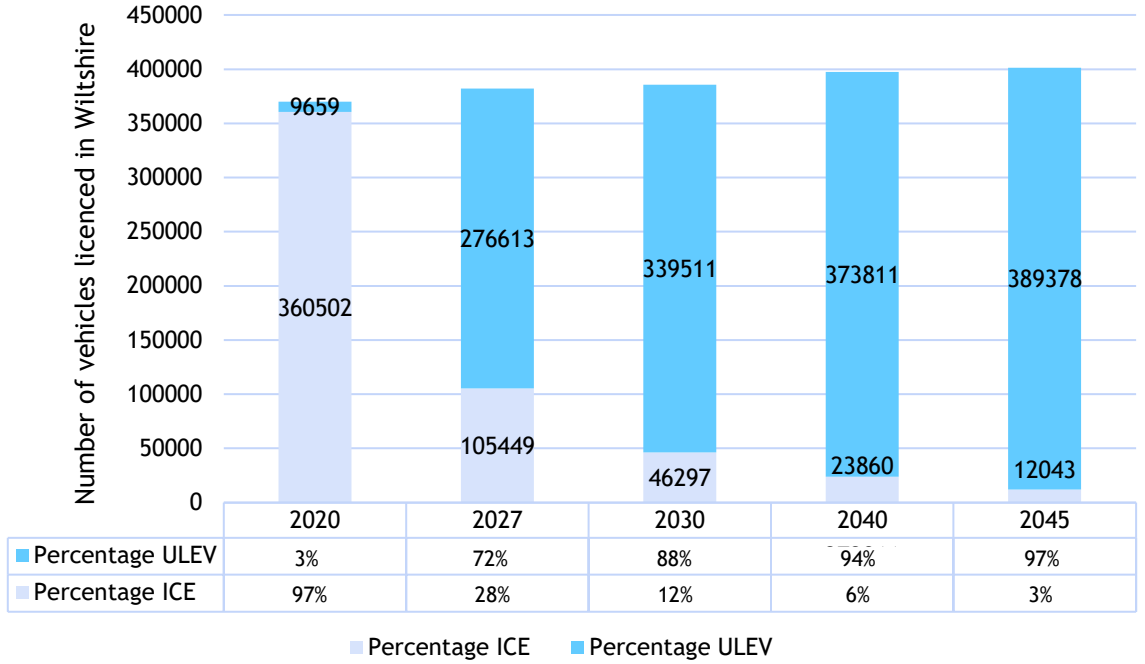


Figure 5.2.6: Transitioning away from fossil-fuel powered internal combustion engines (ICE) private vehicles to ULEV.

Current Statistics	Source
Since 2014, 1,787 charging points have been installed in Wiltshire under the Electric Vehicle Homecharge Scheme (EVHS) and 142 under the Workplace Charging Scheme (WCS). No charging points have been installed using the On-Street Residential Scheme (ORCS)	Number of ULEVs licensed by Local Authority
As of Oct 2021, 164 publicly available electric charging devices are available in Wiltshire.	Number publicly available charging points by Local Authority
3% of vehicles licenced in Wiltshire are ULEV.	Licensed vehicles in the UK

Transport glossary
ICE - Internal combustion engine (petrol and diesel vehicles) ULEV - Ultra-low emission vehicle (currently defined as a vehicle which emits <75 gCO_2/km travelled).
HEV - Hybrid electric vehicle

5.2 TRANSPORT
INTERVENTION MILESTONES

2.4 Reduce freight emissions

Freight emissions are difficult to tackle, posing challenges both in terms of operational technology and emissions accounting. SCATTER considers three measures which reduce freight emissions:

1. Improved journey efficiency: reducing the mileage travelled by HGVs through more efficient infrastructure and fewer "empty-trailer" journeys.
2. Improved efficiency of freight vehicles themselves i.e. reduction in energy used per mile travelled as more fuel-efficient (and eventually electric) vehicles are used
3. A shift from fossil-fuel intensive freight vehicles e.g. HGVs to low-carbon freight e.g. cargo bikes.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Low carbon shifts in the freight sector will largely be driven by national government policy. Local government, however, can encourage low-carbon freight through developing low carbon freight fueling centres, using its own fleet as anchor for infrastructure and providing business support for local hauliers to decarbonise their fleet. For example, Wiltshire's Draft Climate Strategy states that the Council will develop an active travel network that will facilitate cargo bikes and reduce freight emissions. Opportunities for freight distribution hubs for home deliveries could also be explored, and the council can provide communication to the public to consider miles travelled in their purchasing decisions.

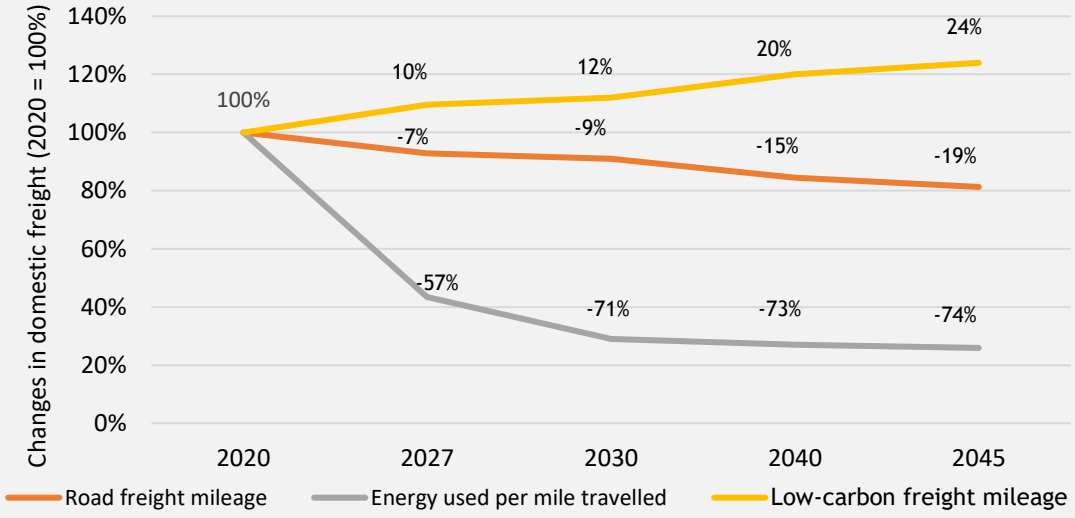


Figure 5.2.7: Changes in freight emissions across three areas of activity. Percentage changes are relative to a 2018 baseline at 100%.

Current Statistics	Source
In 2020, there were approximately 50,000 LGVs and 4,000 HGVs registered in Wiltshire.[1]	Licensed vehicles in the UK

	HGV	LGV
Percentage difference in traffic from 2010 to 2019	+8%	+32%
Percentage difference due to the COVID-19 pandemic from 2019 to 2020	-6%	-9%
Overall percentage difference from 2010-2020	+1%	+19%

Table: Difference in road freight traffic milage in Wiltshire

5.1 TRANSPORT
CO-BENEFITS

It is helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of transport in Wiltshire will offer co-benefits across multiple spheres:

Economy

- Electric vehicles are estimated to be 13% cheaper by 2030 compared to conventional fuel cars over their lifetime.

Employment

- An estimated 1,224 jobs are expected to be needed in Wiltshire in the Low Emissions Vehicles industry by 2030.

Health & Wellbeing

- Air pollution contributed to approx. 5% of deaths in Wiltshire in 2010. A reduction in vehicle exhaust fumes improves air quality and reduces negative effects on people's health
- Increased physical activity due to active travel will help to reduce obesity figures. It is estimated that 64% of adults are classed as overweight or obese and 17% of 10-11-year-olds in Wiltshire as classed as obese.

Environment

- Considerable improvements in air quality and noise reduction from vehicles increase an individual's quality of life.

5.3 Waste

Anthesis

5.3 WASTE
INTRODUCTION

Waste management represents a much smaller proportion of Wiltshire's emissions than the sectors previously discussed, representing 2.7% of total emissions. The waste measures described here relate to all waste streams; reuse, open and closed-loop recycling, combustion and composting and landfill.

The SCATTER emissions inventory aligning to global reporting standards set out by the Global Protocol for City-wide (GPC) Greenhouse Gas Emissions, which requires all GHG emissions from disposal or treatment of waste generated within the county boundary, whether treated inside or outside the county boundary, to be included within the inventory and pathways analysis for Wiltshire. This covers all waste generated across the county excluding business waste collected by private organisations.

KEY LOCAL CONTEXT

- In 2022, Wiltshire Council will assess the delivery of waste collection, household recycling and disposal services to incorporate the requirements of the 2021 Environment Act.
- Wiltshire Council has several partnerships with local charities to repair and reuse items thrown away such as furniture, bikes and white goods.
- In 2020, Wiltshire Council increased the range of recyclable items and redesigned waste collection rounds to improve efficiencies and reduce collection vehicles.
- Wiltshire Council will look to procure suitable anaerobic digestion capacity if it implements food waste collections.

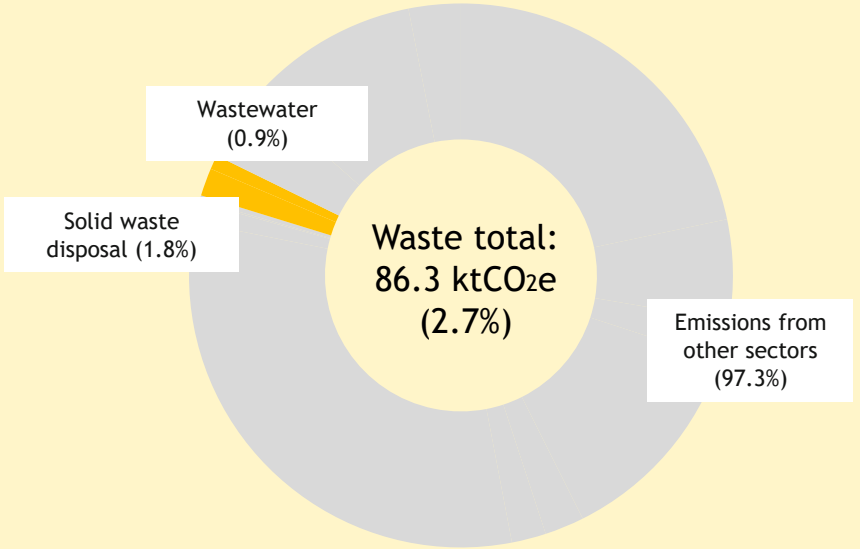


Figure 5.3.1: SCATTER 2018 inventory for the emissions from waste from households, any commercial or institutional sites, and construction and demolition waste collected by the Council.

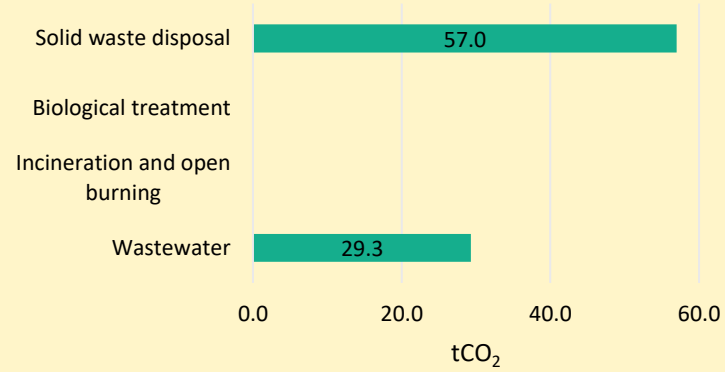


Figure 5.3.2: Scope 1 emissions in Wiltshire's SCATTER 2018 inventory for the waste sector.

5.3 WASTE
KEY PLANS AND POLICIES

National

- Our Waste, Our Resources: A Strategy for England (2018) sets out how the country will preserve resources by minimising waste, promoting resource efficiency and moving to a circular economy.
- Waste and Recycling: Making Recycling Collections Consistent in England (2019) The government are working with local authorities and waste management businesses to implement a more consistent recycling system in England. The measures are expected to come into effect in 2023.
- Waste Prevention Programme for England aims to support a resource efficient economy, reducing the quantity and impact of waste produced whilst promoting sustainable economic growth
- The 2021 Environment Act shall enable national authorities to mandate new waste management measures such as separately collecting food waste and a wider range of plastics to be accepted for kerbside recycling.

Wiltshire

- The Wiltshire Climate Change Strategy details the Council's objectives to work towards a circular economy, zero avoidable waste across the county and to decarbonising the waste management process. Areas of focus include reviewing the potential to expand the range of items collected for recycling and maximising the efficiency of collections.
- The Household Waste Management Strategy 2017-2027 outlines the Council's 5 Priorities to achieve zero avoidable household waste following consultation with residents and elected members, which include waste prevention, repair and reuse, recycling and composting, energy from waste and litter and fly tipping.
- A project to build an energy from waste plant in Westbury has been granted local planning permission.
- Following the introduction of the Environment Act 2021 the council is expecting to re-evaluate its landfill diversion infrastructure, service model and contracts.

5.3 WASTE
INTERVENTIONS OVERVIEW

The following measures seek to reduce emissions from the treatment of solid waste and wastewater. Despite waste treatment emissions representing a relatively small proportion of overall emissions, it is still important to prioritise these interventions to align with the council's key objective on waste. We can think of reducing the quantity of waste as a demand-side reduction, linking it to more efficient waste collections and saved costs associated with wastewater processing and treatment. Increasing the proportion of waste sent for recycling represents the second step in the process for mitigating emissions from waste disposal, following the waste hierarchy of reduction and reuse before recycling.

3.1 Reducing the quantity of waste and wastewater: Considers changes in the overall weight of solid waste and density of wastewater flow produced across all streams from domestic, commercial and industrial activity. Reducing the quantity of waste is a priority when examining the waste hierarchy: reduce, reuse, recycle.

3.2 Increasing recycling rates: Considers the different destinations for waste streams, with the aim of less waste going to landfill.

SCATTER Intervention	Cumulative Emissions Savings			
	2020-2027	2020-2030	2020-2040	2020-2045
1. Reduce quantity of waste and wastewater	13 $ktCO_2e$	33 $ktCO_2e$	179 $ktCO_2e$	309 $ktCO_2e$
2. Increase recycling rates				

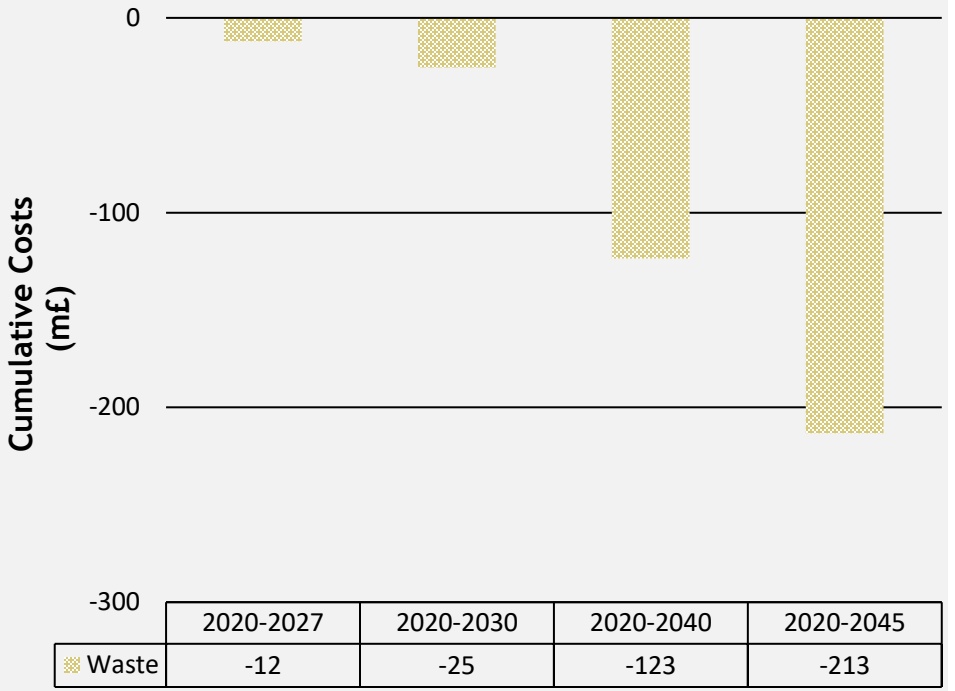


Figure 5.3.3: Cumulative waste revenue costs (pattern), in £m. *Revenue costs are seen as negative where savings are made against a BAU scenario.

The waste costs estimations, shown above, are indicative of both waste interventions. The costs take into consideration the change in gate fees as a result of the reduction in volume of waste as well as an increase in recycling rates. The costs do not account for any expenditure associated with installation of new infrastructure, which may not be incurred only by stakeholders in Wiltshire and could require installation anyway under a BAU scenario. More details on this method can be seen in Appendix 7.

5.3 WASTE
INTERVENTION MILESTONES

3.1 Reducing the quantity of waste

The first step in reducing emissions from waste is a reduction in the total volume of waste produced. This reduction mainly covers waste from households and any commercial or institutional sites and construction, and demolition waste collected by the Council.

The DEFRA dataset on local authority collected waste identified that in Wiltshire, each resident generated an estimated 428kg of household waste from April 2020 to March 2021. Across the county, 42% of this household waste was sent for reuse, recycling or composting. Local authorities have reported large increases in household waste arisings during the COVID-19 outbreak and huge falls in commercial waste arisings, according to the results of the ADEPT COVID-19 Waste Impacts Survey.

The council's Household Waste Management Strategy aims to work towards zero avoidable household waste in the region by 2027.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Councils can influence household waste generated through engagement programs, and working with local businesses can showcase best practice commercial waste management practices. Collaboration with community groups can also increase public engagement on the waste hierarchy and opportunities to support circular economy initiatives. The overall quantity of waste, however, is mainly driven by producers, which will require national action to reduce.

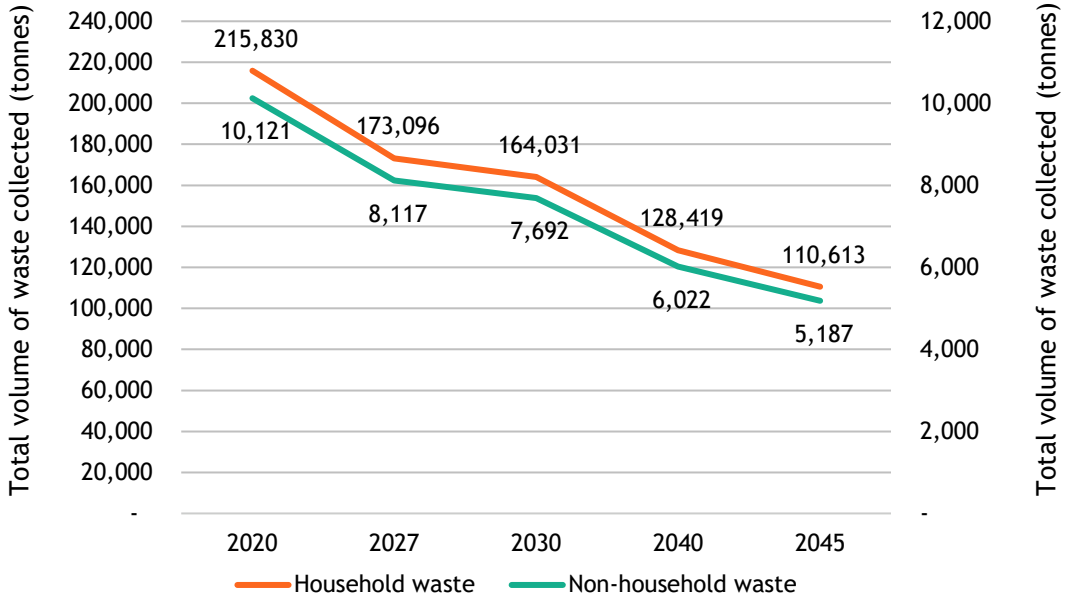


Figure 5.3.4: Modelled changes in volume of household and non-household waste.

Now	2027	2030	2040	2045
215,830 tonnes of household and 10,121 tonnes of non-household waste was collected by Wiltshire Council in 2020/21.[1]	Total volume of waste			
The volume of household waste collected by the council has remained within 1% of 2015 waste levels for the last 5 years.[1]	-20%	-24%	-41%	-49%
The amount of waste sent for reuse, recycling or composting has decreased by 13% compared to 2014.[1]				

[1] BEIS Local Authority Collected Waste.
[2] The Sixth Carbon Budget, CCC

5.3 WASTE
INTERVENTION MILESTONES

3.2 Increasing recycling rates

After reducing the volume of overall waste produced, the next opportunity for reducing waste emissions lies in increasing the proportion of waste that is recycled. SCATTER trajectories incorporate EU targets for recycling rates, with High Ambition projecting a more rapid transition to increased rates of recycling. The growth in recycling rate across Wiltshire that is required in order to follow the High Ambition pathway is illustrated in Figure 5.3.5.

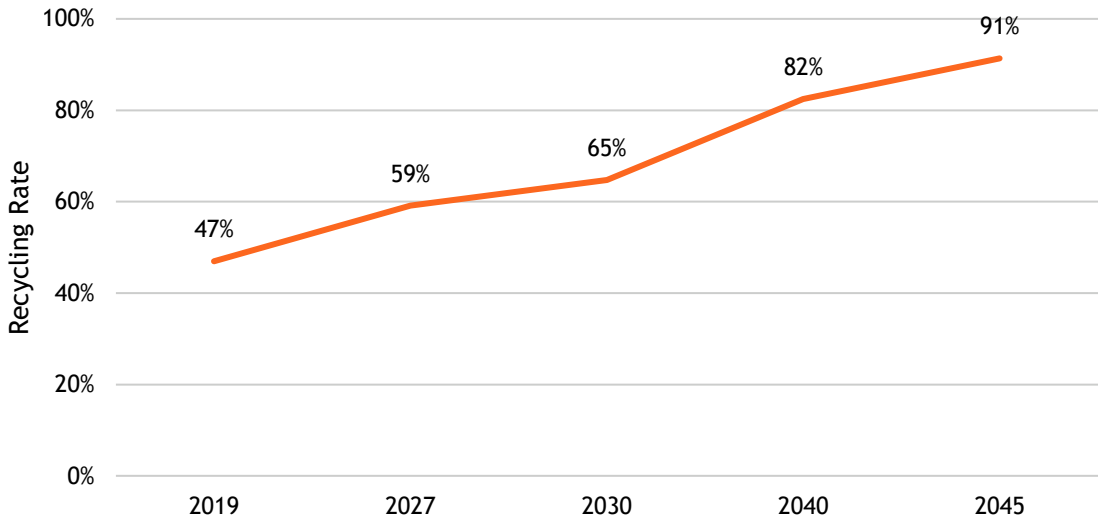


Figure 5.3.5: Modelled changes in the areas household recycling rate.

Now	2027	2030	2040	2045
	Recycling rate			
• The household rate for reuse, recycling or composting in 2020-21, based on Local Authority collected waste was 42%.[1] • 3,742 fly tipping incidents were recorded in Wiltshire in 2020-21.[2]	59%	65%	82%	91%

[1] BEIS Local Authority Collected Waste.
[2] DEFRA Fly tipping incidents and actions taken in England

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Medium

Through public engagement programs, educational campaigns and management of waste collection services, councils can encourage households, schools and other organisations to increase the proportion of collected waste that is recycled. However, influence over commercial waste is still relatively low.

5.3 WASTE
CO-BENEFITS

It is helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of waste in Wiltshire will offer co-benefits across multiple spheres:

Economy

- Reducing waste results in lower costs from waste collection and processing.

Employment

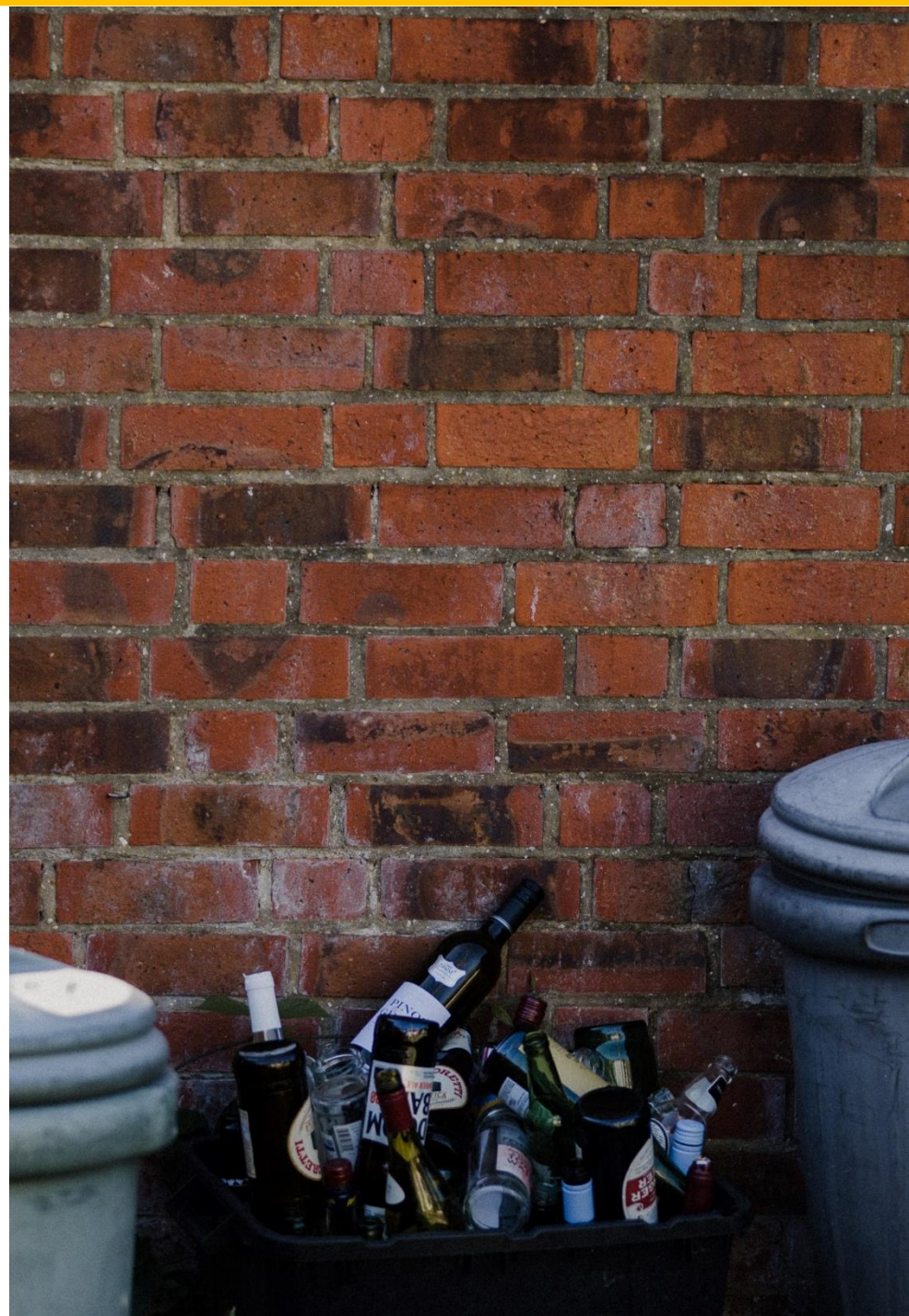
- On average, zero waste strategies create 10 times more jobs than landfill or incineration, which are more technology intensive
- Increased recycling rates have the potential to create more jobs. If a target of a 70% recycling rate is reached in the UK, 50,000 new jobs could be created.

Health & Wellbeing

- Waste reduction can promote social inclusion by creating jobs, volunteer schemes and training opportunities.
- Working towards zero waste helps to mitigate food poverty and hunger by enabling edible surplus food to be recovered and shared through food banks and charities in local areas.

Environment

- Increased recycling rates reduce pollution, reduce incidents of fly-tipping and benefits our health. For example, using recycled glass decreases air pollution by 20% and related water pollution by 50%.



5.4 Industry

5.4 INDUSTRY
INTRODUCTION

Industrial process emissions, like those arising from waste, represent a small proportion of Wiltshire's baseline inventory, with around 4.6% of emissions arising from industrial processes. Tackling industrial emissions can be very challenging, particularly the decarbonisation of very energy-intensive processes and reducing the emissions from the processes themselves.

The emissions associated with industrial buildings are considered as part of the non-domestic buildings sector as a form of stationary energy. Therefore, this section covers emissions arising directly from industrial processes where materials are chemically or physically transformed. Examples of industrial processes include production and use of mineral products; production and use of chemicals and production of metals.

KEY LOCAL CONTEXT

- There is a high proportion of SMEs in Wiltshire, which can make communication and economy of scale with projects targeting businesses more difficult.
- Wiltshire has a large military presence, which has several old assets with a large scope to reduce emissions in their operation.
- A number of businesses in Wiltshire have been active in pursuing more sustainable practices, a collaborative network being hosted by the Wiltshire Climate Alliance. Similarly, Target 2030 is a project delivered by Severn Wye Energy Agency supporting small and medium sized businesses to improve the energy efficiency of their buildings

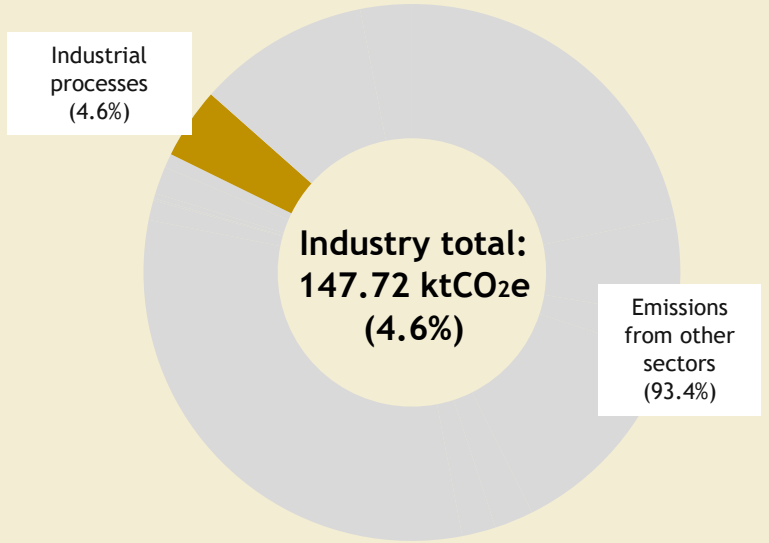


Figure 5.4.1: SCATTER 2018 inventory for the industry sector in Wiltshire.

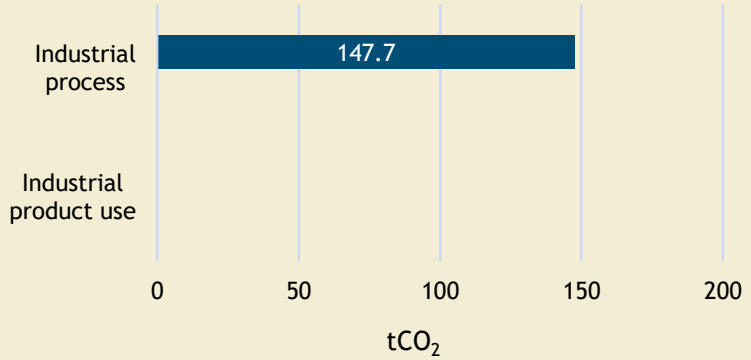


Figure 5.4.2: Scope 1 emissions in Wiltshire's SCATTER 2018 inventory for the industry sector. Emissions associated with Industrial product use are also considered and are nil.

5.4 INDUSTRY
INTERVENTIONS OVERVIEW

The industrial sector represents a relatively small proportion of emissions in Wiltshire, and most of the action in this area will be delivered through the Swindon and Wiltshire LEP. The following industrial measures are defined within the SCATTER tool.

4.1 Shifting away from fossil fuels: Considers changes to the energy consumption in industrial processes and activity. Trajectories measures the changing fuel used – and what proportion of processes can be powered with electricity and natural gas rather than heavier fossil fuels.

4.2 More efficient processes: Considers annual reductions in process emissions via a reduction in the production index of various industries. Separate trajectories are included for chemical, metal, and mineral sectors, with all other industrial activity grouped together (labelled as "other industry").

SCATTER Intervention	Cumulative Emissions Savings			
	2020-2027	2020-2030	2020-2040	2020-2045
1. Shift away from fossil fuels	88 $ktCO_2e$	157 $ktCO_2e$	448 $ktCO_2e$	574 $ktCO_2e$
2. More efficient processes				

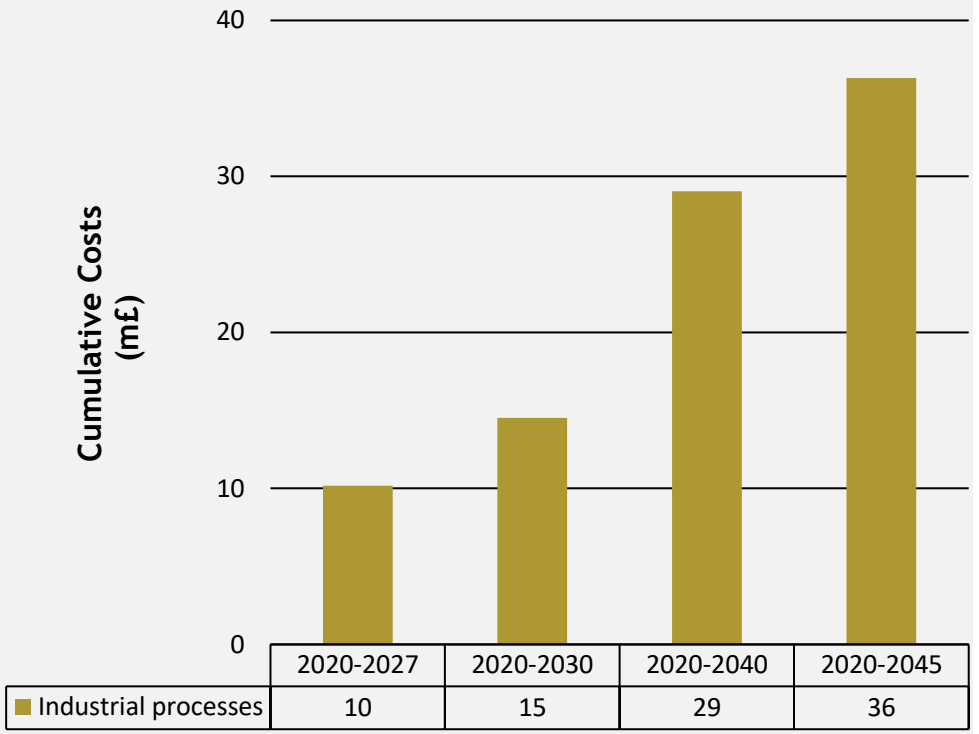


Figure 5.4.3: Cumulative industry capital costs (block), in £m.

The industrial costs are indicative of the investment required to decarbonize the industrial sector. This cost point is derived from the industrial decarbonisation roadmap for UK industry. More information on this method can be seen in appendix 7.

5.4 INDUSTRY
KEY PLANS AND POLICIES

National

- The UK's Industrial Strategy one of the grand challenges set is clean growth and maximising the advantages for UK industry.
- The Clean Growth Strategy includes improving business and industry efficiency. Alongside the strategy, BEIS published joint industrial decarbonisation and energy efficiency action plans with seven of the most energy intensive industrial sectors, including the food and drink sector.
- Ten Point Plan for a Green Industrial Revolution includes plans to invest in carbon capture for industries that are particularly difficult to decarbonise.
- The Net Zero Strategy 2021 details key commitments to deliver 6 $MtCO_2$ per year of industrial CCUS by 2030, and 9 $MtCO_2$ per year by 2035, and to provide funding for energy efficiency and on-site decarbonisation measures under the Industrial Energy Transformation Fund.

Wiltshire

- The Swindon and Wiltshire Local Industrial Strategy aims to promote an entrepreneurial start-up culture, attract new investment and develop talent. The Strategy states that a transition to a net-zero carbon economy is central to its plans. The Strategy also aims to improve energy infrastructure in the region to allow for business growth.
- Swindon and Wiltshire LEP's Strategic Economic Plan 2016 outlines developing the region's strengths in the low carbon energy generation sector and the application of hydrogen technologies as a priority action. The group also provides businesses advice on their low carbon transitions.
- Business West, an organisation representing 23,000 businesses and covering Wiltshire's Chamber of Commerce, alongside Bristol, Bath and Gloucestershire, provides workshops and case studies of businesses reducing their emissions.

5.4 INDUSTRY
INTERVENTION MILESTONES

4.1 Shifting from fossil fuels

This intervention considers changes to the energy consumption in industrial processes, with the trajectories focused on the electrification of industry and the transition away from carbon-intensive fuels. For the chemicals, metals and minerals industries, SCATTER models the changing use of fuels for these processes, shifting off the most high-carbon fuels (i.e., fuel oil) in favour of transition fuels such as natural gas and electricity. Progress to date indicates that in the UK, 34% of energy consumed by the industrial sector in 2020 was electric.[1]

The Swindon and Wiltshire Local Industrial Strategy outlines the Local Enterprise Partnership's (LEP) desire to develop a clean and resilient energy system which allows business and residential growth, whilst embedding low carbon growth in its decision making.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Local governments have limited local influence to shift industrial processing away from fossil fuel use. National government policy and funding combined with key industry bodies collaboration will be key.

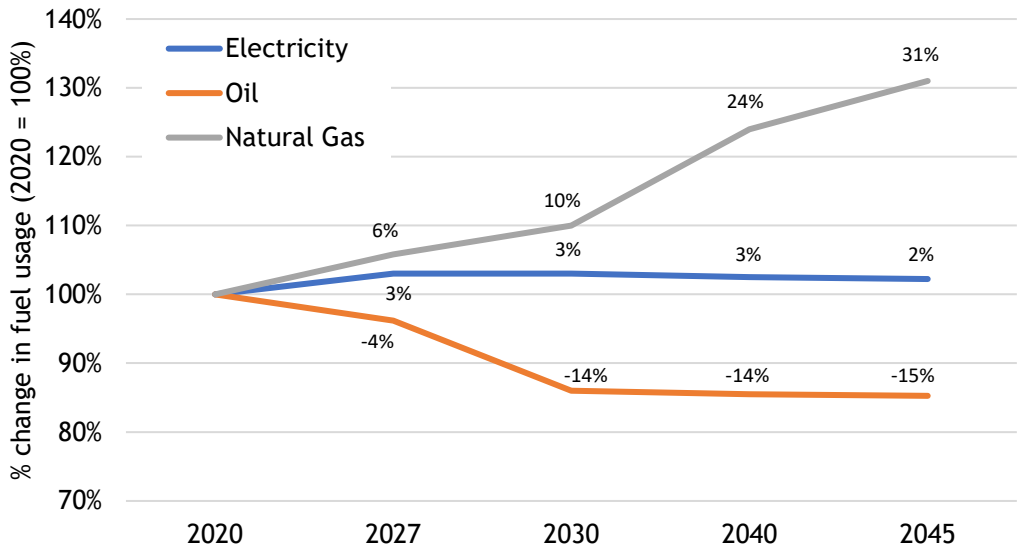


Figure 5.4.4: Modelled changes in industrial process emissions. Percentage figures in the data table relate to cumulative emission reductions against the 2020 baseline.

Now	2027	2030	2040	2045
In the UK, 34% of energy consumed by the industrial sector in 2020 was electric.[1]	Process emissions for chemicals			
	-12%	-14%	-22%	-26%
	for metals			
	-8%	-10%	-16%	-18%
	for minerals			
	-9%	-11%	-18%	-22%
	other industries			
	-42%	-50%	-65%	-73%

[1] DUKES Energy Consumption by final user

5.4 INDUSTRY
INTERVENTION MILESTONES

4.2 More efficient processes

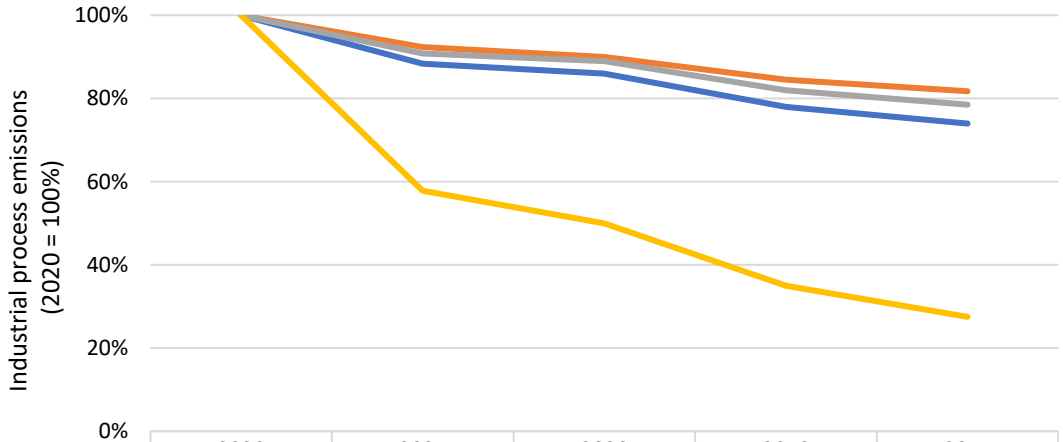
This intervention considers the growth of different industries' greenhouse gas emissions that result from industrial processes. Process emissions arise from the manufacture and/or production of materials, chemicals and other products e.g. through combustion. As with some freight emissions, the direct impact of certain industries within Wiltshire is limited, but are given here to illustrate the necessary actions in the industrial sector. This relies on a national shift in energy and industrial processes.

Separate trajectories are included for chemical, metal and mineral sectors, with all other industrial activity grouped together (labelled as "other" industry). Wiltshire Council can ensure that the council has a programme in place for supporting efficiency improvements within local industry. Across the county, businesses need to review procurement policies and ensure products and services are sourced with a view of reducing overall supply chain emissions. Following this, businesses can identify areas where efficiencies in production can be improved, such as the adoption of a circular economy model.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

Local governments have limited local influence to shift industrial processing away from fossil fuel use. National government policy and funding combined with key industry bodies collaboration will be key, though there may be a role for councils in lobbying for increased efficiency and lower carbon standards for industry. In addition, not all emissions reductions may be effective within the Wiltshire boundary if related to supply chains, however industrial emissions remain important to address.



	2020	2027	2030	2040	2045
Chemicals	0%	12%	14%	22%	26%
Metals	0%	8%	10%	15%	18%
Minerals	0%	9%	11%	18%	21%
Other	0%	42%	50%	65%	72%

Figure 5.4.5: Modelled changes in industrial fuel use. Percentage figures relate to cumulative emission reductions or increases against the 2020 baseline.

Current Statistics	Source
Industrial carbon emissions in the UK, including those from energy-intensive industries, have halved since 1990, which has mainly been due to efficiency gains, fuel switching, a change to industrial structure of the UK and re-location of production overseas.	BEIS. Oil Refining - Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan
Since 1990 the chemical sector has improved its energy efficiency by 35%.	BEIS. Chemicals Sector - Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan

5.4 INDUSTRY CO-BENEFITS

It is helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of industry in Wiltshire will offer co-benefits across multiple spheres:

Economy

- Low carbon industries could grow to around 8% of the UK's GRP by 2030.
  - Improved efficiency of industrial processes will likely see cost and energy use savings. Encouraging businesses to make changes now can also help to protect them and increase resilience as the economy shifts to lower carbon activities.

Employment

- Carbon capture storage and associated negative emissions technologies provide an opportunity for local job creation.
- The UK government announced investments of £1m to establish two new carbon capture storage clusters by the mid-2020s, which have the potential to create an estimated 50,000 jobs UK wide.

Health & Wellbeing

- Advancements in technology through the use of Artificial Intelligence and the Internet of Things (IoT) can help to improve worker safety in factories.

Environment

- Reductions in fossil fuel extraction and burning can lead to biodiversity benefits and avoid land degradation and noise pollution from drilling exploratory wells and surveying leading to habitat destruction.

5.5 Energy Supply

Anthesis

5.5 ENERGY
INTRODUCTION

Throughout this chapter reference has been made of the importance of providing decarbonised electricity to Wiltshire. This is to ensure the benefits of moving away from fossil fuels and switching to electric supply are fully realised. The following analysis provides details for the scale and ambition required to meet Wiltshire's current and future energy consumption with renewable sources. The scaling up of current renewable installed capacity should also accommodate future energy demand rises.

The method by which SCATTER models renewable capacity is based upon the scaling up of installed capacity in a given local authority to meet energy demand locally with renewable sources. These are based on the National Grid's Two Degree Scenario and weighted according to current installed capacity. Appendix 6 provides an indication of what emissions savings could be achieved under the High Ambition Pathway without a shift to renewable energy across the county.

KEY LOCAL CONTEXT

- The county has had a large uptake of solar technology compared to other counties.
- 128 local schools are currently part of a green energy contract.
- Over 40% of Wiltshire is designated as an Area of Natural Beauty (AONB), creating visual and landscape challenges when installing renewables such as wind turbines and solar parks.
- There is limited grid capacity in Wiltshire which is a barrier to renewable energy projects expecting to feed back into the grid, causing spatial constraints around substations.

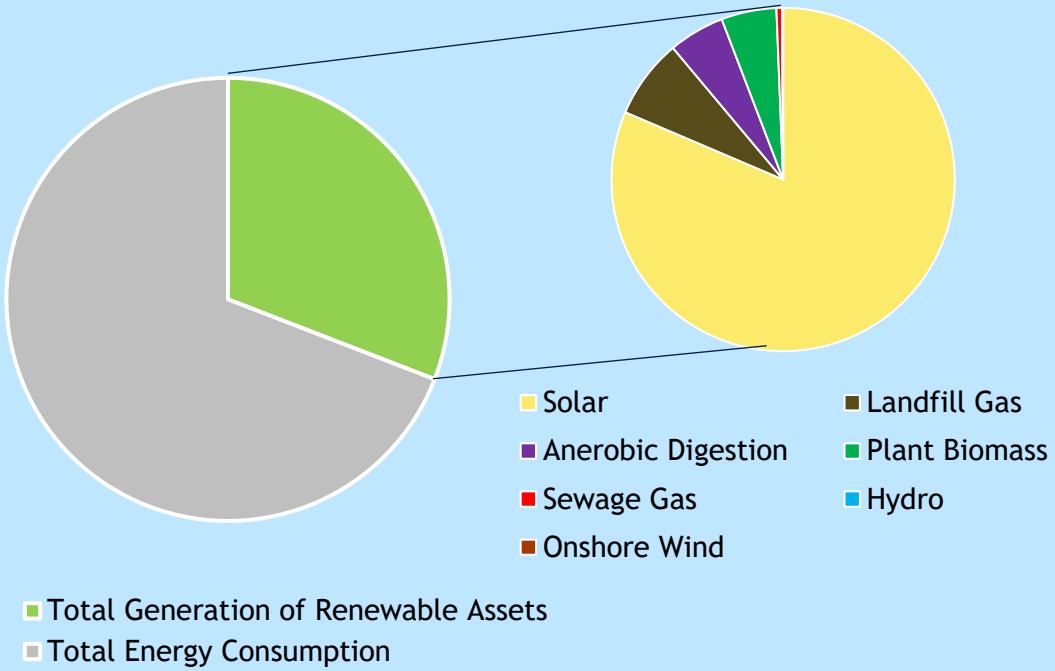


Figure 5.5.1: Local generation from renewable assets expressed as a proportion of total energy consumption in Wiltshire.

Type	Sites	Capacity (MW)	Generation (MWh)
Solar	9,966	548	541,604
Landfill Gas	8	15	49,820
Anaerobic Digestion	8	6	35,096
Plant Biomass	2	6	34,563
Sewage Gas	2	1	3,469
Hydro	7	<1	512
Onshore Wind	2	<1	193

Figure 5.5.2: Sites, capacity (MW) and generation (MWh) of renewable energy sources in Wiltshire.

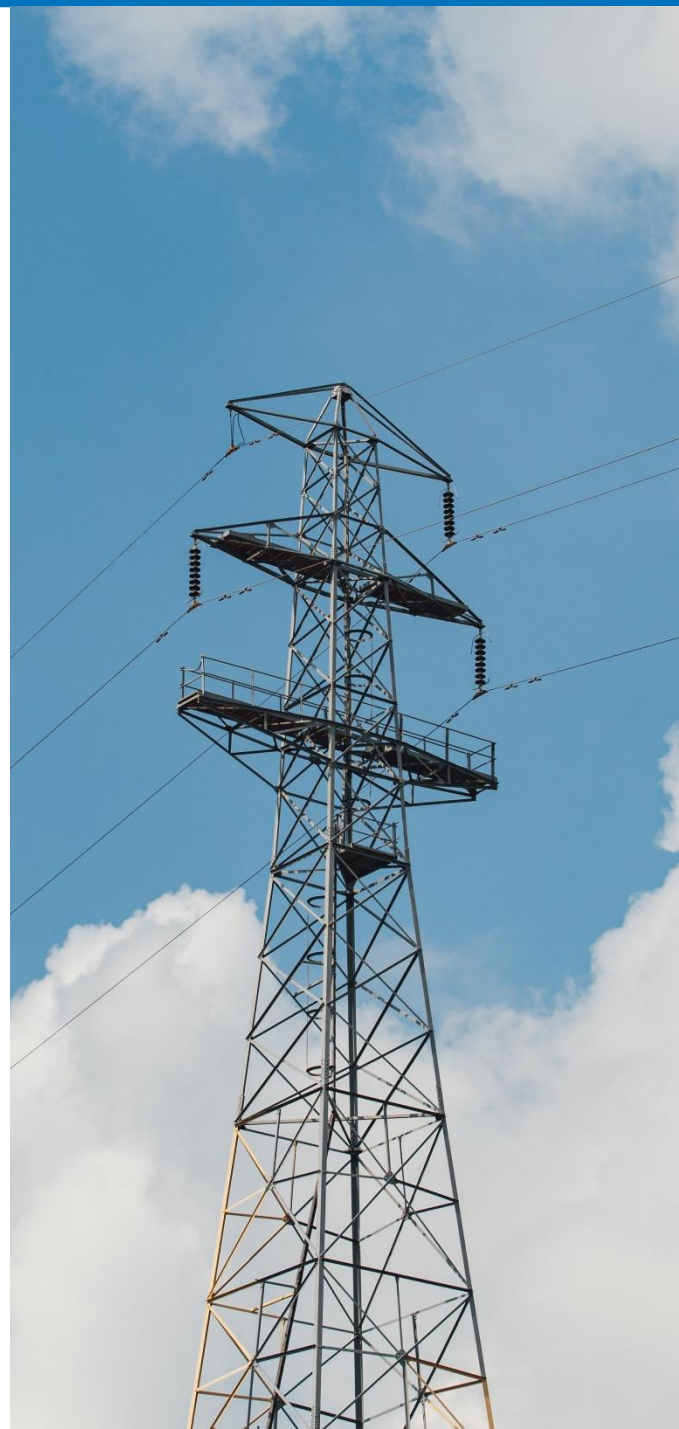
5.5 ENERGY
KEY PLANS AND POLICIES

National

- The UK's National Planning Policy Framework (2019) states that planning should support the transition to a low carbon future.
- UK National Energy and Climate Plan sets out integrated climate and energy objectives, targets, policies and measures for the period 2021-2030.
- Contracts for Difference scheme is the governments principal mechanism for encouraging investment in larger scale renewables.
- The Renewable Heat Incentive and Smart Export Guarantee reward the use of community and domestic scale renewable energy technologies.
- Energy White Paper outlines the latest plans on decarbonising the UK's energy system consistent with the 2050 net zero target.
- The Net Zero Strategy 2021 details key commitments to supply all of the UK's electricity from low carbon sources by 2035 and deliver 40GW of offshore wind by 2030.

Wiltshire

- The Wiltshire Draft Climate Change Strategy details the Council's objectives to reduce existing energy use within the county and decarbonise heating and electricity by moving from fossil fuels to alternatives. Areas of focus include increasing renewable energy generation and promoting green energy tariffs to residents and partners.
- Wiltshire Council is planning to carry out a county-wide assessment of the potential for renewable energy production using a range of technologies.
- Wiltshire Council is looking to set up a bulk buying scheme for solar panels within the county in 2022. The programme, Solar Together, is run by the company iChoosr to enable residents of Wiltshire to get high quality solar panels at a lower cost.



5.5 ENERGY
INTERVENTIONS OVERVIEW

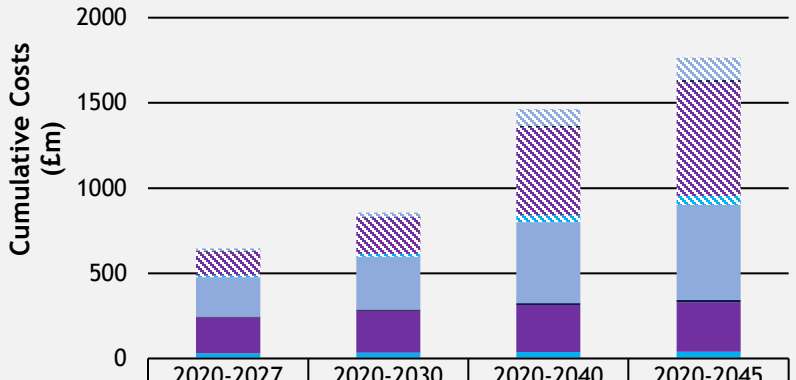
The interventions described so far across the buildings, transport and industry sectors are heavily influenced by the provision of renewable electricity from zero-carbon sources. SCATTER considers a range of renewable technologies, which have been categorised into the following groups for Wiltshire:

5.1 Solar photovoltaics (PV): Both Major Power Producer (large-scale) sites and small-scale sites are considered for Wiltshire. Local capacity is defined as the overall maximum output of other renewable energy installations of any size within the county.

5.2 Other renewable technologies: This covers other renewable technologies, beyond solar, that could be explored within Wiltshire. The other technologies considered within SCATTER include wind, solar thermal, anaerobic digestion, sewage and landfill gas, municipal soil waste generation and plant biomass. Figures for potential wind capacity have been included under **5.2 Other renewable technologies** to allow for flexibility in the ways Wiltshire can meet the overall renewable energy targets modelled by SCATTER, should there be challenges in the installation of wind power.

The modelled capacities are scaled to Wiltshire by the county's projected energy consumption. For all of the supply technologies referenced in this section, if the technology is not deemed feasible within Wiltshire's boundary to the suggested extent, the residual capacity is assumed to occur outside of the boundary or compensated for by other technologies. This is relevant to wind capacity, as well as some of the potentially larger scale installations of solar.

SCATTER does not account for the geographies and local contexts unique to a given local authority, which we acknowledge play a very important role in the viability of a given technology.



	2020-2027	2020-2030	2020-2040	2020-2045
Local PV (Revenue)	16	26	96	130
Large-scale PV (Revenue)	3	4	10	13
Wind (Revenue)	140	213	516	667
Hydro (Revenue)	11	17	41	53
Local PV (Capital)	231	310	476	559
Large-scale PV (Capital)	5	7	11	13
Wind (Capital)	211	247	276	291
Hydro (Capital)	29	33	37	39

Figure 5.5.3: Cumulative Energy costs including both Capital (block) and Revenue (pattern), in £m. Revenue costs are seen as negative where savings are made against a BAU scenario.

Revenue savings from renewable generation are not presented due to variations in potential usage and conditions leading to high error margins but are naturally an important consideration in renewable investments. The council could consider ROI timeframes in line with these estimated costs. For example, ROI on Solar PV is typically 10-15 years. However, ROI is changing rapidly as technology develops, and depends on factors specific to the installation, so caution is advised.

The above cost assumptions are indicative of the interventions described on this page. The assumptions are based on capital investment in new technology and the revenue costs associated with operation and maintenance. The 'other renewables' category relates mostly to Wind. A more detailed explanation of the method can be seen in Appendix 7.

5.5 ENERGY
INTERVENTION MILESTONES

5.1 Solar PV

Solar PV technologies can be split between local installations which could include ground- or roof-mounted arrays, and large-scale sites which are owned by Major Power Producers. According to the Energy Saving Trust, the typical household array capacity is between 2-4 kW. The current average square meter of solar PV panel provides a capacity in the region of 0.15-0.20 kW of energy.

Wiltshire's existing installations mean the county is already ahead of the projected solar PV portion of the 2027 target and is closely approaching its portion of the 2030 target. However, since the current installation of other renewable technologies is limited in the county, there still remains a significant gap to close in the overall amount of renewable energy generation needed by 2027.

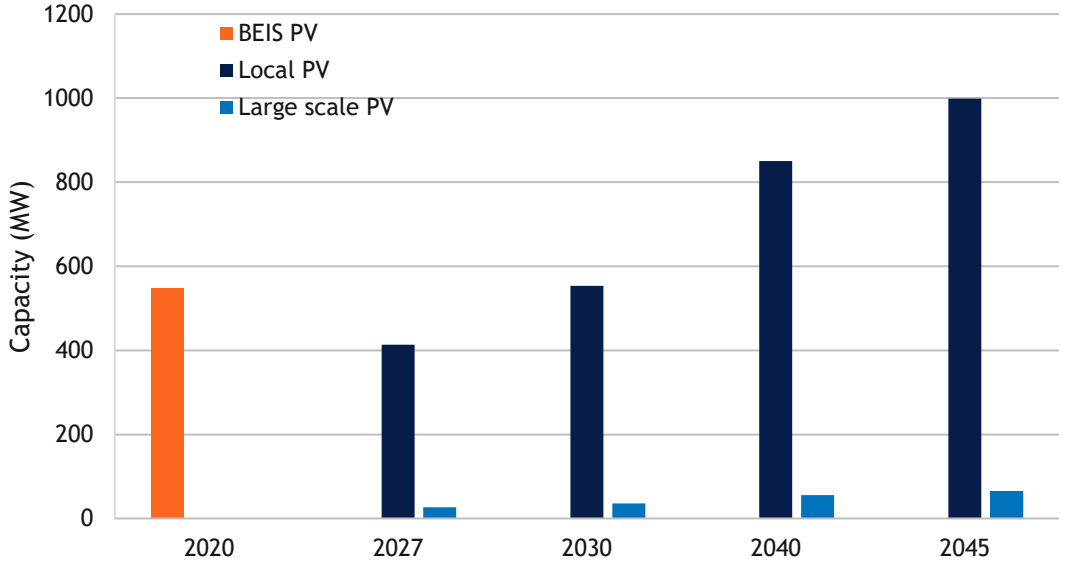


Figure 5.5.4: Comparing the SCATTER targets against the recorded installed capacity (MW) from BEIS renewable energy statistics for energy generated from solar PV in Wiltshire.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Medium

Local government can develop local solar schemes to increase the amount of installed solar PV, as well as encouraging community energy schemes. Public sector buildings and owned land could provide opportunities for solar generation where the council has influencing power. 40% of Wiltshire is designated as an AONB, however, which may limit the amount of available land for installations of solar PV. As large-scale solar PV installations increase, potentially contentious issues regarding land use and environmental landscapes should be considered.

Now	2027	2030	2040	2045
• 9,966 local solar PV sites • 548 MW installed capacity	Installed capacity (local solar PV)			
	414 MW	554 MW	851 MW	999 MW
	Installed capacity (large-scale solar PV)			
	27 MW	36 MW	56 MW	66 MW

5.5 ENERGY
INTERVENTION MILESTONES

5.2 Other renewables (including wind)

SCATTER considers other renewable technologies, including wind, wave, tidal and hydroelectric power. Local authorities with existing installed capacity or significant inland water area are included in the scope of those technologies. The application of wind power can be contested, and its use in Wiltshire is currently subject to a planning review.

The modelling here shows that it provides a significant opportunity to reduce dependency on fossil fuels. With the appropriate selection of location and technologies, the impact of wind installations on the landscape can be minimised. For the High Ambition Pathway, the phasing out of coal and natural gas follow trajectories in the National Grid Two Degrees scenario.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Medium (Wind)

Levers the Council can employ for increasing wind power include engaging with the DNO, communities and wider stakeholders such as the military and AONB to support local involvement in delivery and neighbourhood plans and explore acceptable options. The Council can also employ national advocacy on grid issues, and support community energy delivery that mitigates landscape concerns by providing ownership and benefits to local areas with planning policy, partnership and corporate power purchase agreements and investment. Opportunities for micro-generation may be suitable to the county's landscape due to visual and landscape tensions.

Low (Other Renewables)

The phase out of coal power generation will largely be driven by national policy with limited local influence potential. Biomass is however a strong local renewable asset for energy generation. The council can also work with the National Parks Authorities to explore opportunities for appropriate renewable energy installations.

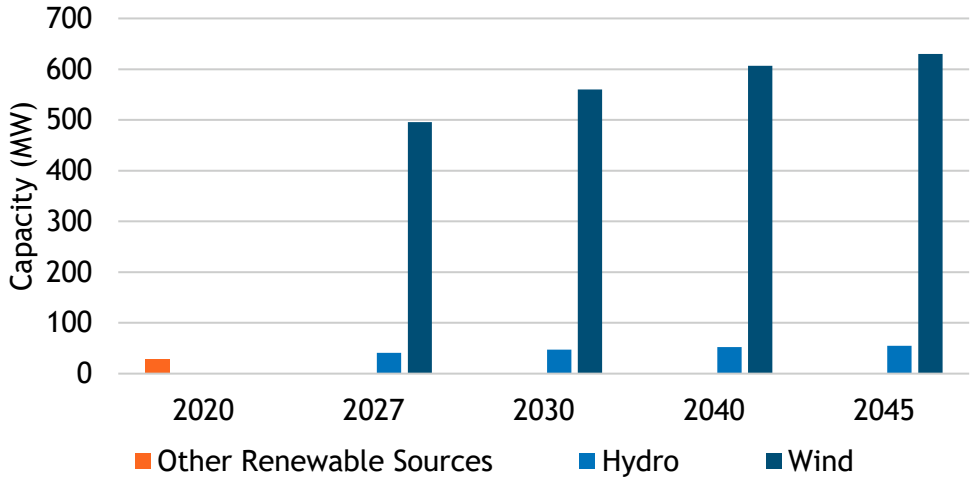


Figure 5.5.5: Comparing the SCATTER targets against the recorded installed capacity (MW) from BEIS renewable energy statistics for energy generated from wind and other renewable technologies in Wiltshire.

Now	2027	2030	2040	2045
• 2 onshore wind installations • 7 hydroelectric sites • Total of 18 anaerobic digestion, landfill and sewage gas sites	Installed capacity (wind)			
	496 MW	560 MW	607 MW	630 MW
	Installed capacity (other renewables)			
	41 MW	47 MW	53 MW	55 MW

Source: BEIS Regional Renewable Statistics

5.5 ENERGY CO-BENEFITS

It is helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of energy supply in Wiltshire will offer co-benefits across multiple spheres:

Economy

- Increasing local renewable energy supply provides resilience against future fossil fuel price increases.

Employment

- Employment is created at different levels, from research and manufacturing to distribution, installation and maintenance. In the UK, low carbon and renewable energy activities generated £46.7 billion turnover in 2018, directly employing 224,800 people (full-time equivalents).

Health & Wellbeing

- Installing low-cost energy within social housing can reduce fuel poverty.
- Renewable energies like solar help to reduce air pollution and long-term health risks of living in industrially polluted areas.

Environment

- Renewable energies like solar help to reduce air pollution created through fossil fuel use and associated long-term health risks of living in industrially polluted areas.

5.6 Natural Environment


Salt Hill Park

5.6 NATURAL ENVIRONMENT
INTRODUCTION

The natural environment has a significant role in acting as a carbon "sink" by storing carbon as part of the carbon cycle, with the oceans, forests and soil being the main carbon stores. Increasing tree cover and healthy soil can increase carbon storage. Management of natural infrastructure can achieve significant co-benefits across Wiltshire, such as net biodiversity gain, improved air quality and improving quality of place.

The net contribution of emissions from the natural environment to Wiltshire's overall emissions total is a net positive value, however, 11% of the county's emissions come from livestock and 3.3% of total emissions are sequestered through land use practices, giving a net emissions total from the natural environment of 7.7%.

KEY LOCAL CONTEXT

- Wiltshire Council has secured approx. £100,000 Forestry Commission funding under the Local Authority Treescape Fund for a Bradford on Avon Town Council tree planting project, which will plant approximately 2,000 trees in community spaces and parks.
- Wiltshire contains two Linking Environment and Farming (LEAF) farms which can provide working examples of lower carbon farming methods.
- Wiltshire Council has partnered with Salisbury River Park to deliver £24 million of flood mitigation and environmental improvements along the River Avon corridor, which will create 13 ha of public open space and 2 ha of new riverside habitat.
- In Wiltshire, there are 87 ha of functional green space, 782 ha of residential gardens, 12 allotments or community growing spaces, and 15 public parks.[1]
- In 2016, there were 2,194 holdings in Wiltshire.[2]
- Community tree planting initiatives, such as "Avon Needs Trees", are active in Wiltshire.

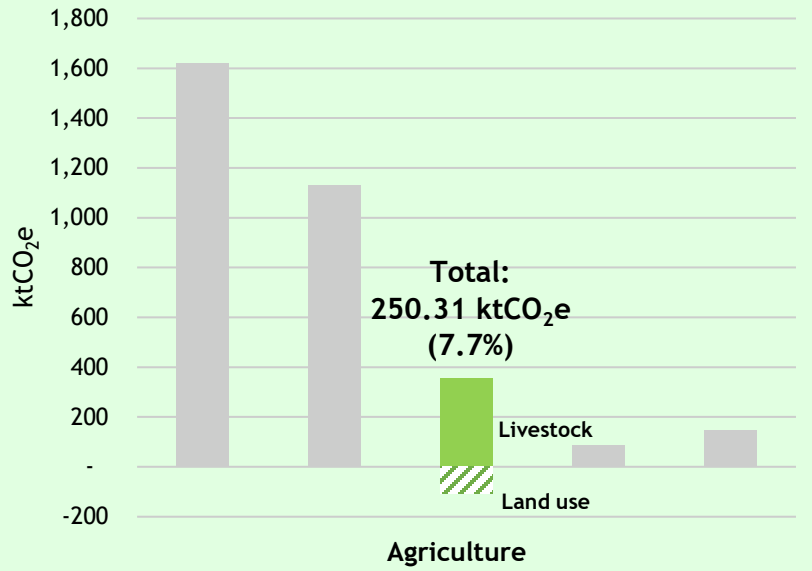


Figure 5.6.1: SCATTER 2018 inventory for the natural environment in Wiltshire.

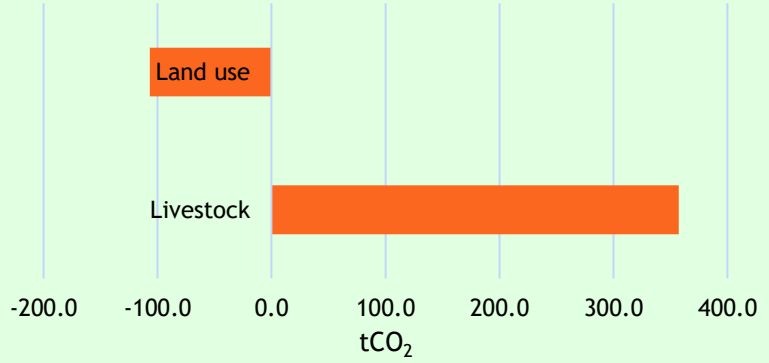


Figure 5.6.2: Scope 1 emissions in Wiltshire's SCATTER 2018 inventory from the natural environment.

[1] Urban Extent of Local Authorities, ONS

[2] Department for Environment, Food and Rural Affairs - Structure of the agricultural industry

5.6 NATURAL ENVIRONMENT
KEY PLANS AND POLICIES

National

- The 25 Year Environment Plan includes commitments to create new forests/woodlands, incentivise tree planting, explore innovative finance; and increase protection of existing trees.
- Land use: Policies for a Net Zero UK (2020) includes converting 22% of agricultural land (mostly from livestock) to forestry.
- Woodland Trust Emergency Tree Plan recommends Local Authorities write an Emergency Tree Plan and set targets for tree planting, something also recommended by the governments The England Trees Action.
- The Path to Sustainable Farming: An Agricultural Transition Plan 2021 to 2024 will replace EU-based systems with a new Environmental Land Management scheme to incentivise sustainable farming practices, create habitats for nature recovery and establish new woodland, and a Farming Investment Fund to support innovation and productivity.
- The Environment Act 2021 includes a legally binding target to half wildlife decline by 2030 and requires Local Nature Recovery Strategies to support a Nature Recovery Network.

Wiltshire

- The Wiltshire Climate Change Strategy details the Council's objectives for natural environment, food and farming include efficiently using land to provide needs for sustainable, low-carbon food production, woodland creation and nature recovery, alongside carbon sequestration by plants and well-managed soils.
- The Green and Blue Infrastructure Strategy for Wiltshire has three main goals of halting the loss of and improving biodiversity, adaptation, mitigation and resilience to climate change, and contributing to health and well-being. The goals will be delivered through six key themes, which include sustainable farming and land management, nature recovery and landscape management, woodland and trees, and valuing natural capital.
- Wiltshire Council have successfully applied for Natural England funding to support the development of a Local Nature Recovery Strategy and evidence mapping of habitats across the county.

5.6 NATURAL ENVIRONMENT INTERVENTIONS OVERVIEW

The use of green spaces and natural environments has a significant role in acting as a carbon "sink" – meaning that it removes carbon emissions from the atmosphere in the form of trees, soil and other natural features. The interventions modelled by SCATTER include:

6.1 Increased tree coverage and tree planting: Considers the increase in the proportion of land which is forest cover. Tree planting considers the changes to the coverage of trees outside of woodland, through new trees being planted and maintenance of existing trees.

6.2 Land management: Considers changes to the green belt and grassland coverage.

6.3 Livestock management: Considers changes in the number of livestock in the area (cattle, pigs, sheep and horses). Changes to farming practices, health and fertility of stock, feed conversion ratios etc. are not considered.

Considering Offsets

Despite aggressive emissions reduction actions across all sectors, some residual emissions still exist, as explored in the 'gap-to-target' discussion on page 22. Offsetting is an approach used to balance the climate impact of an organisation, activity or individual through the purchase of tradeable units representing emissions rights, often through nature-based solutions, and can be applied when seeking to tackle these residual emissions.

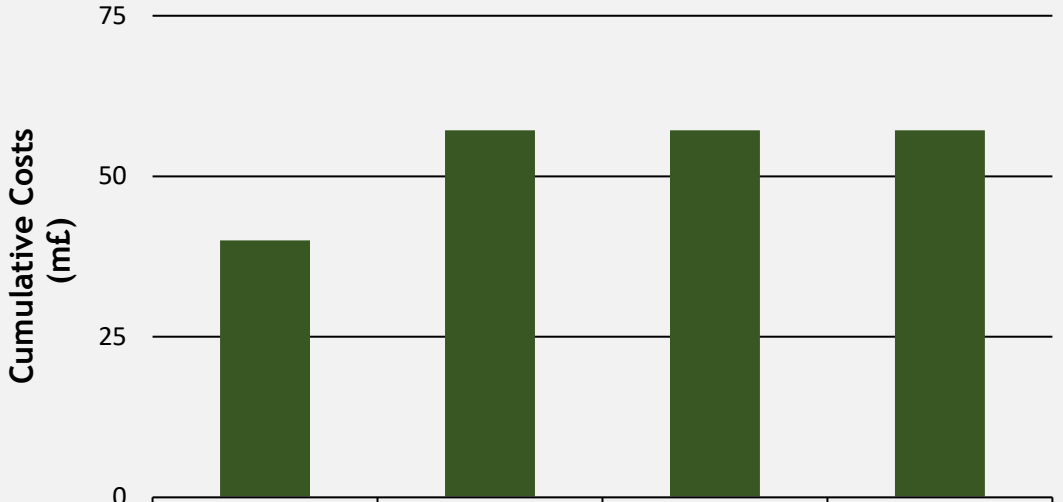


Figure 5.6.3: Cumulative Nature-based capital costs (block), in £m.

The nature-based costs, shown above, relate solely to the first intervention around planting trees. This cost shows the required investment to plant the number of trees to meet the high ambition pathway. This indicator does not include grant support which would drastically reduce the cost of tree planting. More information on this can be seen in appendix 7.

SCATTER Intervention	Cumulative Emissions Savings			
	2020-2027	2020-2030	2020-2040	2020-2045
1. Increased tree coverage	53 $ktCO_2e$	109 $ktCO_2e$	425 $ktCO_2e$	657 $ktCO_2e$
2. Land management				
3. Livestock management	70 $ktCO_2e$	139 $ktCO_2e$	533 $ktCO_2e$	823 $ktCO_2e$

5.6 NATURAL ENVIRONMENT
INTERVENTION MILESTONES

6.1. Increased tree coverage and tree planting

Tree coverage and the associated sequestration potential has been separated out into “forest coverage” and “lone trees”. Forest coverage relates to areas of trees which can be defined as such by a land use map. It is worth noting that the ability of existing forest stocks to sequester carbon is expected to weaken in the future due to the aging profile of trees.

Lone trees instead relate to smaller wooded areas, hedgerows, trees contained within gardens and so on.

The sequestration potential of carbon dioxide per ha of trees is based on academic research, which stipulates that for a tree whose canopy coverage extends to 25m^2, the lifetime uptake of carbon is around 750kgCO_2.

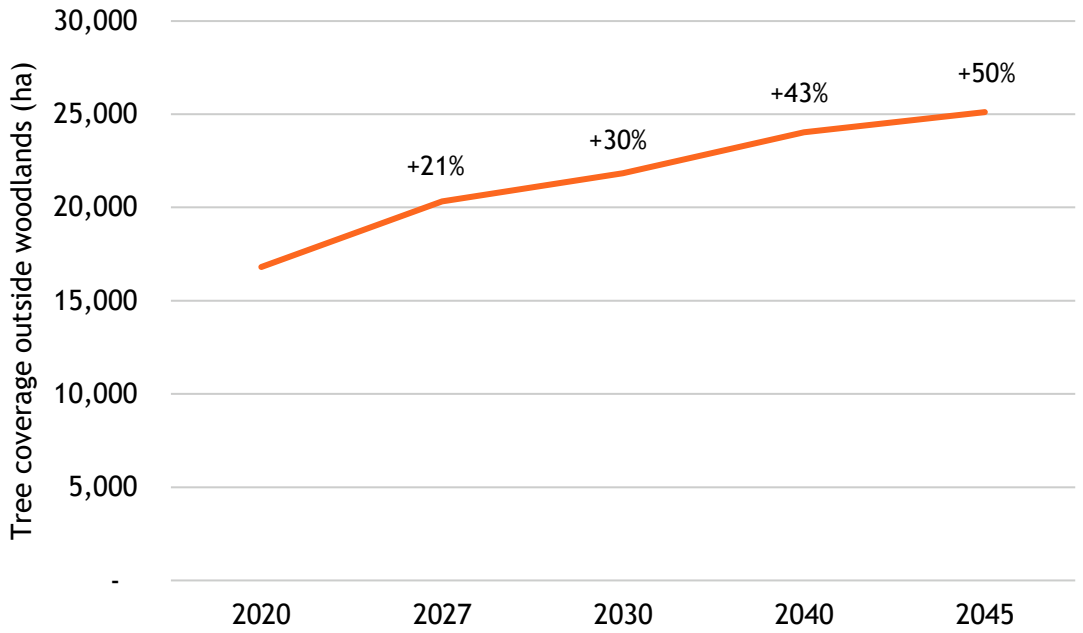


Figure 5.6.4: SCATTER High Ambition Pathway milestones for tree planting outside of woodlands (including lone trees, hedges and small woodlands).

WILTSHIRE COUNCIL’S CURRENT INFLUENCE

Low

Local government has potential to make changes on land owned and managed by the council. Local government can also work with national parks and other key green space organisations to improve woodland and tree cover within the area. Action may be limited, however, by the designation of 40% of the county as an AONB, which also increases pressure for non-designated land for development, further limiting opportunities. The council does have a role in engaging the public, businesses and landowners on the benefits of increasing tree coverage.

Now	2027	2030	2040	2045
• Wiltshire’s tree cover is currently 9%.	Tree coverage and tree planting			
• 16 individual woods being considered under threat[1] • Tree planting outside woodlands is currently reported at around 3,500 hectares across Wiltshire.	+21%	+30%	+43%	+50%

[1] Woodland Trust: Woodland indicators by parliamentary constituency

5.6 NATURAL ENVIRONMENT INTERVENTION MILESTONES

6.2. Land use change

Changes to land use types can achieve higher carbon sequestration. This is modelled within SCATTER as a transition from land use types that do not sequester carbon or act as carbon sources towards land use types that absorb more carbon into natural features. Land use change is modelled as a transition from open grassland to land which can be used to sequester greater levels of carbon through the growing of crops for bioenergy and carbon capture through forestry. The land use trajectories from DECC 2050 emissions calculator have been mapped to Wiltshire.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

The council can influence behaviours in local landowners by working with agriculture industry bodies to share knowledge and best practice, however, influence is limited. Planning can play a role in ensuring the environmental and carbon impacts of land use change are considered. The council can also support other stakeholders in providing information and guidance on methods for land management which can support carbon storage and improve biodiversity.

Other research on land-use

The Committee on Climate Change (CCC) report on land use highlights the fundamental role of land as a natural asset and its provision of our food, clean water and natural regulation of the environment.

The report also recognises that the current approach to land use is not sustainable once the growth of the UK population and the associated per capita food production is considered. These concerns, coupled with the need to respond to climate change, have encouraged a future land strategy for the UK which is mindful of the current contexts around agriculture whilst securing long-term sustainability and meeting climate goals.

CCC analysis balances the need to reduce land-based emissions with other essential functions of maintaining food production and the agricultural industry. Their key actions are based around transitioning to low-carbon farming practices, restoring carbon-sequestering natural habitats such as peatlands and afforestation and agro-forestry.

Specific recommendations call for coordination between landowners and land managers in terms of investment, innovation and farming practices. By adopting different land use strategies, the proportion of carbon sequestered by the the natural environment can grow significantly and enable Wiltshire to meet their carbon reduction goals.

Now	2027	2030	2040	2045
• In 2018, there was approximately 14,662 ha of rough grassland (4.5% of land use) in Wiltshire.[1] • In 2018, 74% of land use in Wiltshire was agricultural.[1]	Grassland (ha)			
	-2% by 2050			
	Cropland (ha)			
	+5% by 2050			

[1] Ministry of Housing, Communities and Local Government - Land Use

5.6 NATURAL ENVIRONMENT
INTERVENTION MILESTONES

6.3. Livestock management

SCATTER models livestock numbers based on scenarios from the DECC 2050 emissions calculator. These scenarios assume different priorities for the future of agriculture, with the High Ambition Pathway forecasting a shift away from livestock. This shift could be underpinned by behavioral changes to diet or a switch to less land-intensive meats such as chicken.

These emissions are plotted in terms of outright livestock numbers, and this does not explicitly consider changes to specific farming practices such as nitrogen usage, or feed conversion ratios. The adoption of sustainable farming practices should also be considered as a potential action under this intervention alongside reducing the overall number of livestock.

The intervention milestones for livestock needed to progress along the High Ambition Pathway for Wiltshire are identified in figure 5.6.5.

WILTSHIRE COUNCIL'S CURRENT INFLUENCE

Low

The council can influence behaviours in local landowners by working with agriculture industry bodies to share knowledge and best practice, however, influence is limited. Planning can be used to support and plan for land use changes or development that enable sustainable farming practices and a shorter food supply chain. The council can work with key agricultural stakeholders such as the National Farmers Union to encourage farmers to use low-carbon practices in livestock rearing. The council can also promote local and sustainable food through its own events and estates to reduce the carbon impact of high carbon livestock in food.

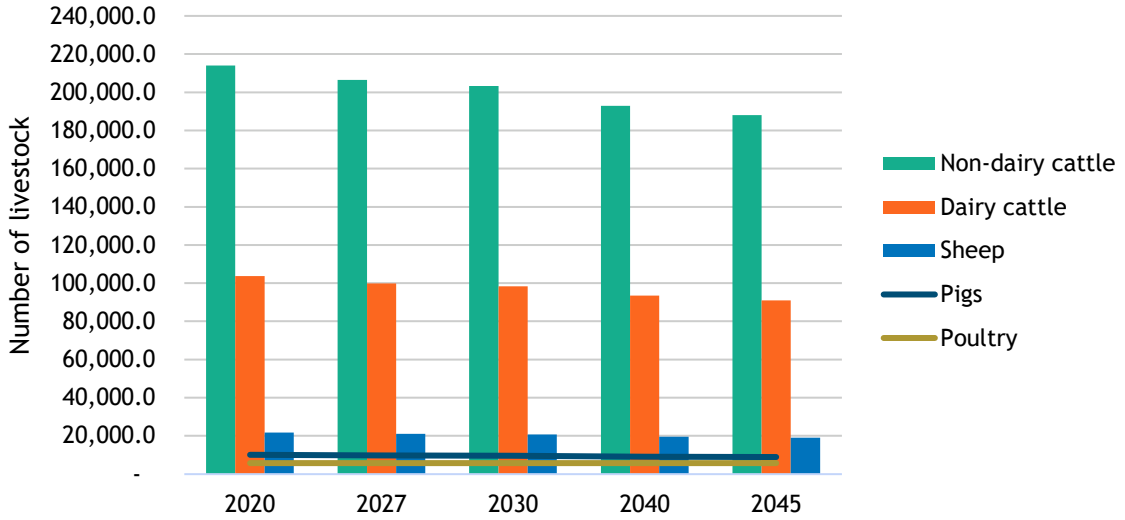


Figure 5.6.5: Reduction in livestock figures following a High Ambition emissions reduction pathway for Wiltshire.

	Dairy cattle	Other cattle	Sheep	Pigs	Poultry
Emissions per head (tCO_2e)	4.63	1.94	0.13	0.41	<0.01

Table 5.6.1: Carbon emissions per head for each livestock type.

Now	2027	2030	2040	2045
	Number of livestock			
• In 2018, 73% of Wiltshire was categorised as agricultural land. [1] • In 2016, 77,727 ha of Wiltshire's land were designated under cereals farming. [2]	-8%	-12%	-30%	-39%

[1] Ministry of Housing, Communities and Local Government - Land Use

[2] Department for Environment, Food and Rural Affairs - Structure of the agricultural industry

5.6 NATURAL ENVIRONMENT
CO-BENEFITS

It is helpful to consider the added co-benefits of given measures when planning climate action. Taking climate action around the natural environment in Wiltshire will offer co-benefits across multiple spheres:

Economy

- If everyone had access to sufficient green space, the benefits associated with increased physical activity could save the health system £2.1bn per year.

Employment

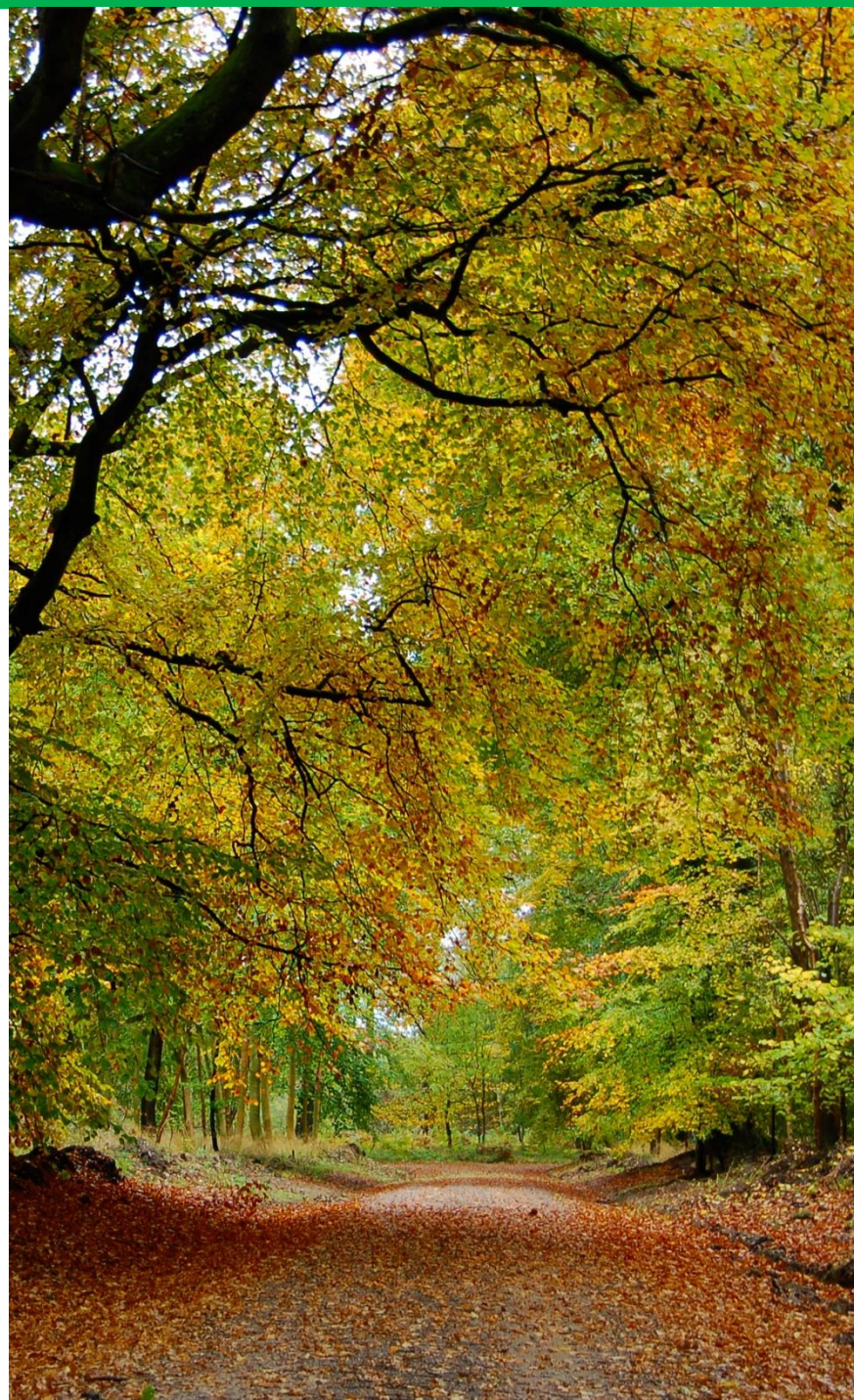
- Industrial areas and employment sites with access to natural greenspace can have more productive employees and these employees tend to have greater job satisfaction. Retail areas with trees perform better than shopping centres without them, as customers are found to spend both more time and money.

Health & Wellbeing

- Those living closer to green spaces in urban areas have been found to experience lower stress, anxiety and depression.
- Children living in areas with good access to green spaces have lower prevalence of obesity (11-19%) compared to children with limited access to green spaces.
- Green infrastructure can improve air quality by reducing nitrous oxide pollution (by up to 23%).

Environment

- Trees and vegetation can reduce surface run-off and thus flood risk. They can also help to reduce temperature and the urban heat island effect.
- Trees and green spaces can create habitats, support species and increase biodiversity.



06 Conclusions

6. CONCLUSIONS
SUMMARY OF COSTS

The total estimated capital expenditure required by 2045 to achieve the interventions outlined SCATTER's High Ambition pathway in Wiltshire is in excess of **£5.3bn**. Revenue costings analysis indicates that over **£4.5bn** worth of potential savings may also be realised by 2045, most significantly in the transport sector. The Council will only bear a small amount of the significant investment required. Whilst a key actor in terms of leading progress and shaping the county's emissions reductions, bearing the cost of the transition to carbon neutrality is the responsibility of the entire county.

The cost of inaction

The changing climate will lead to more extreme weather events, ultimately causing monetary damages to assets, livelihoods and lives. Similarly, not taking climate action can lead to social impacts such as poorer health from polluted air, lower rates of active travel, and colder homes. Therefore, it is valuable to consider the "cost of inaction" in reviewing the cost of carbon mitigation. The Social Cost of Carbon (SCC) was a method used by the UK government to measure the social impacts of climate change by calculating the cost for each tonne of CO_2 added into the atmosphere. These estimates can be used, in line with the BAU pathway, to estimate what the "cost of inaction" might be in Wiltshire. The cost of inaction ranges from **£154m** to **£403m** in 2030 and, from 2018 to 2045, the cost would range from **£3.4bn** to **£8.5bn**.

The cost of offsetting

Using a range of anticipated market prices of carbon credits, it is possible to estimate the cost of offsetting Wiltshire's residual emissions. From 2030, purchased offsets are estimated to cost around **£47-131m** per year for the residual emissions after achieving the high ambition pathway. Cumulatively, it could cost up to **£1.7bn** to offset all residual emissions between the period of 2030 and 2040. The cost of offsets, along with the fact that they do not offer a financial return on investment, underscores the need to prioritise rapid emissions reduction and avoidance activities in Wiltshire.

Cumulative Costs to 2045		
Capital (m£)	Revenue (m£)	Description of cost
1,919.80	-4,411.70	New on-road vehicles and rail transport
1443.7	NE	Retrofitting existing households with wall insulation
901.8	863.2	Installation & maintenance of local renewable energy sources
297.8	-	New transport infrastructure for on-road vehicles and rail
271.4	NE	Retrofitting household heating systems with electrified systems over gas boilers
183.9	-5.6	Retrofitting non-domestic buildings with energy efficiency measures
168.7	NE	Constructing new-build homes to PassivHaus standard, rather than Part L
46.3	1.1	Planting & maintenance of additional new woodland
40	3.4	Retrofitting non-domestic heating systems with electrified systems over gas boilers; revenue represents maintenance but not fuel costs
36.3	NE	Scaled portion of UK-wide action for decarbonising industry
-	-793.9	Demand reduction and efficiency gains in the transport sector
-	-213.3	Savings in gate fees as a result of increased recycling and reduced overall volume of waste
NE	17.8	Additional fuel bills as a result of switching to electrified cooking systems in domestic households
5,309.7	**-4,539**	**Total estimated cumulative costs by 2045.**

Table 6.1: Summary of cost estimates. Negative vales indicate savings. *NE* denotes costs that have not been estimated as result of time, resource, and high error margins, where site-specific calculations could be more appropriate. It should be noted that savings from household bills would significantly influence revenue costs, given the current price rises in gas and electric. Costs associated with new woodland area align with action needed to achieve the High Ambition pathway, rather than any additional offsetting or insetting initiatives to target residual emissions. Dashes indicate no *additional* cost has been estimated. See Appendix 7 for details on the methodology.

6. CONCLUSIONS
RECOMMENDATIONS

Using this report

This report sets out a roadmap to carbon neutrality for the county of Wiltshire. Using the SCATTER tool, we have modelled the potential actions that could be achieved in the area under a Highly Ambitious climate strategy, along with the associated emissions savings. SCATTER models measures that are currently available, rather than innovations that are yet to be developed. The pathway modelled is intended to be aspirational, rather than a "target" in of itself. As such, it does not account for potential shortcomings in supporting policy, finance, or skills which could challenge implementation. It is intended to provide Wilshire council with an indication of what would need to happen to achieve carbon neutrality, and a view of the relative impacts of differing carbon mitigation opportunities as they apply in Wiltshire. These insights are supplemented by commentary around the ability of the council to implement action, costs, and co-benefits.

The High Ambition Pathway

The scale and speed of the interventions outlined in this report (see across) are significant. The cumulative investment required to achieve the high ambition pathway would be in excess of £5.3 billion between now and 2045, although a substantial portion of this could be offset by significant savings in operational expenditure across the county. While achieving the SCATTER High Ambition Pathway would result in a 77% reduction in emissions by 2045, the county would still not reach carbon neutrality by this time.

Additional shifts in behaviour and technology may be needed to achieve carbon neutrality. Carbon offsets could also be explored as a way of tackling these "residual" emissions. However, action to avoid and reduce emissions should be prioritised as they typically yield better value for money and more direct benefits in the community. In other words, having committed to carbon neutrality, there is also a "cost of inaction" which should be considered in seeking to deliver the best value for money in climate action in the county.

Referring to the SCATTER Interventions

The SCATTER Interventions modelled are summarised below. Potential emissions savings associated with different action areas vary, as do their costs and co-benefits. Prioritisation is explored on page 81, and the information provided in this report provides a basis upon which this could be carried out. Although not necessarily exclusive, these interventions give an important starting point for the council and other stakeholders as they seek to build on the Climate Strategy 2022-2027 and create an Action Plan for a Carbon Neutral Wiltshire. The council's ability to influence is frequently considered "Low". Therefore, in any action planning, "Crosscutting" actions focussed on making the county more conducive to climate action, rather than targeting any specific intervention, are important.

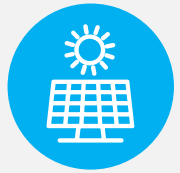
Buildings
1.1 Improving energy efficiency
1.2 Reducing gas heating systems
1.3 Low carbon and energy efficient cooking, lighting and appliances

Industry
4.1 Shifting away from fossil fuels
4.2 More efficient processes

Transport
2.1 Travelling shorter distances
2.2 Driving less
2.3 Switching to electric vehicles
2.4 Improving freight emissions

Natural Environment
5.1 Increased tree coverage & tree planting
5.2 Land use management
5.3 Livestock management

Waste
3.1 Reducing the quantity of waste
3.2 Increasing the recycling rate



Energy Supply
6.1 Increase solar photovoltaic (PV) capacity
6.2 Increase the capacity of other renewable technologies

6. CONCLUSIONS
RECOMMENDATIONS

Suggested next steps

This report is intended to act as a starting point from which Wiltshire Council can drive climate action with stakeholders across the county. We recommend the council:

1. **Confirm Wiltshire's target:** The council should reflect on the outcomes of this report, and engage with other stakeholders, to confirm and publicise its ambition for a carbon neutral county. This will build on the commitments laid out in the Wiltshire Climate Strategy 2022-2027, which outlines the vision for climate action in Wiltshire. The council may also implement a stretch goal of Net Zero - this would carry implications for the role of offsets.
2. **Draft an "Action Plan":** Engage with stakeholders across Wiltshire to produce a detailed "action" or "delivery" plan detailing specific steps to be taken to achieve carbon neutrality. This report provides a starting point, giving the evidence base and justification for these measures and illustrating the areas in which impact can be achieved most quicky and reliably.

   Overleaf, we give recommendations on how the council could prioritise action, focussing on carbon impact and the council's ability to influence stakeholders across the county.
3. **Maximise the council's ability to influence:** This analysis has highlighted that the council's ability to influence action in many intervention areas is low. The council should consider further "crosscutting" actions to increase its influence and ability to enable action in the county. For example, the council could:
   - **Lobby central government** for more powers and financial support, such as increased planning powers to drive higher new build standards, or financial support to enable the setup of grants or other initiatives which could be used to drive action by residents or businesses.
   - **Use its convening powers** to work together with other stakeholders. For example, by running workshops and other direct engagement with the community. A charter, or similar commitment, would also encourage collaboration and develop a sense of joint aspiration.
   - **Collaborate with local colleges and educational centres** to ensure sufficient, relevant skills capacity exists within the local workforce

The council may choose to explore these opportunities within its action plan as a separate set of opportunities not aligned directly to any single intervention outlined in this report. There may also be elements of the plan which overlap with any emerging action plan for a carbon neutral Wiltshire Council, particularly if the council chooses to tackle its Scope 3 emissions in the future.

4. **Monitor and report on your progress**: This is vital in ensuring action taken against your plan is coordinated and sustained. This should include assigning and tracking responsibility against your action plan, to ensure the actions are having the desired effect. It is also important for continued external buy-in and public mandate that the council reports its progress publicly and transparently. CDP Cities offers extensive guidance on disclosure of environmental information by local authorities.
5. **Consider a variety of funding streams** to support financing local carbon reduction initiatives including community investment schemes and government grants.

6. CONCLUSIONS
PRIORITISING ACTION

Prioritising Next Steps

In order to achieve carbon neutrality, it is vital that stakeholders in Wiltshire pursue all the opportunities presented in this report. However, given the number of interventions presented, and possible limitations in resource, stakeholders may seek to prioritise certain areas for immediate action. Here, we present recommendations on how to consider priority areas for action. This is based on Anthesis' judgement and is intended to support Wiltshire in more efficiently formulating an action plan, rather than eliminating any opportunities for action. We recommend that two key factors are considered during any prioritisation exercise to ascertain next steps by stakeholders:

1) Carbon Impact

As presented throughout the report, SCATTER provides an indication of the carbon savings to be made on an annual basis associated with different action areas. Based on an analysis of the potential savings, intervention areas offering the highest potential emissions savings are:

- **Buildings**: Improving building energy efficiency to reduce demand for heating and hot water in domestic and non-domestic buildings
- **Transportation**: Reducing the impacts of on-road transportation, through a mix of new technologies, infrastructure, and behaviour change
- **Energy Supply**: Maximising renewable energy supply in Wiltshire. This is also important to underpin the switch away from fossil fuels in other action areas.

Appendix 1 provides a full breakdown of the cumulative carbon savings associated with each intervention area, in line with the High Ambition pathway.

2) Ability to influence

The council alone is not responsible for delivering carbon neutrality. Nevertheless, any action plan for carbon neutrality in the county is expected to highlight the council's leadership role in facilitating change across the county, and in influencing others. Therefore, the ability of the council to drive action should be a factor when choosing what to prioritise. Similarly, there may be contexts within wider Wiltshire which help or hinder the ability of stakeholders to achieve action, including those outside the council.

Narrative around the "Level of Influence" is provided in chapter 5 in line with each intervention and highlights key factors for consideration by the council.

Other factors

Cost- Naturally, decision makers may seek to factor costs into their decision making- caution is advised here. The costs presented in this report are intended to act as a guide and offer value in demonstrating the potential payback and operational savings of action. The analysis doesn't allow full consideration of the nuances of **who pays** (i.e. the split between the council, and other stakeholders), and equally, where savings will be made. Additionally, the council, in its position as a leader in influencing others, has a role to play in advancing all climate action in the county. This may include backing options that are less appealing in terms of cost, with the intention of stimulating the market so that others can follow suit.

Co-benefits- In this report we indicate the co-benefits of action in each sector. By considering these benefits in line with strategies focused on other themes, the council may also be able to identify areas of strategic overlap, further boosting the case for action. For example, actions around building retrofit would likely align with any efforts to tackle fuel poverty in the county.

07 Glossary

GLOSSARY OF TERMS

AFOLU: Agriculture, forestry & land use.

BEIS: UK Government Department for Business, Energy and Industrial Strategy, the successor to the Department for Energy & Climate Change (DECC).

Carbon budget: a carbon budget is a fixed limit of cumulative emissions that are allowed over a given time in order to keep global temperatures within a certain threshold.

Carbon dioxide equivalent (CO_2e): the standard unit of measurement for greenhouse gases. One tonne of CO_2 is roughly equivalent to six months of commuting daily by car or burning 1-2 bathtubs' worth of crude oil. "Equivalent" means that other greenhouse gases have been included in the calculations.

Carbon Neutral/ Net Zero: these two terms typically mean the same thing in the context of CO_2-only emissions. Whilst emissions are reduced overall, those that remain (e.g. from industrial and agricultural sectors) are then *offset* through carbon dioxide removal from the atmosphere. This removal may occur through technology such as carbon capture and storage (CCS) technologies, or through natural sequestration by rewilding or afforestation.

Carbon offset: defined by the IPCC as a reduction in emissions of carbon dioxide or other GHGs made in order to compensate emissions made elsewhere.

Carbon sink: a process or natural feature that removes carbon from the local atmosphere (e.g. trees or wetlands). The carbon is said to be *sequestered* from the atmosphere.

Climate Emergency: a situation in which urgent action is required to reduce or halt climate change and avoid potentially irreversible environmental damage resulting from it.

Decarbonisation: the process of changing our activities and industry practices to create an economy that sustainably reduces emissions of carbon dioxide.

Deep/Medium Retrofit: the aim of retrofit is to drive down the energy demand for heating and hot water in buildings; typical measures include things like insulation for floors, windows and ceilings and improved ventilation. Medium retrofit represents a 66% reduction in energy demand and a deep retrofit represents an 83% reduction.

Energy system: the consumption of fuel, heat and electricity across buildings, transport and industrial sectors, from solid, liquid and gaseous sources.

Gross emissions: the emissions total before accounting for local carbon sinks.

IPCC: Intergovernmental Panel for Climate Change.

Indirect emissions: GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat and/or cooling within the city boundary.

Insetting/Offsetting: the action of compensating for carbon emissions by utilising an equivalent or unrelated carbon dioxide saving elsewhere. Insetting refers to more local activity within a 'sphere of influence'.

LULUCF: Land use, land use change & forestry.

SCATTER: Anthesis-developed tool which is used to set emissions baselines and reductions targets. See the SCATTER website for more information.

08 Appendices

APPENDICES CONTENTS

APPENDIX 1: SCATTER FAQS

What do the different emissions categories mean within SCATTER?

Direct = GHG emissions from sources located within the local authority boundary (also referred to as Scope 1). For example petrol, diesel or natural gas.

Indirect = GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the local authority boundary (also referred to as Scope 2).

Other = All other GHG emissions that occur outside the local authority boundary as a result of activities taking place within the boundary (also referred to as Scope 3). This category is not complete and only shows sub-categories required for CDP / Global Covenant of Mayors reporting.

What do the different sectors and subsectors represent within the SCATTER Inventory?

- **The Direct Emissions Summary and Subsector categories** are aligned to the the World Resource Institute's Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC"), as accepted by CDP and the Global Covenant of Mayors.
- **The BEIS Local Emissions Summary** represents Local Authority level data published annually by the Department for Business Energy & Industrial Strategy (BEIS).
- **Stationary energy** includes emissions associated with industrial buildings and facilities (e.g. gas & electricity).
- **IPPU** specifically relates to emissions that arise from production of products within the following industries: iron and steel, non-ferrous metals, mineral products, chemicals. These are derived from DUKES data (1.1-1.3 & 5.1).
- **Waterborne Navigation** relates to trips that occur within the region. The figures are derived based on national data (Department for Transport) and scaled to Wiltshire.
- The full methodology is available at http://SCATTERcities.com/pages/methodology

How does SCATTER treat future energy demand?

Future demand is hard to predict accurately. The National Grid's Future Energy Scenarios (FES) indicates that under all scenarios that meet the UK's net zero by 2050 target (including "Leading the Way", which illustrates the fastest credible rate of decarbonisation) electricity demand still increases. On the other hand, SCATTER's High Ambition Pathway assumes that electricity demand reduces due to improvements to efficiency of operation.[1] Factors such as increased electrification of heating technologies and transport are naturally big drivers for the increase, but incentives and opportunities for demand reduction and energy efficiency measures are still significant and could slow or tip trends in the other direction.

1 - It should be noted that this optimism for demand reduction is consistent with the legacy 2050 Pathways tool.

APPENDIX 2: WILTSHIRE SCATTER INVENTORY DATA

Notes:

- SCATTER calculates a territorial emissions profile and therefore excludes emissions from goods and services generated outside the district (also referred to as consumption emissions).
- Within the SCATTER model, national figures for emissions within certain sectors are scaled down to a local authority level based upon a series of assumptions and factors.
- The inventory data presented here relates to the 2018 reporting year as emissions are reported two years in arrears

*Emissions from Incineration and open burning are currently zero. At the time of writing this report, a planning request for a Northacre Renewable Energy plant, a new energy from waste plant in Wiltshire, was pending. The analysis provided in this report is based on the latest available activity data, and therefore includes no provision for the plant. Should the project proceed, some, but not necessarily all, emissions associated with waste management at the plant would be allocated to the Incineration and open burning category in Wiltshire's emissions inventory. Wiltshire would be responsible for all the emissions associated with waste generated in the county, but not any arising from waste generated outside of the county boundary.

IE	Included Elsewhere
NE	Not Estimated
NO	Not Occurring
	Included as part of profile
	Excluded as part of profile

Sub Sector	DIRECT Scope 1 $ktCO_2e$	INDIRECT Scope 2 $ktCO_2e$	TOTAL $ktCO_2e$
Residential buildings	475.88	271.77	**747.66**
Commercial buildings & facilities	65.38	140.91	**206.30**
Institutional buildings & facilities	50.31	30.59	**80.91**
Industrial buildings & facilities	262.28	172.01	**434.29**
Agricultural fuel use	80.81	0.02	**80.83**
Fugitive emissions	70.384	0.00	**70.38**
On-road	1,073.86	IE	**1,073.86**
Rail	40.98	IE	**40.98**
Waterborne navigation	3.99	IE	**3.99**
Aviation	NO	IE	**0.00**
Off-road	10.74	IE	**10.74**
Solid waste disposal	56.99	0.00	**56.99**
Biological treatment	NO	0.00	**0.00**
Incineration and open burning*	NO	0.00	**0.00**
Wastewater	29.32	0.00	**29.32**
Industrial process	147.72	0.00	**147.72**
Industrial product use	0.00	0.00	**0.00**
Livestock	357.14	0.00	**357.14**
Land use	-106.83	0.00	**-106.83**
Other AFOLU	NE	0.00	**0.00**
Electricity-only generation	3.53	0.00	**3.53**
CHP generation	0.00	0.00	**0.00**
Heat/cold generation	NO	0.00	**0.00**
Local renewable generation	0.05	NO	**0.05**
TOTAL:	**2,662.54**	**615.32**	**3,237.86**

APPENDIX 3: DERIVING THE CARBON BUDGET

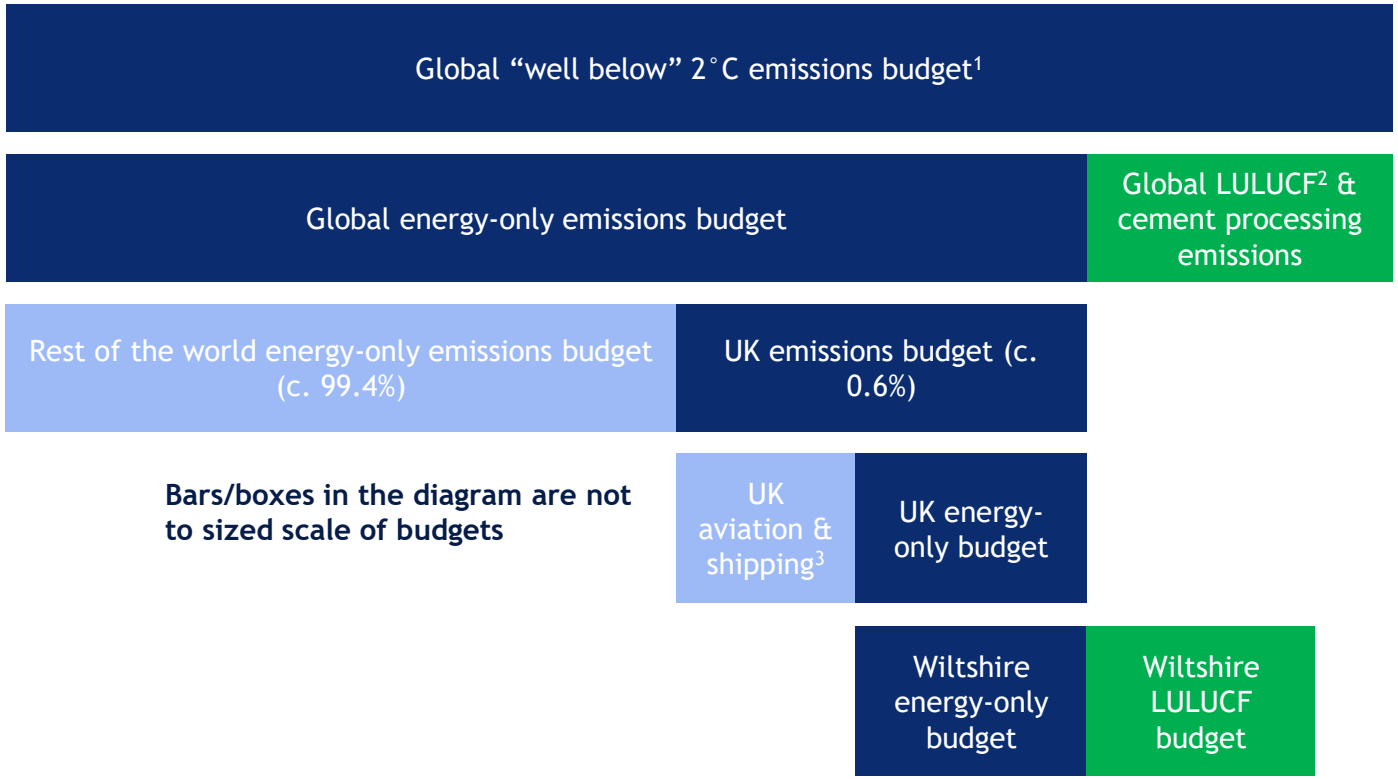
Wiltshire's carbon budget

The carbon budget sets out a finite emissions limit that Wiltshire should not exceeded in order to remain in line with the Paris Agreement. The budget itself is derived from a 'scaling-down' approach – a full methodology is available to view for Wiltshire in the full print version of the Tyndall Centre's research.
The Tyndall Centre for Climate Change Research have based this budget on a 2˚C global average temperature rise, on the basis that:

1. The Paris Agreement commits us to limiting warming to this level.
2. Global modelling for both 1.5˚C and 2˚C assume planetary scale negative emissions.

Negative Emissions Technologies (NETs)

NETs remain a highly speculative and uncertain development and are leaned upon heavily in IPCC models. If research, development and demonstration of NETs shows that they may work at scale, and then they are rolled out globally at unprecedented rates, 1.5˚C may theoretically be achievable. However this is only made possible if rapid, deep 2˚C mitigation begins now and additional feedbacks do not occur.



1 - Budget derived from IPCC AR5 synthesis report and represents a 66-100% probability of global warming not exceeding 2˚C ("well below"). Due to the inertia in our energy systems and the amount of carbon we have already emitted, the Paris 1.5˚C commitment is now only likely to be viable if negative emissions technologies (NETs) prove to be successful at a global scale. If the 12.7% emissions reduction rate for Wiltshire is achieved and NETs are deployed at the scales assumed in the global models, then the targets adopted may be considered as 1.5˚C compatible. This also expressly assumes that other carbon cycle feedbacks, such as methane released due to melting permafrost etc., do not occur, and that an overshoot of 1.5˚C does not result in increased feedbacks that further accelerate warming at lower budgets than the IPCC budgets currently estimate.
2 - Land Use, Land Use Change & Forestry
3 - UK Aviation & Shipping is accounted for at the national level. If emissions due to aviation and shipping increases, then a smaller proportion of the UK-wide budget is available for the energy-only budget and vice versa.

APPENDIX 4: CARBON SAVINGS METHODOLOGY

Estimating emissions savings

Using the SCATTER "High Ambition" and "Business as Usual" scenarios, we can estimate emissions savings, broken down into different categories. This is done by comparing the projected emissions along each pathway from different subsectors (e.g. domestic lighting or commercial heating) for each year, and defining the difference between them.

A visual representation of this method is given opposite in Figure 11.1.

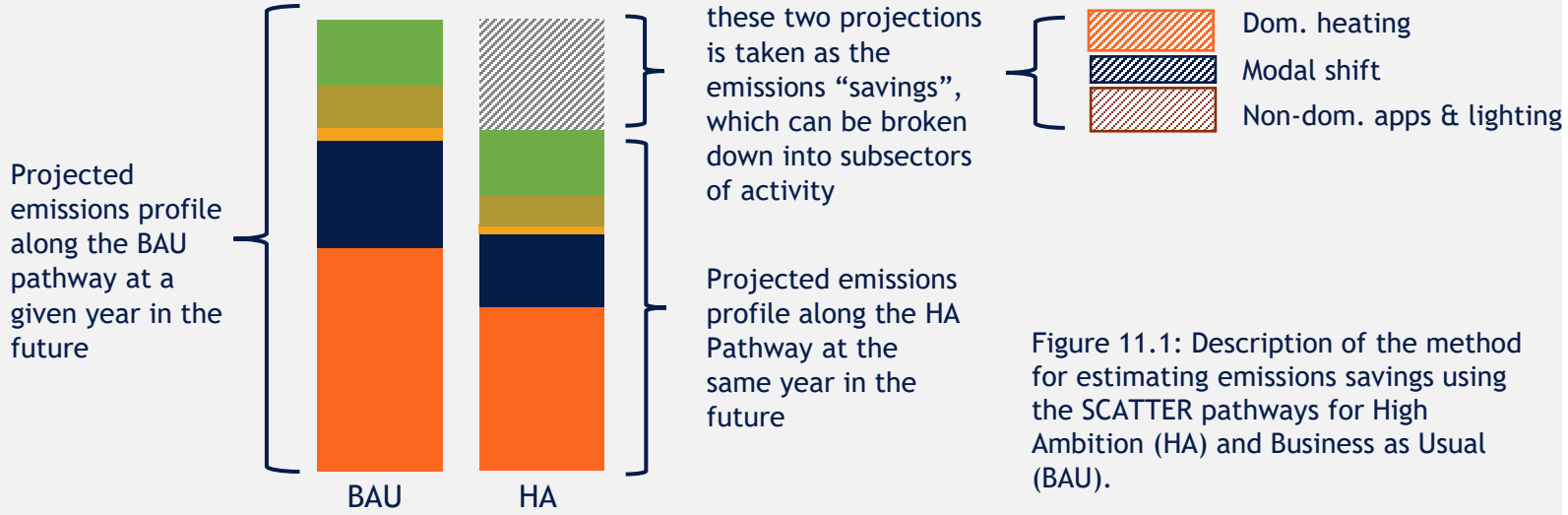


Figure 11.1: Description of the method for estimating emissions savings using the SCATTER pathways for High Ambition (HA) and Business as Usual (BAU).

Which areas of activity have been estimated?

The categories of emissions savings are broken down slightly differently to the SCATTER interventions, meaning that the savings are grouped slightly differently. This is because of the interdependency of the SCATTER interventions, where more than one intervention contributes to the same savings subcategory.
Since one action can contribute to more than one SCATTER intervention target, the savings from multiple separate interventions may be combined into one subcategory. This is illustrated below:

Interdependent SCATTER interventions	Common savings subcategory	Example activity that meets both interventions
1. Domestic heating technologies 2. Hot water demand	Domestic space heating & hot water	Installation of an efficient household heat pump

Energy supply

In order to isolate the impact of supply-side measures, a pathway of business-as-usual installation of renewables was created within SCATTER, with all demand-side measures kept at high ambition levels. The emissions were then compared along this hybrid pathway to the High Ambition Pathway, with the difference taken as savings directly from energy supply measures.

APPENDIX 5: CARBON SAVINGS SUMMARY

The estimated cumulative carbon savings related to the interventions within this chapter are listed below for the periods 2021-2027, 2021-2030, 2020-2040 and 2021-2045. Emissions savings are calculated relative to the BAU scenario within SCATTER.

Sector		SCATTER Intervention	Subsector matching the SCATTER Intervention	Cumulative Carbon Savings			
				2021-2027	2021-2030	2021-2040	2021-2045
Buildings	Domestic	1.1 Improving building efficiency	Domestic space heating and hot water	**736 $ktCO_2e$**	**1,493 $ktCO_2e$**	**5,611 $ktCO_2e$**	**8,291 $ktCO_2e$**
		1.2 Shifting off gas heaters	Domestic lighting, appliances, and cooking	**225 $ktCO_2e$**	**420 $ktCO_2e$**	**1,015 $ktCO_2e$**	**1,299 $ktCO_2e$**
		1.3 Improving lighting and appliance efficiency					
	Non-Domestic	1.1 Improving building efficiency	Industrial buildings and facilities	**425 $ktCO_2e$**	**819 $ktCO_2e$**	**2,473 $ktCO_2e$**	**3,512 $ktCO_2e$**
			Non-domestic space heating, cooling, and hot water	**154 $ktCO_2e$**	**314 $ktCO_2e$**	**1,048 $ktCO_2e$**	**1,533 $ktCO_2e$**
		1.2 Shifting off gas heaters	Non-domestic lighting, appliances, equipment, and catering	**150 $ktCO_2e$**	**281 $ktCO_2e$**	**723 $ktCO_2e$**	**958 $ktCO_2e$**
		1.3 Improving lighting and appliance efficiency					

APPENDIX 5: CARBON SAVINGS SUMMARY

The estimated cumulative carbon savings related to the interventions within this chapter are listed below for the periods 2021-2027, 2021-2030, 2020-2040 and 2021-2045. Emissions savings are calculated relative to the BAU scenario within SCATTER.

Sector	SCATTER Intervention	Subsector matching the SCATTER Intervention	Cumulative Carbon Savings			
			2021-2027	2021-2030	2021-2040	2021-2045
Transport	2.1 Travelling shorter distances	On-road transportation	**2,037 $ktCO_2e$**	**3,356 $ktCO_2e$**	**7,584 $ktCO_2e$**	**9,473 $ktCO_2e$**
	2.2 Driving less					
	2.3 Switching to electric vehicles					
	2.4 Improving freight emissions					
Waste	3.1 Reducing the quantity of waste	Solid waste disposal	**13 $ktCO_2e$**	**33 $ktCO_2e$**	**179 $ktCO_2e$**	**309 $ktCO_2e$**
	3.2 Increased recycling rates					
Industry	4.1 Shifting from fossil fuels	Industrial processes	**88 $ktCO_2e$**	**157 $ktCO_2e$**	**448 $ktCO_2e$**	**574 $ktCO_2e$**
	4.2 More efficient processes					

APPENDIX 5: CARBON SAVINGS SUMMARY

The estimated cumulative carbon savings related to the interventions within this chapter are listed below for the periods 2021-2027, 2021-2030, 2020-2040 and 2021-2045. Emissions savings are calculated relative to the BAU scenario within SCATTER.

Sector	SCATTER Intervention	Subsector matching the SCATTER Intervention	Cumulative Carbon Savings			
			2021-2027	2021-2030	2021-2040	2021-2045
Energy Supply	5.1 Solar photovoltaics (PV)	Renewable energy generation	**1,778 $ktCO_2e$**	**3,485 $ktCO_2e$**	**11,318 $ktCO_2e$**	**16,167 $ktCO_2e$**
	5.2 Other renewable technologies					
Natural Environment	6.1 Increase tree coverage and tree planting	Land use	**53 $ktCO_2e$**	**109 $ktCO_2e$**	**425 $ktCO_2e$**	**657 $ktCO_2e$**
	6.2 Land use management					
	6.3 Livestock management	Agriculture	**70 $ktCO_2e$**	**139 $ktCO_2e$**	**533 $ktCO_2e$**	**823 $ktCO_2e$**

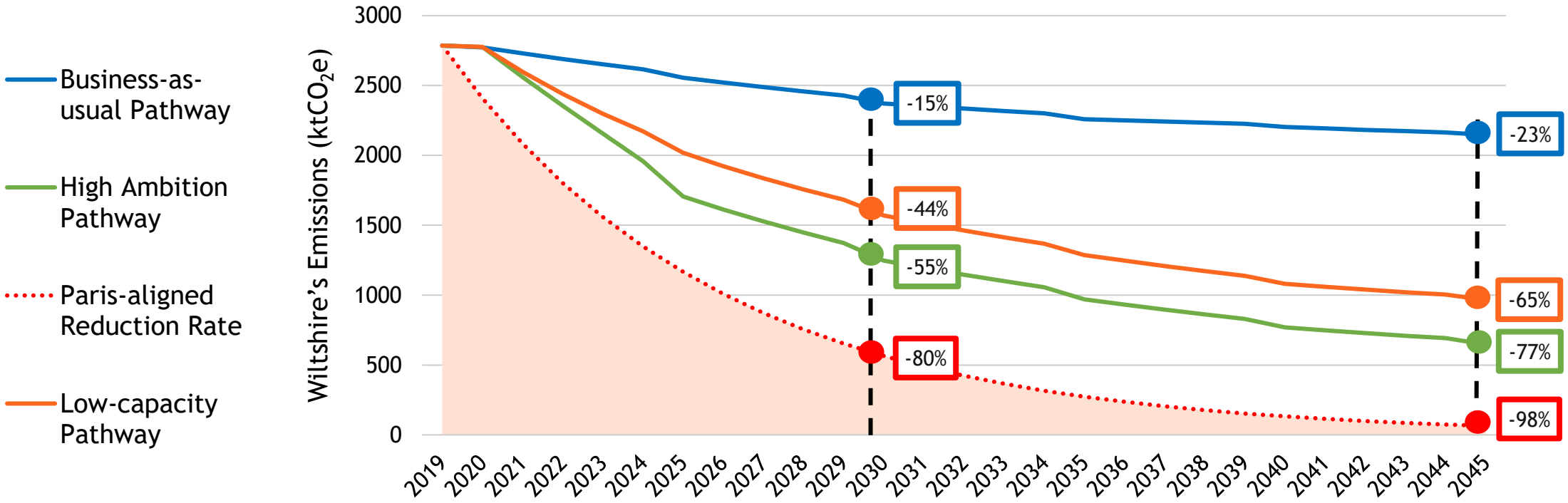
APPENDIX 5: CARBON SAVINGS SUMMARY

The table below presents cumulative emissions savings achieved, by sector, under the High Ambition pathway, against 2019. This demonstrates the relative difference in emissions saving potential between different sectors.

	2025	2027	2030	2040	2045
Domestic Buildings	42%	48%	61%	90%	94%
Non-Domestic Buildings	36%	39%	45%	60%	66%
Transport	45%	55%	66%	79%	82%
Waste	24%	31%	41%	69%	80%
Industry	42%	42%	63%	86%	90%
Agriculture & Land Use	8%	10%	14%	24%	29%
Total	**39%**	**45%**	**55%**	**72%**	**77%**

APPENDIX 6: WILTSHIRE'S LOW-CAPACITY PATHWAY

The energy supply sector has been presented differently to other sectors to avoid double counting. It is not possible to separate out the savings specifically from renewable energy supply as it is interdependent with demand-side measures. This chart only serves to demonstrate the importance of energy supply measures. The green line tracks the High Ambition Pathway and the blue line the BAU. The orange line tracks a High Ambition scenario for all measures except those which relate to renewable energy sources (termed a low-capacity scenario).



APPENDIX 7: COSTINGS

Costings Summary

The table below shows the cumulative costs, by sector, to achieve the High Ambition pathway. This table does not highlight costs that were Not Estimated, instead highlighting all estimated capital and revenue costs by sector.

£ (million)	2020-2027		2020-2030		2020-2040		2020-2045	
	Capital	Revenue	Capital	Revenue	Capital	Revenue	Capital	Revenue
Domestic Buildings	705	2	908	4	1579	13	1884	18
Non-Domestic Buildings	93	1	114	1	187	-1	224	-3
Transport	497	-330	750	-734	1716	-3318	2218	-5206
Energy	477	170	597	260	800	662	902	863
Waste	-	-12	-	-25	-	-123	-	-213
Industry	10	-	15	-	29	-	36	-
Agriculture & Land Use	40	-	57	-	57	-	57	-
Total	**1822**	**-169**	**2441**	**-494**	**4368**	**-2767**	**5321**	**-4541**

APPENDIX 7: COSTINGS

Domestic Buildings

Notes & Caveats

Switch to electric cookers

- No additional capital costs assumed with the cost of installation for new electric cooking systems.
- Main cost here represents the potential added cost of fuel each year if the borough switches over time to electric systems, based on a marginal cost over a gas equivalent.
- High Ambition assumes a linear transition to electric cookers ending in 2035 – modelled as a retirement rate of 1/15th of gas systems replaced each year.
- The cost for a household that switches from a full gas to a full electric system may incur higher energy bills as a result of the higher cost of electricity. Long-run energy prices taken from the CCC Sixth Carbon Budget.
- This analysis does not consider government subsidies for energy prices which may have a significant role to play in lowering the cost to consumers.

New build standards are to PassivHaus

- These figures are taken from a Currie & Brown and AECOM report which defines the marginal cost between building Part-L or PassivHaus standard both during construction and retrofit phases at a later date. This also accounts for heating systems (assumes air-source heat pump in a semi-detached house).
- The cost of retrofitting runs very high because retrofitting newly-built Part L to higher standards in future can cost between 3-5 times more than building to PassivHaus during construction.
- Number of new builds taken from SCATTER newbuild projections between 2020-40.

Reduced energy demand in homes

- This represents the capital costs required to complete inner/external wall retrofit on the numbers of households described by the HA pathway.
- Point capital costs for insulation and all other costs come from this BEIS study into the cost of domestic retrofitting. This also accounts for economies of scale, other fixed project costs and local geographical weighting, as well as a hurdle rate.
- Assumes a linear transition of completed retrofit from 2020 household numbers.

Switching away from gas heating

- CCC Sixth Carbon Budget has data on capital costs and revenue costs of a variety of domestic heating systems. An average of these systems was used to determine the cost estimate opposite.
- Number of households taken from SCATTER (2020) and split between gas/non-gas according to aggregated government estimates at LSOA level. A flat 5% assumption was made on households already served by an electric system. All other off-gas properties assumed to be oil boilers.
- All systems assumed replaced at some point (retirement rate 1/15), so replacement costs are calculated for all systems including fossil.
- Revenue costs assumption assumes energy bills are reduced over time as a result of efficiency improvements of electric over gas.

APPENDIX 7: COSTINGS

Non-Domestic Buildings

Notes & Caveats

Improved building efficiency

- Non-domestic buildings in any area make up a very broad stock of diverse properties.
- The Non-Domestic National Energy Efficiency Database (ND-NEED) was used to find the number of rateable properties in Wiltshire.
- Costings from Building Energy Efficiency Survey (BEES), which outlines the cost of a package of retrofit measures across different non-domestic archetypes. These were mapped onto the ND-NEED rateable properties register at the local level according to a nationally representative mix of archetypes.
- Costs represent one round of retrofit. Annualised costs relate to the annual marginal expenditure across all sectors over the lifetime of a 15 year cycle of retrofit.

Switching away from gas heating

- Average load demand for heating across different archetypes calculated based on a combination of BEES consumption data and CCC statistics on heating systems.
- CCC publish £/kW values for capital costs and revenue costs which have been applied to a scaled figure of average load demand for space heating and hot water.
- Figures represent the capital costs of a new heating system, whilst revenue cost covers routine maintenance but **not** fuel costs. Fuel costs are only projected to constitute significant additional bills in the retail and office sectors, offering cost savings to many archetypes due to more efficient systems.
- Heating systems assumed to be replaced at a rate of 1/15th each year.
- Costs expressed represent the **annualised, marginal** cost between a business-as-usual gas case and a High Ambition transition to electrified systems. They represent the annual additional cost of electric systems versus replacement like for like with gas.

APPENDIX 7: COSTINGS

Energy Supply

Notes & Caveats

- SCATTER High Ambition projections for installed capacity across different renewable energy types has been cost modelled according to a BEIS report on the development of new installations.
- Costs of installation and maintenance are in constant flux; two benchmark constructing years (2030 & 2050) have been chosen from BEIS data and compared against capacities within the SCATTER High Ambition Pathway.
- It is important to acknowledge that not all costs are incurred by a single stakeholder, since larger installations are often government funded or privately financed and smaller scale PV installations are paid for by households and businesses.
- Figures below indicate the scale of investment in renewable energy each year in order to meet the capacity targets set out by the High Ambition Pathway.

APPENDIX 7: COSTINGS

Transport

Notes & caveats

- CCC Sixth Carbon Budget costings for capital expenditure and operational savings in the surface transport sector have been recast under SCATTER interventions to 2050 to give an estimate for the implications of the SCATTER High Ambition Pathway.
- Costs represent a scaled down portion of national expenditure in each area as set out in the Sixth Carbon Budget, based on vehicle registrations in Wiltshire.
- Demand reduction and modal shift interventions have been mapped from the High Ambition Pathway onto the expenditure, assuming all costs rise proportionally.
- The vast majority of expenditure and savings related to transport is made in the purchase and operation of new electric vehicles.
- Additional costs have also been given as part of this analysis, shown below in Table 7.8. These are sourced from DfT and CCC Sixth Carbon Budget.
- Scaled costings have also been included for the "efficiency measures" intervention from CCC modelling. It should be noted that whilst the costings are representative of similar changes within SCATTER, the details of this measure do differ and this figure should be taken with an added caveat.

Additional costs	Cost (£)
Capital costs: new cycle lane (per km, varies on type of path)	£240,000-£1,300,000
Capital costs: per bicycle	£350
Capital costs: commercial bike storage unit	£6,500
Capital costs: new electric bus & associated infrastructure	£162,000
Revenue cost: lifetime savings following switch to EV	~£6,000

Costings for additional individual actions.

APPENDIX 7: COSTINGS

Waste, Industry and Natural Environment

Notes & caveats

Waste disposal

- This is based on simple modelling of future gate fees for recycling, landfill and incineration based on statistics in the 2019/20 WRAP gate fees report.
- SCATTER estimates for the volume and stream of waste are applied to current figures cast forwards to 2040.
- Gate fees represent the charge levied per tonne to dispose of waste by a given means e.g. landfill site or material recovery facility.
- Estimates do not cover the cost of collection and transport of waste. We have assumed there is no marginal cost between the two scenarios – lifetime cost of electric refuse collection vehicles (RCVs) is comparable to that of diesel RCV (see table opposite from DfT data).
- Not all payments for waste are handled purely through gate fees but this represents a useful proxy for comparative costs of increased recycling and reducing waste volumes versus the counterfactual.

Increased forest and tree coverage

- Tree coverage and land area change under SCATTER interventions were modelled to 2030 in terms of increase in hectares of woodland.
- Woodland Creation & Management Grant gives costs for capital costs and revenue cost per hectare of new woodland, which have been applied to the new hectares.
- Further funding opportunities for woodland creation, maintenance, management and tree health can be found here.
- Figures represent a marginal case for High Ambition over BAU; the range represents the impact government grant funding may have.

Industrial processes

- Cost represents the marginal capital costs of a low-carbon pathway for industry, scaled to Wiltshire based on their share of national industrial fuel consumption.
- Government pathways can be found in the industrial pathways to decarbonisation summary report.

Cost type	Cost of RCV (k£)	
	Diesel	Electric
Capital costs	164	365
Revenue cost	459	245
Lifetime total	623	611

Assessed costings of RCVs

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