LONDON BOROUGH OF RICHMOND UPON THAMES

Emissions Reduction Pathways Analysis

September 2023

VERSION 1.2

Anthesis

Anthesis is the Sustainability Activator

Proud to be a B Corp, we are the largest group of dedicated sustainability experts in the world: a team of 900+ professionals, 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 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.

Area 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 area, and increase collaboration between stakeholders.

Anthesis Impact Tracker: A new digital platform to support local governments in monitoring and reporting on climate action and impact. Providing a single location for climate related data, the platform boosts stakeholder engagement, helps accelerate decision making, and enables more initiatives on the ground.

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.

EMISSIONS REDUCTION PATHWAYS ANALYSIS
EXECUTIVE SUMMARY

Research objectives

The London Borough of Richmond Upon Thames has set a **borough-wide target to be net zero by 2043**, based on analysis by the Tyndall Centre, with the intention of acting in line with the Paris Agreement. This report has been commissioned by the council to provide a roadmap towards net zero, using Anthesis' SCATTER tool to outline the scale of action and technological interventions required to achieve this. This will help the council by providing an evidence base against which it can set goals for climate action in the borough as part of its new climate action plan.

Emissions in London Borough of Richmond Upon Thames

In 2019, the borough was responsible for net emissions totalling **680.79 $ktCO_2e$.** The majority resulted from **domestic buildings (46%) and transport (24%)**, seen here in Figure a. 2019 baseline data, which aligns with the commencement of Richmond Upon Thames's current climate change strategy. Emissions from agriculture and land use amount to <1% of emissions.

*Industry emissions includes activities associated with industrial processes as well as emissions from space heating and hot water in industrial buildings.

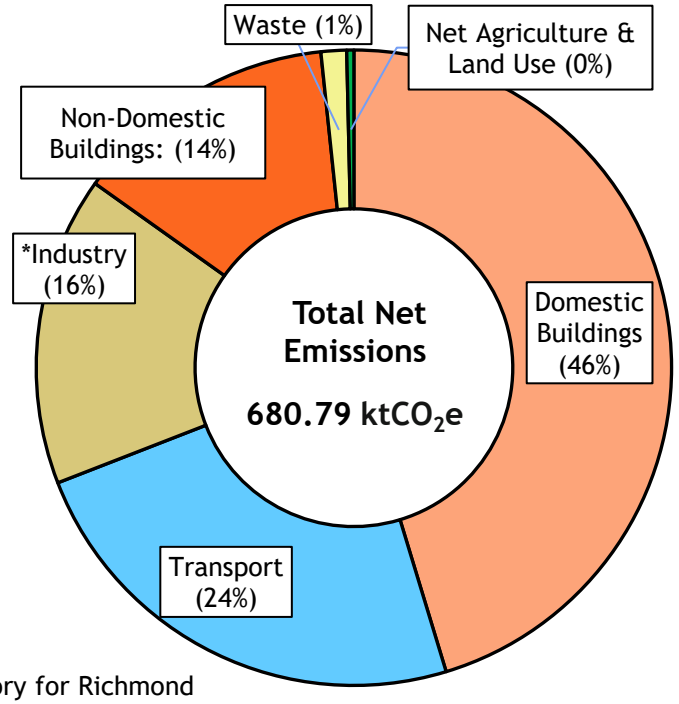


Figure a: SCATTER 2019 emissions inventory for Richmond Upon Thames's Scope 1 & 2 emissions, shown by sector.
Note: Percentages may not sum to 100% due to rounding.

Emissions Reduction Pathways

Emissions reduction pathways illustrate how the borough's carbon emissions may change over time depending on differing levels of local and national action. Figure b below shows four possible pathways for the borough. The High Ambition pathway, in green, assumes Richmond Upon Thames goes significantly beyond national policy and that action is not hindered by any funding or national policy constraints. The interventions detailed in the report, and the associated impact milestones, are based on the borough implementing the High Ambition Pathway. Even with these interventions, 66 $ktCO_2e$ emissions remain in the energy system at 2043, therefore it is important to consider options to go beyond the SCATTER High Ambition pathway.

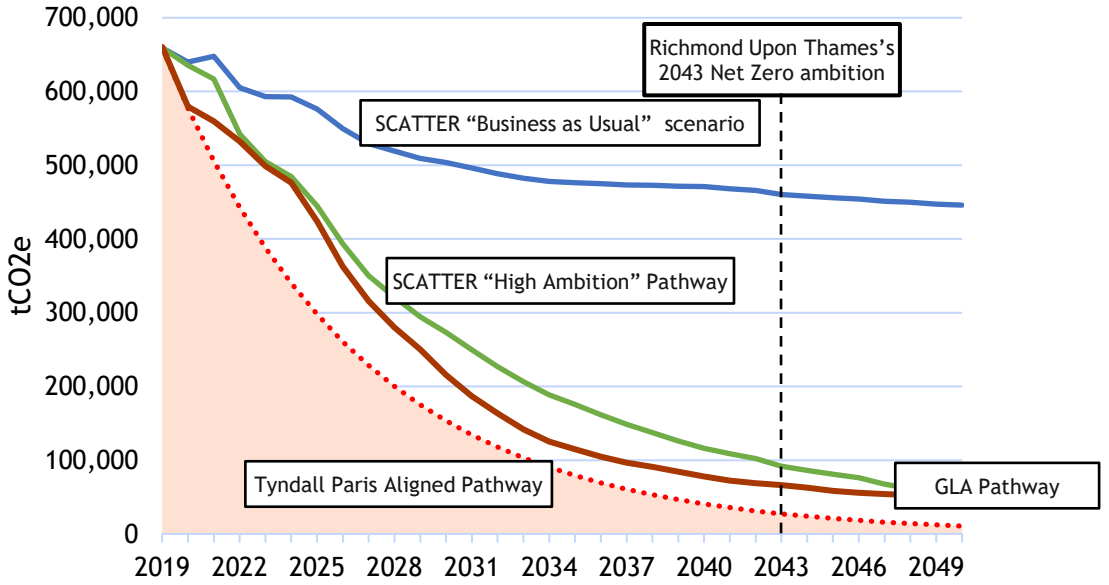


Figure b: Emissions reductions pathways for Richmond Upon Thames. The outputs of this report focus on the implementation of the High Ambition Pathway. The GLA pathway is presented for context.

EMISSIONS REDUCTION PATHWAYS ANALYSIS
EXECUTIVE SUMMARY

Emissions Reduction Measures

The High Ambition Pathway sets out recommendations for action across several areas:

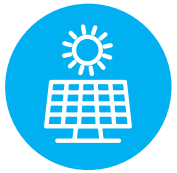
Buildings
1.1 Improving energy efficiency
1.2 Reducing gas heating systems
1.3 Low carbon and energy efficient cooking, lighting and appliances

Waste
4.1 Reducing the quantity of waste
4.2 Increasing the recycling rate

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

Industry
3.1 Shifting away from fossil fuels
3.2 More efficient processes



Energy Supply
6.1 Increase solar photovoltaic (PV) capacity

For each sector and its interventions, we provide potential **carbon savings** at given intervals, along with a summary of the practical milestones which stakeholders across the borough would need to achieve in implementing the intervention. The indicators are intended to demonstrate an ambitious but achievable level of action. **Council views** on the practical considerations around their implementation are provided. Anticipated **co-benefits** (i.e. benefits beyond carbon savings) are also detailed. To support the council in prioritising next steps, commentary is given around the **current policy and strategic context** as it relates to the intervention, and the anticipated **costs and funding availability**.

Key Findings

- If Richmond Upon Thames successfully implements the High Ambition pathway, there would be an **86% reduction in emissions by 2043**, compared to the 2019 baseline.
- The cumulative investment required to achieve the high ambition pathway would be in excess of **£2.1 billion between now and 2043**, although a portion of this could be offset by savings in operational expenditure.
- To go beyond the reductions achieved through the High Ambition pathway, and achieve net zero, the council can explore deploying decarbonisation interventions at a **faster rate** than outlined in SCATTER, and **new innovations** not modelled by SCATTER. **Carbon offsets** can also be explored. For example, the council is participating in Anthesis' Area Based Insetting (ABI) initiative.

The pathway does not account for potential shortcomings in supporting policy or finance, and the borough is dependent on national policy support.

Recommended next steps

To achieve net zero, stakeholders in Richmond Upon Thames should pursue all the opportunities presented in this report. Stakeholders may seek to prioritise certain areas for immediate action. This could be done along long two axes:

1) The **potential impacts** of the interventions, with a focus on carbon impact and co-benefits. Based on this, priority action areas will include domestic building retrofit, decarbonising domestic heating, transportation related interventions, and local Solar PV
2) Stakeholders' **ability to implement the actions,** considering costs and funding, policy, and the council's ability to influence action. On the latter point, the council should use its unique role in the borough as an "enabler" of action, such as in lobbying national government.

The council should review these findings to determine on which basis to prioritise action and consider this in the development of its action plan.

CONTENTS

01 Introduction

1. INTRODUCTION
BACKGROUND AND CONTEXT

Overview & Scope

The London Borough of Richmond upon Thames has set a **borough-wide target to be net zero by 2043**. This is following analysis by the Tyndall Centre on what is a 'fair' contribution for the borough in line with the Paris agreement.

This report has been commissioned by the council to provide a roadmap towards net zero, helping everyone in Richmond Upon Thames understand the scale of action required and providing an indication of the technological interventions required to achieve this. It will also highlight the factors influencing the ability of Richmond Upon Thames to meet these pathways, and where the biggest opportunities are.

- **Chapter 1** introduces the work and provides a review of Richmond Upon Thames's emissions target.
- **Chapter 2** contains a review of the Richmond Upon Thames's current greenhouse gas emissions baseline, outlining key sources.
- **Chapter 3** details carbon reduction pathways associated with differing levels of climate ambition in the borough.
- **Chapter 4** 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. For each action area, we also explore the factors influencing the ability for Richmond Upon Thames to achieve these, such as costs, funding availability, and policy.
- **Chapter 5** contains our conclusions, including recommendations on action areas.

Objectives of this report

- Set out the current baseline of emissions in Richmond Upon Thames, and a pathway to net zero in line with a highly ambitious level of action.
- Give an indication of the nature and scale of technological interventions needed in Richmond Upon Thames 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, policy and strategic support, and funding availability.
- Based on the above, give recommendations on how to consider priority areas and opportunities for action.

The data provided in this report is intended to give a sense of the scale and speed of change needed across Richmond Upon Thames to achieve net zero by 2043. This will help the council by providing an evidence base against which the it can set further strategic goals for climate action in the borough as part of its new climate action plan.

1. INTRODUCTION
RICHMOND UPON THAMES'S EMISSIONS TARGET

Richmond Upon Thames's Target: A carbon budget is a fixed limit of cumulative emissions that are allowed over a given time to keep global temperatures within a certain threshold. The Tyndall Centre for Climate Change Research have created carbon budgets for each local authority, based on the Paris Agreement, to limit global temperature rise to 1.5°C. A carbon budget emphasises the need for action now, because it represents a finite allowance of greenhouse gas emissions, which, once emitted, remain in the atmosphere for hundreds of years. See Appendix 7 for information on the Tyndall centre methodology, and a comparison to SCATTER and the GLA pathway. The graph, shown right, shows the Tyndall budget for the borough. Richmond Upon Thames have set a target to stay within an emissions budget of **4.3 MtCO2**, between 2020 and 2100, in line with the Tyndall budget and the Paris Agreement. **This means reaching zero or near (5% budget remaining) net zero by 2043.** In line with this, the annual emissions reduction rate recommended by the Tyndall Centre for Richmond Upon Thames is **12.4%**. In Chapter 3 we introduce how this target relates to the borough's emissions pathways.

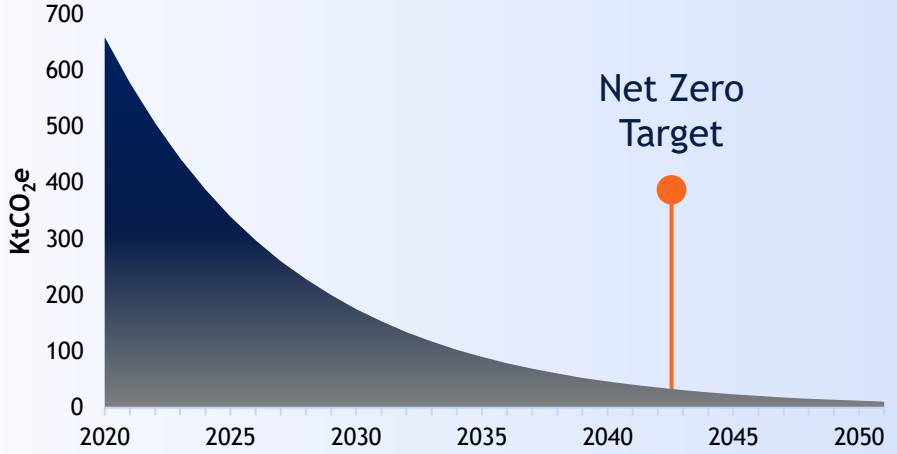


Figure 1.1: Showing the Tyndall Annual Reduction Rate.

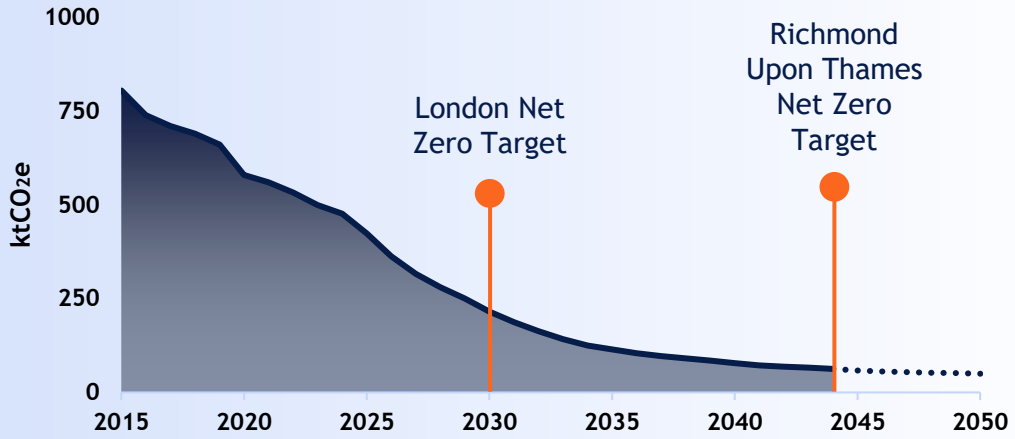


Figure 1.2: Showing the Accelerated Green Pathway.

The Mayors preferred Net Zero Pathway: Shown left, this is also referred to as the 'Accelerated Green Pathway' within the Analysis of a Net Zero 2030 Target for Greater London report. The borough is working towards the reductions outlined in the Tyndall pathway (above), so this pathway is presented for context. It represents an '*Intermediate Scenario*' which allows for the consideration of future technology changes, such as hydrogen-based heating, whilst also decarbonising ahead of national targets. The cumulative emissions from this pathway, between 2020 and 2043 (the borough's target year), are **5.8 MtCO2e**. This means that Richmond Upon Thames would exceed its targeted budget (see above) of **4.3 MtCO2** under this scenario. In other words, the borough's target pathway achieves greater reductions than this scenario. It is also notable that this pathway does not achieve net zero by 2030, with **216 ktCO2e** remaining at this interval. The pathway presents the impact of a given range of interventions, and "does not aim to prescribe the precise approach for getting to net zero". It is likely that offsetting would play a role in addressing such "residual emissions" (see Chapter 3).

02 Richmond Upon Thames's Emissions Baseline

2. RICHMOND UPON THAMES'S EMISSIONS BASELINE
UNDERSTANDING THE BASELINE

Reporting the emissions baseline

Understanding the emissions baseline provides a reference point for measuring progress, setting realistic targets, and designing effective strategies to reduce greenhouse gas emissions. To date, the council has referred to data from various sources, including London Energy and Greenhouse Gas Inventory (LEGGI) and using the Tyndall centre analysis.

In this chapter, we provide an emissions baseline for the borough using our SCATTER tool (see page 12). The SCATTER emissions inventory is aligned to global reporting standards set out by the Global Protocol for City-wide (GPC) Greenhouse Gas Emissions and provides a robust basis for future reporting to platforms such as the CDP-ICLEI Track and Global Covenant of Mayors. It includes a range of greenhouse gasses, as opposed to the Tyndall data, which is limited to CO2.

Considering the Footprint Boundary

Our analysis focusses on Scope 1 and 2 emissions in the borough:

- **Scope 1** describes greenhouse gas emissions associated with direct in-boundary consumption of fossil fuels, such as exhaust emissions from on-road transport, and emissions from gas-fired boilers.
- **Scope 2** describes greenhouse gas 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.

More information on scopes can be found in the Global Protocol for City-wide (GPC) Greenhouse Gas Emissions. Further detail for the borough is given in Appendix 2.

Considering Scope 3, and Consumption-Based emissions

Scope 3 emissions describe greenhouse gas emissions which occur outside of the local authority but are a result of activities or consumption within the boundary of Richmond Upon Thames. For example, transportation of goods and services to Richmond Upon Thames, delivered from outside the boundary. A selected range of scope 3 emissions sources are included within SCATTER (in line with the BASIC+ emissions reporting principle), notably including emissions from aviation and freight. These are omitted from this analysis to reflect the lack of local authority influence over these emissions and to help maintain consistency with the Tyndall pathway.

Consumption based emissions are a similar metric based on purchased goods and services. This approach differs slightly, in that it can include emissions from activities both inside and outside the borough.

These emissions are typically very large, particularly if using a consumption-based approach. The council is currently exploring ways to tackle these emissions, including through a programme of work with the One World Living Programme focusing on four initial themes: electricals, food, plastics, and textiles. This programme has proposed an overall consumption emissions reduction target of two thirds of 2017 levels by 2030. A first step will be to refer to baseline figures, calculated by the University of Leeds.

Key to taking action in this space will be applying principles of a circular economy, which aims to reduce waste and the need for further consumption through the reuse and recycling of resources already existing in the local energy system.

2. RICHMOND UPON THAMES'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. SCATTER stands for Setting City Area Targets and Trajectories for Emissions Reduction.

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, Greater Manchester Combined Authority, Nottingham City Council and others and it has been used by over 300 UK local authorities to date. The tool offers:

- **Emissions Inventories:** The tool provides an exportable greenhouse gas emissions inventory for any UK local authority, covering Scope 1 and Scope 2 emissions (i.e. Richmond Upon Thames'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 3.

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 2020, whereas the SCATTER baseline inventory represents data from 2019.** Full details of the Inventory and Pathways methodologies are available on the SCATTER website.

[1] DECC responsibilities were reformed into BEIS in 2016 , and then into DESNZ in 2023

2. RICHMOND UPON THAMES'S EMISSIONS BASELINE

SCATTER EMISSIONS PROFILE

In 2019, Richmond Upon Thames was responsible for net emissions totaling 680.79 $ktCO_2e$ (kilotonnes of carbon dioxide equivalent). The majority resulted from Domestic buildings (46%) and Transport (24%).

Emissions baseline provides a fixed point against which progress can be tracked. Data in SCATTER is presented in arrears, 2019 being the most recently available in the tool. This is also the year that the borough declared a climate emergency and launched its current climate programme, meaning it is a logical milestone against which progress achieved through the strategy can be judged.

The current emissions profile for the Richmond Upon Thames is shown opposite, based on the SCATTER tool. This covers three greenhouse gases: carbon dioxide (CO_2), nitrous oxide (NO_2) and methane (CH_4) and relates to the 2019 reporting year. Throughout this report, emissions are given as a single figure measured in kilotonnes of carbon dioxide equivalent ($ktCO_2e$) and this accounts for other greenhouse gases based on a global warming potential.

The emissions profile covers emissions generated within the borough 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.

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.

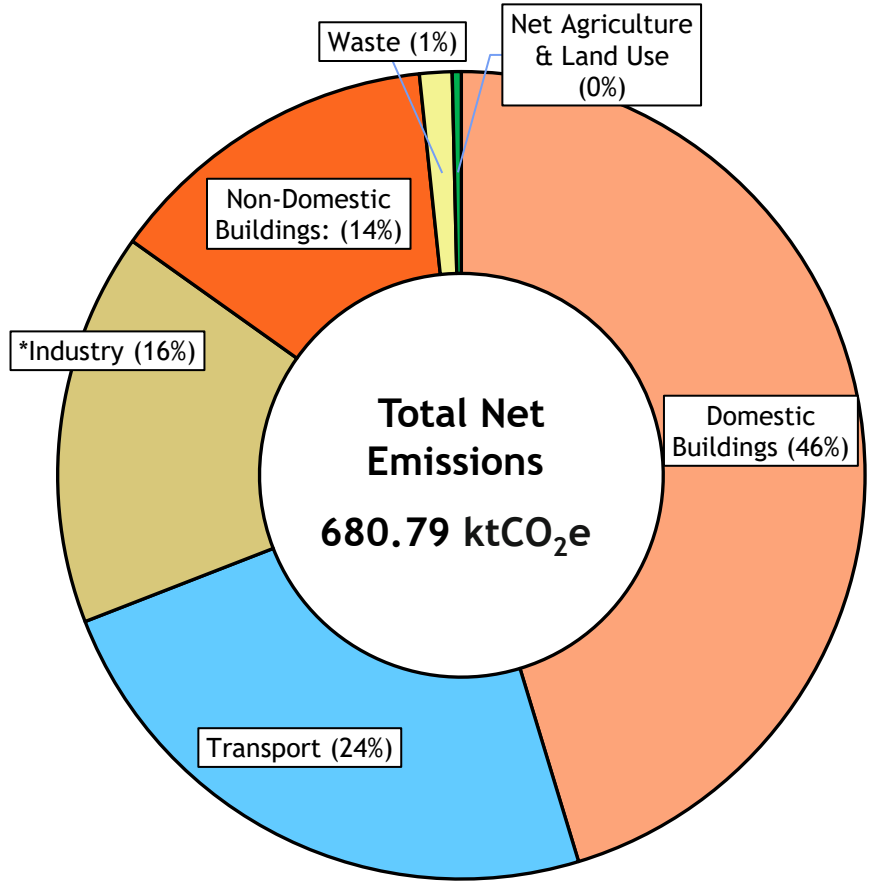


Figure 2.1: SCATTER 2019 inventory for Richmond Upon Thames's Scope 1 & 2 emissions, shown by sub-sector. This is broken down further overleaf.
Note: Percentages may not sum to 100% due to rounding.

*Industry emissions include industry from industrial processes as well as emissions from space heating and hot water in industrial buildings. SCATTER does not separate the energy used for space heating versus industrial processes and therefore cannot be modelled in the same way as other building types. The breakdown is shown on the following page.

2. RICHMOND UPON THAMES'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 4, along with commentary on key local factors contributing to the emissions profile.

59.2% of emissions in Richmond Upon Thames come from buildings

- **Residential buildings (45.6%):** Households of all tenure types.
- **Commercial buildings & facilities (6.7%):** Buildings from which commercial businesses operate e.g., shops, shopping centres, offices, restaurants etc.
- **Institutional buildings & facilities (2.7%):** Public sector buildings including schools, colleges and educational buildings, health centres, hospitals, leisure centres, Council buildings etc.
- **Fugitive emissions (4.1%):** Fugitive emissions are leaks and releases of gases from a pressurized containment - such as appliances, storage tanks and pipelines

0.1% of emissions in Richmond Upon Thames come from livestock and land use acts as a net carbon 'sink' of -0.4%

- **Livestock (0.06%):** Including emissions from both dairy and non-dairy cattle as well as other farm livestock.*
- **Land use (-0.4%):** These emissions estimations rely on Department for Environment, Food and Rural Affairs (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 underestimated.

*London borough livestock numbers are scaled from figures for Inner & Outer London, which are very low. It is acknowledged that this apportioning of livestock may not accurately reflect the numbers of in-boundary livestock, but also that this represents an extremely limited contribution to the emissions profile.

24% of emissions in Richmond Upon Thames come from transport

- **On-road transport (23.7%):** Emissions from all forms of on-road passenger vehicle, including cars, vans, motorcycles, buses and taxis.
- **Off-road (0.3%):** Based on a base assumption of 1% of total on-road emissions

1.3% of emissions in Richmond Upon Thames come from waste disposal

- **Solid waste disposal (0.6%):** Incorporates various waste streams across commercial, industrial and municipal sources.
- **Wastewater (0.5%):** Scaled directly from national wastewater data by population.
- **Incineration (0.2%)** incorporating disposal and incineration, and open burning, of waste

15.9% of emissions in Richmond Upon Thames come from industry

- **Industrial processes (5.5%):** National industrial processing emissions associated with heavy industry, such as iron & steel and chemicals, have been scaled down for Richmond Upon Thames
- **Industrial buildings & facilities (10.3%):** Larger industrial facilities, including factories, warehouses and workshops associated with manufacturing and engineering.

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

03 Richmond Upon Thames's Carbon Reduction Pathways

3. RICHMOND UPON THAMES'S CARBON REDUCTION PATHWAYS
SCATTER PATHWAYS MODELLING

Introduction

Whilst the Tyndall Centre's Paris-aligned carbon budget in Chapter 1 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 2, 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 differing levels of climate action, or "Ambition" in Richmond Upon Thames. 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 17.

The pathways are intended to act as an indicator of what emissions reductions could notionally be achieved in Richmond Upon Thames, 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 Richmond Upon Thames brought about by shortages in funding, skills, or policy.

Interpreting this analysis

In Section 4, we provide further detail of *what is required* in Richmond Upon Thames 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 Richmond Upon Thames.

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 Richmond Upon Thames 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*

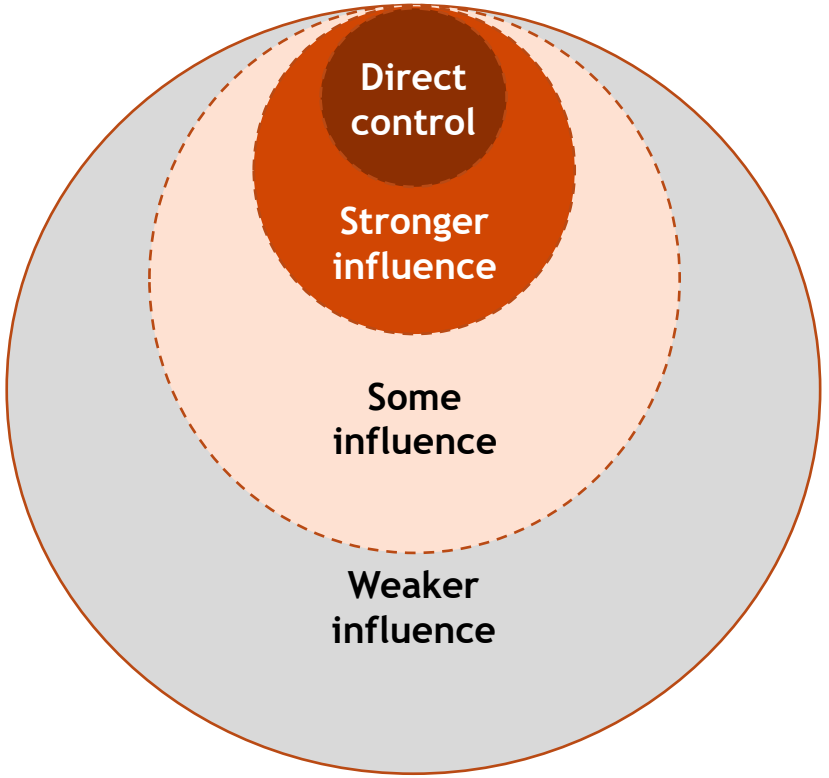
- Current political limitations of implementation
- Availability of skills or funding
- New and emerging technologies may also be excluded

3. RICHMOND UPON THAMES'S CARBON REDUCTION PATHWAYS
COUNCIL INFLUENCE

The council cannot deliver a net zero borough 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 Richmond Upon Thames. This is illustrated across- the different bandings showing the different levels of **influence over emissions sources** in the borough. 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 borough boundary, where Richmond Upon Thames'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 (see discussion of Consumption based emissions in chapter 2).

Influence	Description
Direct control	Emissions sources are directly owned or operationally controlled by the council. These typically represent around 5-10% of the total area's emissions
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 Richmond Upon Thames (e.g., high street businesses).
Weaker influence	Owners and operators of emissions sources are not clearly defined, but still within the borough. Influence limited to lobbying central government, NGOs, trade associations and public behaviour (e.g., private vehicle ownership).



Richmond Upon Thames boundary

[Chart is illustrative only and not to scale]

3. RICHMOND UPON THAMES'S CARBON REDUCTION PATHWAYS

EMISSIONS REDUCTION PATHWAYS

The graph below shows possible future emissions pathways for Richmond Upon Thames as modelled by the SCATTER tool (Scopes 1 and 2), compared against the Tyndall Centre's recommended 12.4% annual reduction pathway, and the GLA Emissions Reduction Pathway. The most recent SCATTER baseline available is for 2019 and is therefore the starting point for the pathways comparison. The GLA pathway and Tyndall budget are calculated using started points from earlier years so may show a different 2019 value, due the difference in real versus estimated emissions. For a look forward beyond 2019, see Appendix 3 for the most recent BEIS data for Richmond Upon Thames.

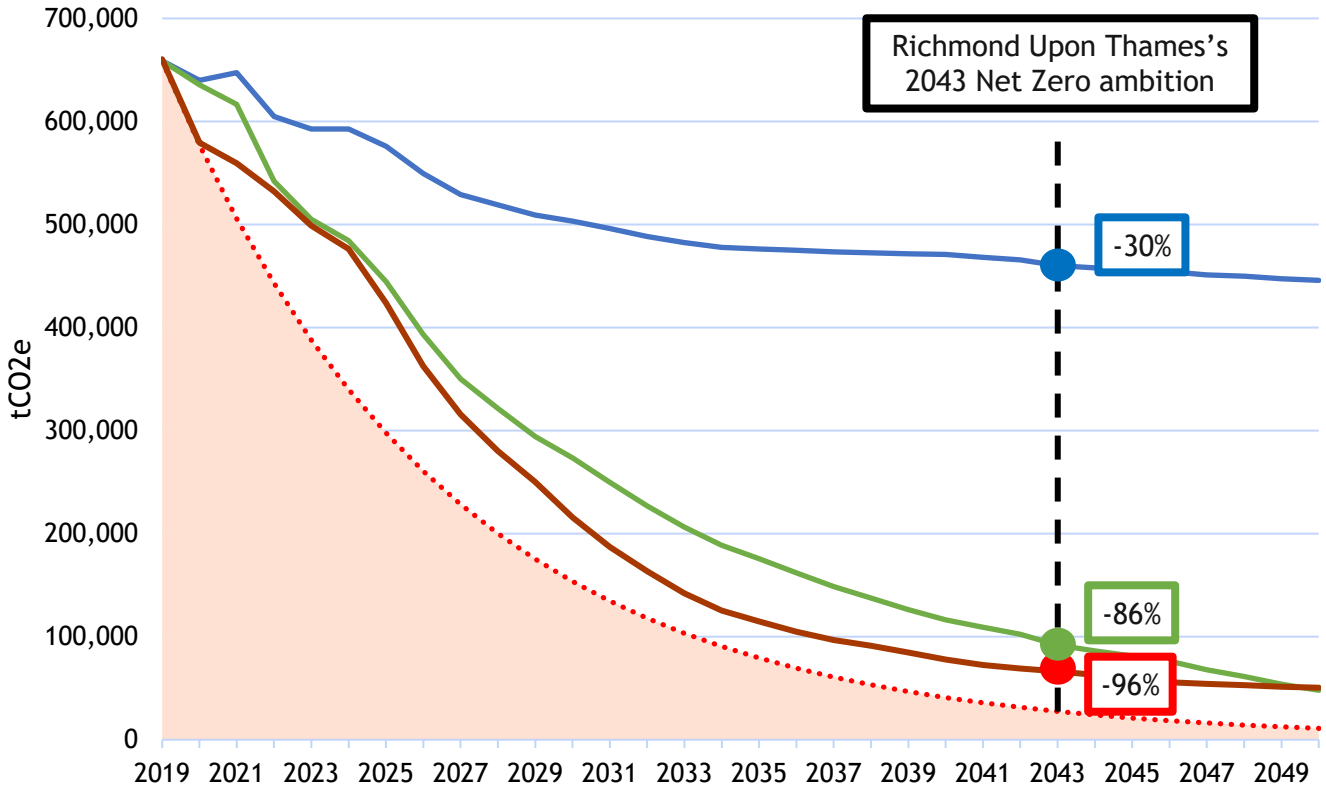


Figure 3.1: Possible percentage reductions (fall in emissions compared to 2019 levels) in emissions for Richmond Upon Thames along different emissions reduction pathways.

Key

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

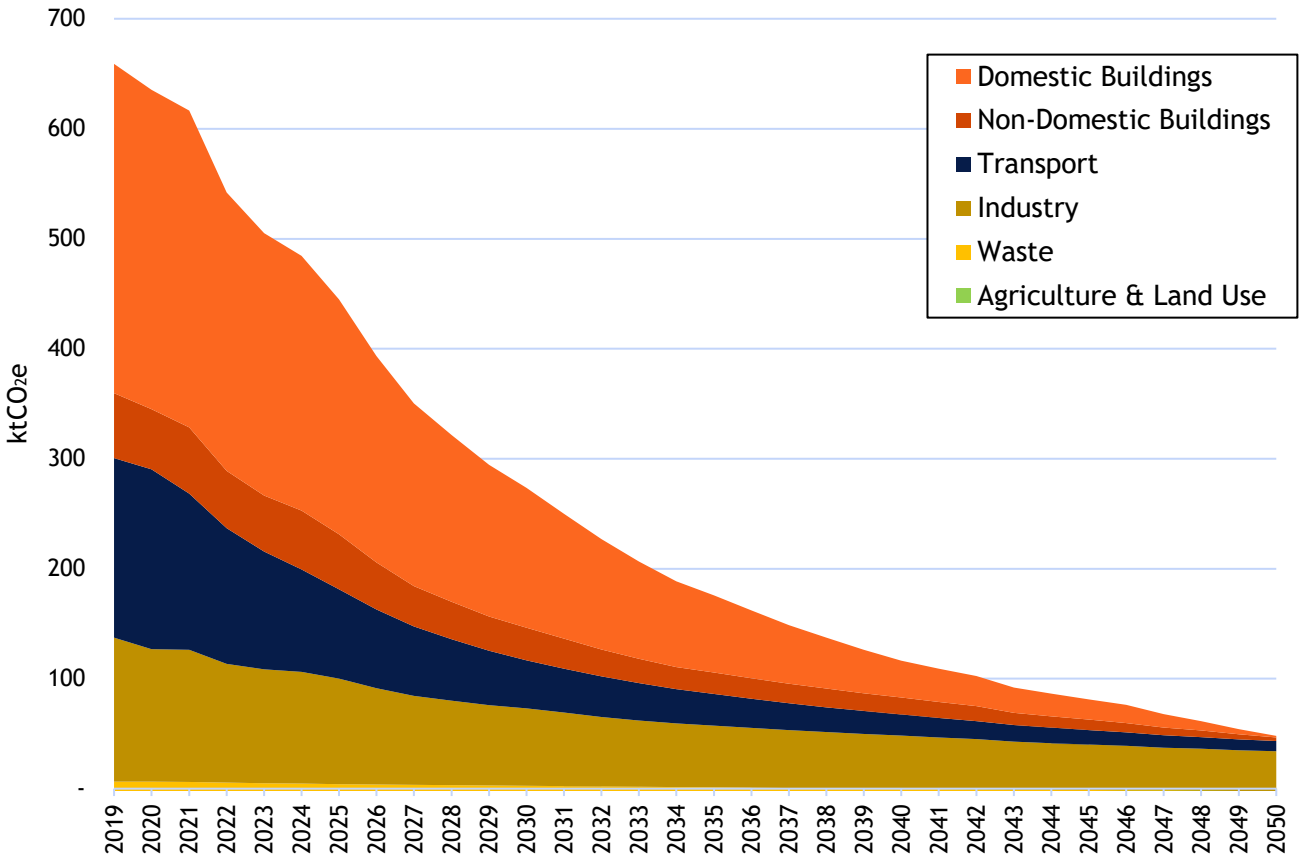
SCATTER High Ambition Pathway: Assumes Richmond Upon Thames goes significantly beyond national policy and National Grid assumptions and that action is not hindered by any funding or policy constraints and achieves an 86% reduction. It is the result of all interventions modelled by SCATTER at maximum ambition levels and provides an indication of the scale of action required in reaching for net zero. ***Note:*** *On page 19, we explore the extent to which this pathway moves Richmond Upon Thames towards net zero by 2043, and what would be required to go beyond this and address the "gap to target".*

GLA Pathway: The GLA pathway shown here is the 'Mayor's preferred pathway' otherwise known as the Accelerated Green Pathway. Showing this here allows for comparison between SCATTER, GLA and Tyndall.

Paris-aligned Carbon Budget: The borough's target pathway and budget. Based on the Tyndall Centre's recommended annual reduction rate of 12.7%. This is not based on tangible policy or implementation, but informs the action required to meet Paris Agreement targets.

3. RICHMOND UPON THAMES'S CARBON REDUCTION PATHWAYS
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 Richmond Upon Thames would change substantially under this scenario, and that the volume of emissions associated with some emissions sources will change more than others. It should be noted that the High Ambition Pathway does not achieve Richmond Upon Thames's net zero target. Even with the most ambitious interventions, 66 $ktCO_2e$ emissions remain by 2043.



Understanding the High Ambition Pathway

The High Ambition Pathway outlines the maximum level of climate action deemed reliably feasible, not accounting for any challenges due to skills, funding, policy, or other local factors impacting the feasibility of climate action in Richmond Upon Thames. It is intended to be notional only, and achieving it would require ambitious and urgent action, from a range of stakeholders across Richmond Upon Thames, and beyond. It is also reliant on national policy meeting the given decarbonisation and policy milestones on which the pathway depends.

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 4 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.

Overleaf we explore how the borough could also go beyond the High Ambition pathway.

Figure 3.2: Breakdown of key emissions sources, by sector, under SCATTER's High Ambition pathway.

3. RICHMOND UPON THAMES'S CARBON REDUCTION PATHWAYS
THE GAP TO TARGET

With ambitious local action, and national policy to support it, it is possible for the borough to achieve the emissions reductions associated with the High Ambition pathway. This would lead to a significant reduction in carbon emissions contributing towards the goal of net zero by 2043. The "Gap to Target" illustrated below shows the quantity of remaining emissions at the target year. It is possible for the council, and stakeholders across the borough, to tackle these "residual emissions", and to achieve net zero, by exploring opportunities for action "going beyond" the interventions outlined in SCATTER.

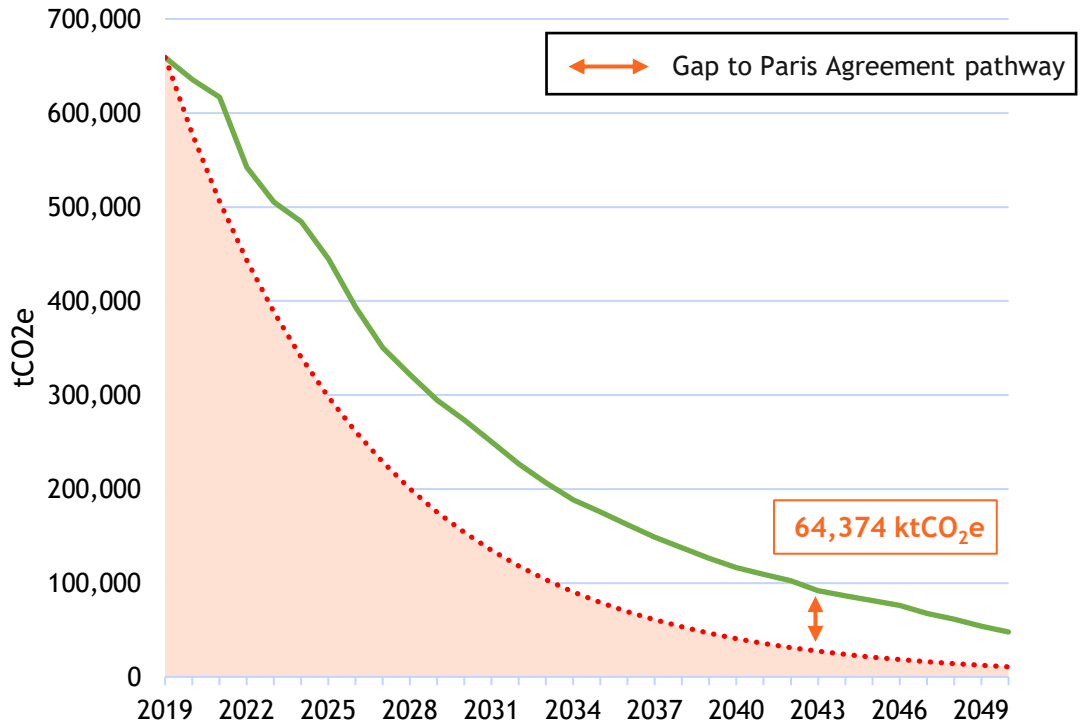


Figure 3.3: Illustration of High Ambition pathway, and associated "Gap to Target"

How can we go beyond High Ambition?

Stakeholders across the borough could look to address residual emissions and achieve net zero through:

Accelerated and increased deployment: Action driving change 'above and beyond' the interventions outlined in Section 4 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. An immediate next step in looking to accelerate deployment could be to engage national government on helping address any current perceived policy barriers. These are explored further in Chapter 4.

Technological innovations: Improvements in technology and reductions in market costs may dramatically increase the potential reduction in emissions in different sectors. For instance, many are anticipating scaling of "Green Hydrogen" for heating and transportation. Similarly, Carbon Capture and Storage (CCS) is an emerging technology which some believe could be used to store emissions arising from energy intensive processes underground. This could be linked to an offsetting programme, see below. It should be noted that improvements and innovations are unpredictable and no "silver bullet" technology can be relied upon or anticipated.

Offsetting and Insetting: Carbon offsetting refers to the purchase of a tradeable unit representing emissions savings or emissions reductions. They can be applied by an organisation, or the council, to address or neutralise any residual emissions, with the goal of achieving Net Zero. This is explored further overleaf.

3. RICHMOND UPON THAMES'S CARBON REDUCTION PATHWAYS
OFFSETTING AND INSETTING

Considering Offsets and Insets

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 Richmond Upon Thames achieved the highly ambitious set of actions outlined in the High Ambition pathway, emissions of 91,856 tCO_2e would remain at 2043 (Figure 3.3). Offsetting offers a means through which stakeholders in the borough could address these residual emissions after direct action to reduce emissions has taken place.

The council could also apply the principles of carbon **insetting,** a form of offsetting where carbon mitigation projects are run locally inside the borough boundary (as opposed to outside the local authority). Insetting can demonstrate action against a council's own organisational targets while reducing borough wide emissions. It is less likely to be subject to the challenges local authorities typically face in applying traditional offsets, such as concerns in investing local taxpayers' money in programmes based outside the borough.

Insets are not traditionally 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 the **Area Based Insetting** mechanism through which local authorities would be better equipped to identify and engage in such partnerships.

Area Based Insetting (ABI) in Richmond Upon Thames

Anthesis has led on the development of a model supporting local carbon insetting, in partnership with local authorities, businesses, and community groups. The Area Based Insetting (ABI) framework facilitates the implementation of locally based insetting projects. This enables local authorities to achieve their emissions reduction goals through investments locally, addressing the challenges typically encountered by local authorities looking to reduce their emissions through regular offsets (see across).

ABI will stimulate greater investment in carbon-saving projects locally, in contrast to traditional offsetting schemes where finance may flow much further afield. The scheme will drive collaboration by matching potential low carbon projects and initiatives with funding provided by stakeholders (such as businesses operating locally) who are looking to offset their emissions. This process will be driven by the roll out of the ABI Registry, a digital platform for hosting and sharing local low carbon projects. The goal of the programme is ultimately to help councils, and other stakeholders, to reduce emissions across their local area.

Richmond Upon Thames Council is now using the ABI registry and exploring the use of this in supporting funding of carbon offsetting projects locally. Learn more about Area Based Insetting here.

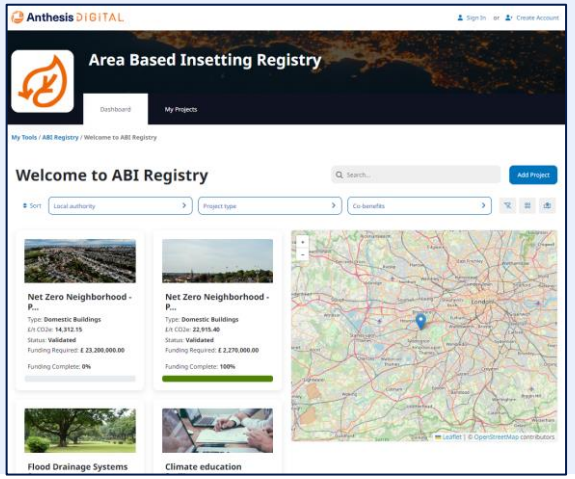


Figure 3.4: Area Based Insetting Registry

04 Carbon Reduction Measures

4.1 Buildings

Anthesis

4.1 BUILDINGS
INTRODUCTION

The built environment sector represents 375 $ktCO_2e$ of Richmond Upon Thames's emissions, totaling 55% of baseline emissions. This is then further split into emissions from residential buildings (homes) which represent 45.6% of total emissions, and non-domestic buildings (places of work, schools and hospitals), which account for 9.4% of emissions.

The following interventions relate to domestic households, commercial properties and institutional buildings. 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. Since SCATTER models industrial buildings using interventions specific to the industry sector, industrial buildings are not included here.

KEY LOCAL CONTEXT

- Richmond Upon Thames has a high proportion of listed and heritage buildings which include a wide range of building types and ages that are of national importance. This may have impacts on the number of buildings suitable for retrofit and other energy efficiency installations.
- Redevelopment rates in Richmond Upon Thames are lower than in other parts of London, and rates of residential property ownership are higher.
- The Council does not own or directly manage social housing but works in partnership with social housing providers and private landlords to address housing issues.
- Richmond Upon Thames is host to some major non-domestic building infrastructure, including Twickenham Stadium, and Kew Gardens.

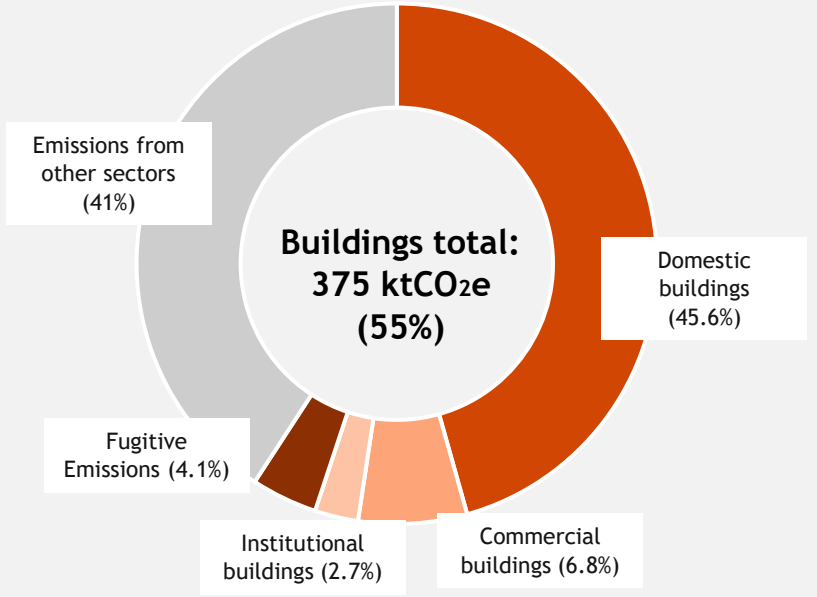


Figure 4.1.1: SCATTER 2019 emissions associated with buildings, not including industrial buildings. Fugitive emissions are visualized here but not included in any intervention modelling in SCATTER.

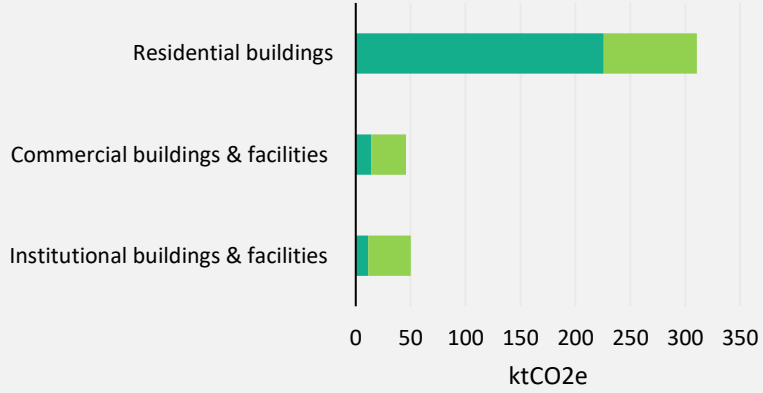


Figure 4.1.2: A breakdown of buildings emissions, from SCATTER 2019.

4.1 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.

THE COUNCIL VIEWS

What factors are considered as barriers to action in this sector?

- Lack of in-house experts in the council on green technologies such as heat pumps and solar panels. Conversely, improving this will create enabling impacts.
- Challenges in the council's ability to directly influence or enable building improvement works- many leases are repair and maintenance only.
- Identifying and bidding for funding support is considered time consuming, as is the process to identify and complete due diligence on suitable new technology, with a lag time on data.
- Perceived balance, or conflict, between affordable housing and inclusion of sustainability features when determining planning applications.
- Building heritage protections can influence the ability of the council to retrofit buildings.
- Lack of national policy support or direction- conversely, political will here can help enable action.

What factors are considered enablers of action in this sector?

- The Local Plan can set ambitious local targets for climate action, and the borough aims to go above the London Plan, and national targets, on carbon dioxide reduction.
- When working with developers, the council has cited the use of the planning validation checklist to help highlight to developers' sustainability features early in the development process.
- New technologies are expected to improve the impact and scale of the rollout of initiatives in building decarbonisation.

4.1 BUILDINGS
INTERVENTION DETAIL

1.1a Improving building efficiency - Domestic buildings

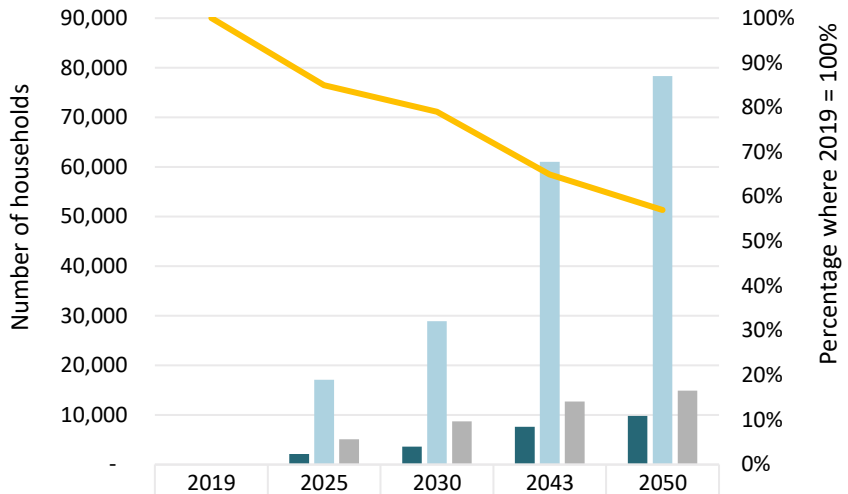
This measure considers changes to the energy demand for heating homes, in both existing properties and newly built homes. The aim of retrofit is to drive down the energy demand for heating and hot water in buildings; typical measures include insulation for floors, windows and ceilings, as well as improved ventilation. Currently household retrofit is led largely by government-supported schemes as part of the 'Help to Heat' package of initiatives. 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.

LOCAL DECARBONISATION INITIATIVES

The council has used Green Homes Grant funding from central government to provide energy efficiency retrofit for low-income households and those with poor EPC ratings.



	2019	2025	2030	2043	2050
"Medium" retrofit	-	2,100	3,600	7,630	9,800
"Deep" retrofit	-	17,100	28,900	61,010	78,300
PassivHaus new-build	-	5,100	8,700	12,730	14,900
Domestic space heating and hot water demand	100%	85%	79%	65%	57%

Figure 4.1.3: Cumulative retrofit rates and new build standards for the borough. The yellow line on this graph shows the impact of the retrofit measures on the demand for space heating and hot water.

Current Statistics	Percentage Change	Trend
In 2019, **8.1%** of submitted domestic EPCs were rated B or above. This has decreased to **6.3%** in 2022. (Source)	-22.73%	
In 2019, **1,296** households have received ECO measures. This has increased to **1,641** in 2022. (Source)	26.62%	
In 2019, **9,034** households were classified as fuel poor. This has decreased to **8,271** in 2021. (Source)	-8.45%	

*Trend lines displayed are based on the currently available data in column one, this varies between each row of current context and sector based on available data.

4.1 BUILDINGS
INTERVENTION MILESTONES

1.1b 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.

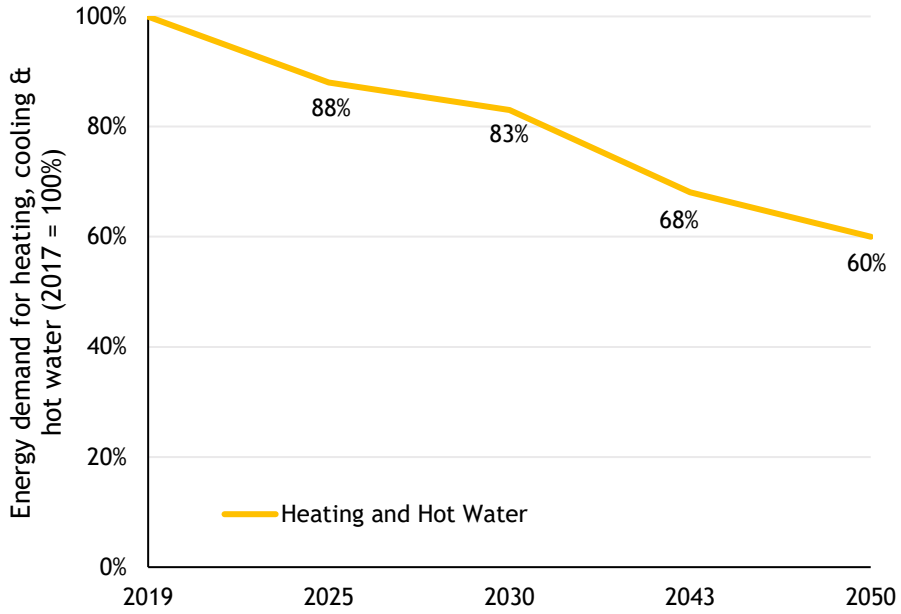


Figure 4.1.4: Modelled changes in energy demand for space heating and hot water relative to a 2020 baseline of 100% and BEES average non-domestic retrofitting potentials. The number of retrofits are cumulative, each value showing the total number of buildings retrofit since 2020.

LOCAL DECARBONISATION INITIATIVES

The council has developed a schools decarbonisation framework. As an initial step, the council has conducted energy audit pilots on 3 schools and will be providing them with reports that contain tailored recommendations for decarbonisation projects.

The council has used Public Sector Decarbonisation (PSDS) funding to support improvements to energy efficiency in council owned buildings.

Current Statistics	Percentage Change	Trend
In 2019, **13.12%** of submitted non-domestic EPCs were rated B or above. This has increased to **30.38%** in 2022. (Source)	131.64%	

4.1 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 supplied by renewables. 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).

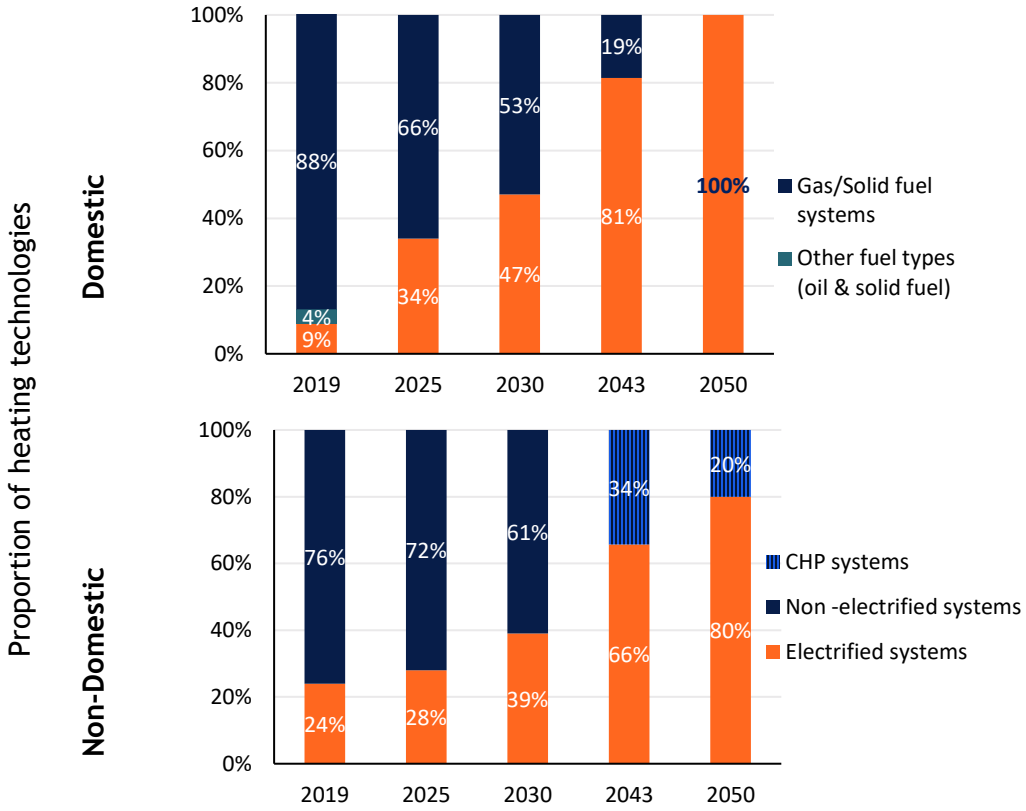


Figure 4.1.5: Modelled changes in the technology mix used for heating domestic and non-domestic buildings. *Note, the non-domestic graph transitions from 'Non-electrified systems' to 'CHP' when no other forms of non-electrified heating remain in the model.

Current Statistics	Percentage Change	Trend
In 2019, **6,440** households were not connected to the gas grid. This has increased to **6,740** in 2021. (Source)	4.66%	
In 2019, **1,215** GWh of gas was consumed by domestic buildings. This has decreased to **1,177** GWh in 2021. (Source)	-3.14%	
In 2019, **277.8** GWh of gas was consumed by Non-Domestic buildings. This has increased to **281.7** GWh in 2021. (Source)	1.43%	

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

4.1 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.

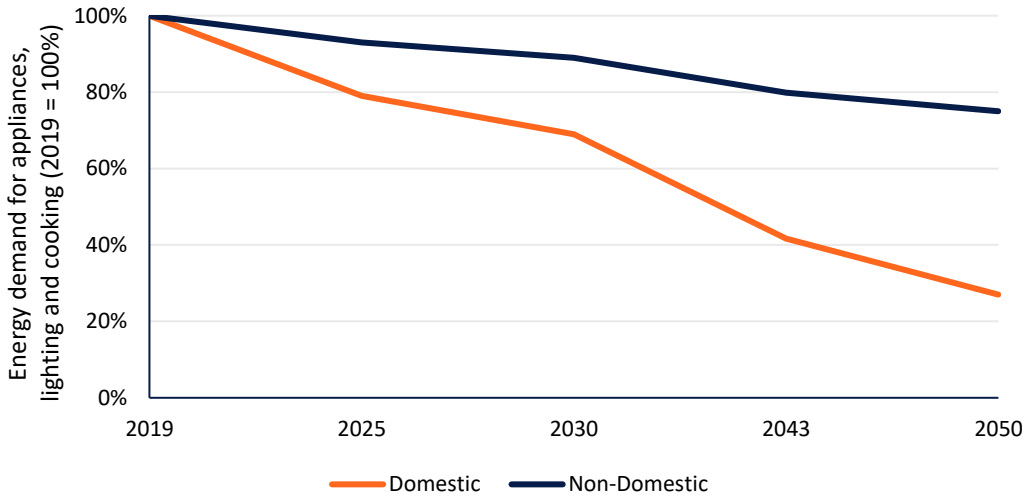


Figure 4.1.6 : Modelled energy demand reduction for changes for appliances, lighting and cooking in kWh. Example appliance and lighting energy savings are modelled below. Reduction in demand from cooking is explored on the following page.

Current Statistics	Percentage Change	Trend
In 2019, **17.25%** of electricity UK wide was estimated to be used for lighting and appliances. This has decreased to **16.89%** in 2021. (Source)	-2.04%	
In 2019, the average electricity consumption per household in Richmond Upon Thames was **3,907** kWh. This has decreased to **3,798** kWh in 2021. (Source)	-2.79%	

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]

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

4.1 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.

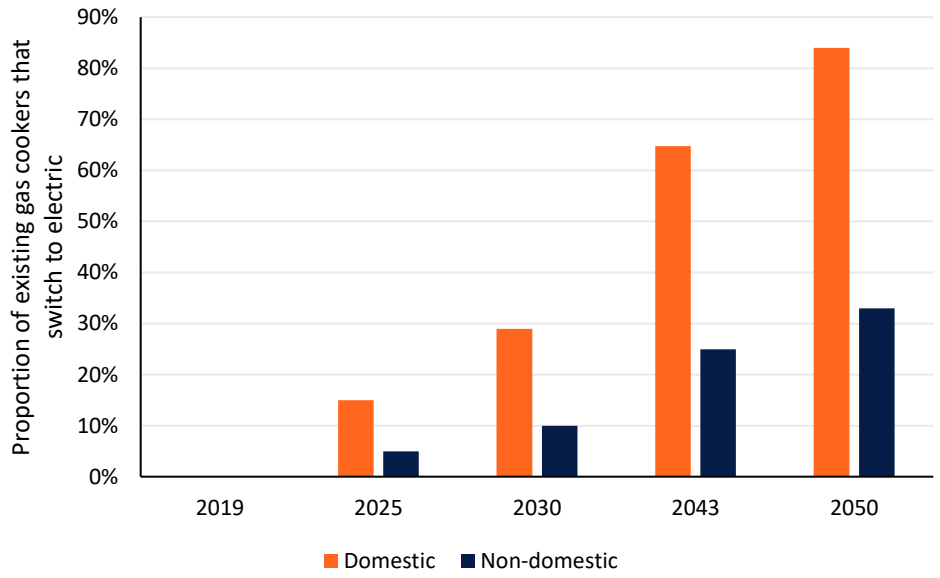


Figure 4.1.7 : Modelled changes in fuel usage type for domestic and by 2050, all cookers are electrified. The graph shows the proportion of systems that switch fuels from gas to electricity; systems that are already electrified are assumed to remain so.

Now	2025	2030	2043	2045
	Electric fuel usage for domestic cooking			
Nationally in 2016, it was estimated that around 45-50% of domestic cooking was electrified.[1]	+15%	+29%	65%	+84%
	Electric fuel usage for non-domestic cooking			
	+5%	+10%	+25%	+33%

[1] Based on underlying fuel consumption data within SCATTER

4.1 BUILDINGS
IMPACT OF ACTION

The below summary highlights the cumulative costs and cumulative carbon savings associated with achieving the High Ambition Pathway in Richmond Upon Thames. The below table highlights these costs and carbon savings for all interventions within this sector. The full methodology used to estimate the costs associated with the buildings sector can be found in Appendix 6.

Year	Carbon Savings	Capex	Opex*
2025	152 ktCO2e	£563.37m	-£0.25m
2030	707 ktCO2e	£910.61m	£47.2m
2043	**3,789 ktCO2e**	**£1.65bn**	**£122.8m**
2050	6,007 ktCO2e	£2.04bn	£112.4m

Important Method Notes and Highlights

Over **75%** of the capital costs to meet the High Ambition pathway are associated with domestic retrofitting, largely external wall insulation costs. These costs include additional fixed costs or planning, scaffolding surveys and hurdle rate. Assumptions relating to domestic retrofitting, which relate to the highest's costs within this sector, are based on BEIS' study for domestic retrofitting costs.

Similarly, over **85%** of cumulative carbon savings come from reducing emissions from Domestic space heating and hot water, as a result of retrofit and heating technology replacement. While savings associated with reduced bills from retrofitting are not estimated in the Opex values, changes in bills are estimated using the Green Books estimates on future energy prices. This leads to an increase in bills of around **£87.6m** by 2043, due to the price difference between Gas and Electric.

Also considered in the additional capital cost of improving the quality of new builds, which requires a capital investment of **£61.1m**.

Co-benefits of action in this sector

1.1 Improving building efficiency:

- **Public health:** More comfortable, liveable buildings. Reduction in excess winter and summer mortality.
- **Financial Savings:** Reduction in resident energy bills- households in Richmond Upon Thames could save up to £23 million a year, creating reductions in fuel poverty and associated inequalities. Similarly, non-domestic buildings such as schools and offices, could save £8 million a year.
- **Local environment:** Improvements to air quality because of more efficient energy consumption.
- **Economic security:** Creation of new jobs and opportunities for skills and training in the low carbon construction sector. Increased investment into low carbon construction businesses.

1.2 Reducing gas heating systems & 1.3 Low carbon and energy efficient cooking, lighting and appliances:

- **Public health:** Reduction in indoor pollution, primarily from gas boilers, which emit roughly 1/5th of the total NOx emissions in the U.K.
- **Economic security:** Creation of new jobs and opportunities for skills and training in the low carbon construction sector. Increased investment into low carbon construction businesses

*Negative opex include savings from purchased fuel/electricity, compared to the BAU scenario

4.1 BUILDINGS
POLICY & STRATEGY REVIEW (1)

How much do these policies and strategies impact implementation of the SCATTER interventions in this sector?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	1.1 Improving Building Efficiency	1.2 Reducing Gas Heating Systems	1.3 Switch to low carbon and energy efficient cooking, lighting and appliances
National	Net Zero Strategy 2021: Lays out the Government's key policies for net zero heat and buildings, including helping businesses and households reduce energy bills.	**Higher Impact:** Sets out steps to improving building efficiency, such as through the Home Upgrade Grant, and the Social Housing Decarbonisation Fund.	**Moderate Impact:** Outline steps to achieving the commitment to phase out gas boilers by 2035 in line with the natural replacement cycle	**Lower Impact:** High level exploration of the role of low carbon appliances
	Future Homes Standard and Future Buildings Standard: Updated building standards setting out pathways to energy efficient domestic and non-domestic new building.	**Higher Impact:** Sets out new requirements of the energy efficiency of new homes and non-domestic buildings.	**Moderate Impact:** Will require new homes to move away from high carbon heating systems by 2025.	**Lower Impact/ Not applicable:** Not covered
Regional	London Plan: Spatial development strategy for the Capital, including frameworks for development of the built environment. See also: London Energy Planning Guidance	**Higher Impact:** Planners and developers "must support the move to more energy efficient buildings". New developments must exceed building regulations in energy efficiency.	**Moderate Impact:** Heat network Priority Areas advocate for a hierarchy of lower carbon heating systems in new developments. Only applicable to new buildings.	**Lower Impact/ Not applicable:** Not covered

4.1 BUILDINGS
POLICY & STRATEGY REVIEW (2)

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	1.1 Improving Building Efficiency	1.2 Reducing Gas Heating Systems	1.3 Switch to low carbon and energy efficient cooking, lighting and appliances
Richmond Upon Thames	Richmond Upon Thames Climate Emergency Strategy (RCES) (2019-2024) summarises the council's priorities in addressing climate change across a range of themes, including the built environment.	**Moderate Impact:** Working with housing providers and landlords to promote energy efficiency and retrofit. Opportunities to engage and support residents more widely.	**Higher Impact:** Commits to go further than the London Plan in designating Heat Network priority Areas	**Lower Impact:** Currently only a high-level commitment on energy efficient appliances in the council's own buildings.
	The Council's Local Plan sets out policies and guidance for the development of the borough over the next 15 years.	**Moderate Impact:** Outlines strategic policies to ensure the council promotes zero carbon development, and promotes retrofit of existing buildings, in line with the London Plan.	**Moderate Impact:** In line with the London Plan, new developments in Heat Network Priority Areas are subject to requirements.	**Lower Impact/ Not applicable:** Not covered
	Policy Gap Summary: Improving building efficiency is the intervention most supported by policy, at the national and regional level. The council has an opportunity to build on this by setting more ambitious building standards that go beyond these. Conversely, the council has taken a leading role in reducing gas heating systems and supporting the roll out of heat networks by looking to go further than the London plan requirements. Support for energy efficient appliances was not meaningfully observed in the key policies reviewed, presenting a substantial policy gap, although it should be noted that this intervention will yield the lowest emissions savings comparatively and requires more behaviour change rather than policy intervention.			

4.1 BUILDINGS
COSTS AND FUNDING - DOMESTIC

Funding gap defined as the likelihood of the necessary level of funding being achieved	
	High Funding Gap
	Medium Funding Gap
	Low Funding Gap

		Funding Gap Analysis			
	Public funding: historic	Private funding: historic	Public funding: challenges/ opportunities/considerations	Private funding: challenges/ opportunities/ considerations	Funding Gap
Low carbon heating	Low levels of Renewable Heat Incentive installations in the borough (although high relative to London boroughs)	No available evidence	Public funding required amongst lower-income households. Current public funding levels are insufficient. Some able-to-pay households won't need public support. As heat pumps reduce in price, the need for public support will diminish	Incentives for private investment don't encourage investment: - Heat pumps worsen EPC ratings - Electricity is currently a lot more expensive than gas High upfront capital costs.	HIGH
Energy efficiency	Low number of households receiving Energy Company Obligation (ECO) funding, no data available on wider energy efficiency funding	No available evidence	Public funding will be necessary particularly in lower income homes Current public funding levels insufficient for scale of problem	Economic incentives are in place for private investment due to energy bill reductions. Differing incentives in private rented sector compared to home owners (although future regulatory changes will affect this) High upfront capital costs.	HIGH (MEDIUM/ HIGH)
Cooking, lighting and appliances	N/A	No available evidence	N/A	Economic incentives for private investment aren't attractive because electricity is more expensive than gas.	MEDIUM
	Summary	There is a high funding gap for domestic buildings in Richmond Upon Thames which suggests an important barrier to achieving the high ambition pathway. Future regulatory changes may leverage in more private investment, but in the near future there is a need for increased public funding. Lower-income households should be encouraged to apply to ECO/ LAD/ HUG funding whilst able to pay households should be encouraged towards the BUS scheme. Awareness raising regarding the benefits of energy efficiency could also result in greater private investment in energy efficiency.			

4.1 BUILDINGS
COSTS AND FUNDING – NON-DOMESTIC

Funding gap defined as the likelihood of the necessary level of funding being achieved	Higher Funding Gap	
	Medium Funding Gap	
	Lower Funding Gap	

	Funding Gap Analysis				
	Public funding: historic	Private funding: historic	Public funding: challenges/ opportunities	Private funding: challenges/ opportunities	Funding Gap
Low carbon heating	Low levels of RHI installations in the borough (although high relative to London boroughs) Some PSDS funding received in Richmond Upon Thames	No available evidence	Current public funding insufficient to achieve necessary deployment for high ambition pathway	Incentives for private investment don't encourage investment: - Heat pumps worsen EPC ratings - Electricity is currently a lot more expensive than gas Upfront capital costs are high	HIGH
Energy efficiency	Some PSDS funding received in Richmond Upon Thames	No available evidence	Current public funding insufficient to achieve necessary deployment for high ambition pathway	Economic incentives are in place for private investment due to energy bill reductions. Differing incentives for private funding in private rented sector compared to home owners	HIGH (MEDIUM/ HIGH)
Cooking, lighting and appliances	N/A	No available evidence	N/A	Economic incentives for private investment aren't attractive because electricity is more expensive than gas	MEDIUM
	Summary	There is a high funding gap for non-domestic buildings in Richmond Upon Thames which suggests an important barrier to achieving the high ambition pathway. Public buildings should continue applying for PSDS funding whilst private buildings should consider funding low carbon heating through the BUS scheme. Awareness raising regarding the benefits of energy efficiency could also result in greater private investment in energy efficiency.			

4.2 Transport

Anthesis

4.2 TRANSPORT
INTRODUCTION

Emissions from transport represent 24% of the borough's emissions profile, making them a key source to target action. Transport emissions in Richmond Upon Thames come almost exclusively from on-road transport, off-road transport creates 0.2% of Richmond Upon Thames's total emissions footprint.

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

- The borough's public transport network is managed by several agencies including TfL, train operating companies and Network Rail.
- 59% of residents use active and sustainable methods of transport such as walking, cycling or public transport. This compares to an average of 63.5% for London boroughs.
- Access to public transport varies across the borough, with Public Transport Accessibility Levels (PTALs), which capture the availability of public transport options, ranging from 6a (the second highest level) in Richmond Upon Thames and 5 in Twickenham, to PTAL 2 and below in most of the borough. There is some correlation between car ownership and PTALs, with lower car ownership levels in Richmond Upon Thames and Twickenham.
- Most trips in the borough do not involve a car – 60% of trips taken by residents are by foot, cycle or public transport.

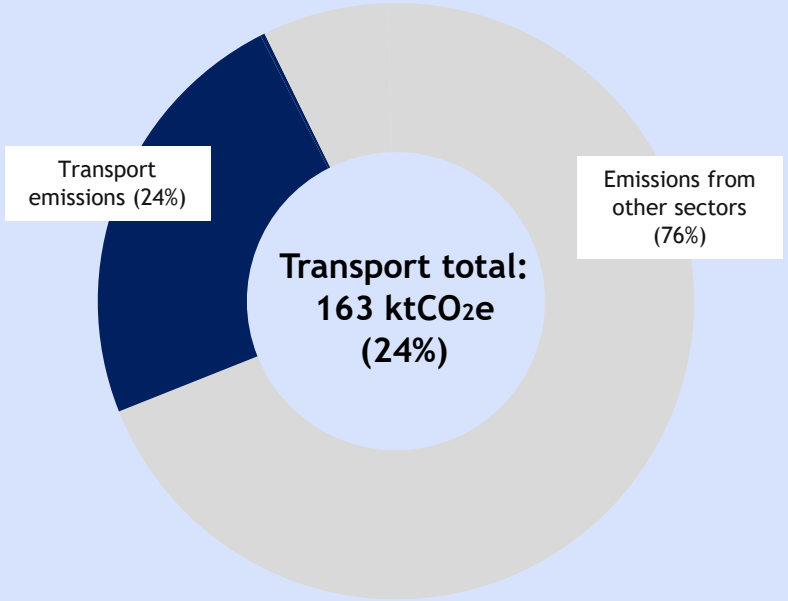


Figure 4.2.1: SCATTER 2019 inventory for the transport sector in the borough.

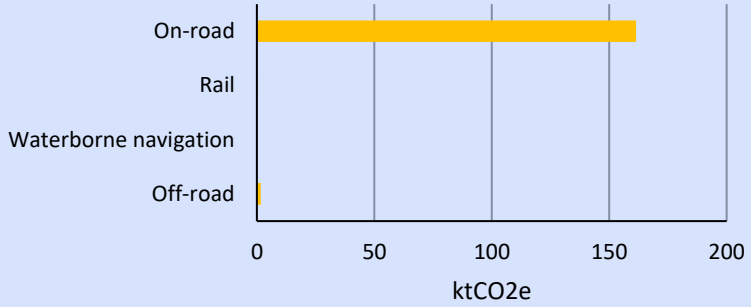
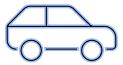


Figure 4.2.2: Scope 1 emissions in the borough's SCATTER 2019 inventory for the transport sector.

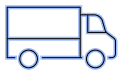
4.2 TRANSPORT
INTERVENTIONS OVERVIEW



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.

THE COUNCIL VIEWS

What factors are considered as <u>barriers</u> to action in this sector?

- The council has multiple roles, including acting as a traffic authority, highway authority and planning authority, and is required to exercise its functions in accordance with the relevant legislation, much of which was written before the climate emergency. The council therefore needs to balance its statutory obligations with the need to cut carbon emissions.
- Separation of powers between the council, and other organisations such as Transport for London and the Department for Transport mean the council's ability to act is limited in many areas.
- Some measures may be opposed by residents on grounds such as affordability or inconvenience.
- Richmond Upon Thames has an older population than many London boroughs, which is an indicator of greater reliance on private cars.
- High cost and low availability of electric vehicles and associated electric vehicle infrastructure.
- Skills and knowledge shortages within the council, particularly relating to the rapidly changing transport landscape, and associated considerations such as electrification of transport infrastructure, data, connectivity and automation.

What factors are considered <u>enablers</u> of action in this sector?

- Strong local leadership is cited as a big enabling factor, and a reason for the success of existing traffic greening measures.

4.2 TRANSPORT
INTERVENTION MILESTONES

2.1 Travel shorter distances

This measure models the reduction in 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 have become receptive to 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.

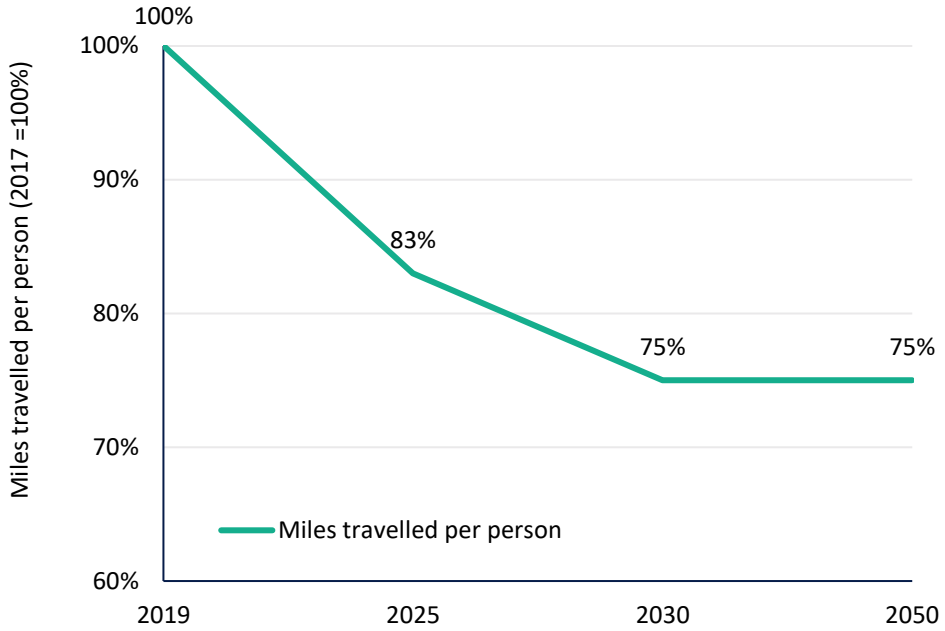


Figure 4.2.3 : Modelled reduction in miles travelled per person per day by car and taxi in the borough. The reduction rate has been applied to available data for cars and taxis to provide a resident car-owner's perspective. Note that this intervention relates to all modes of transport, not car and taxi exclusively.

Current Statistics	Percentage Change	Trend
In 2019, road traffic accounted for 545m vehicle miles. This decreased to 488m miles in 2021. (Source)	-10.46%	
According to the 2021 Census Data, the most common distance travelled to work by residents of Richmond Upon Thames was 5-10km, which accounted for around 8.2% of residents. Notably, 2-5km and 10-20km were also around the 8% mark. (Source)		

4.2 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 the borough 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.

Relative to the rest of the country, a significant share of the population already use active or public transport in London. This is due to the quality of public transport on offer and the inconvenience of driving in London, as well as the impact of policies such as the Congestion Charge (now the ULEZ). Richmond Upon Thames has an ambition to further decrease the proportion of journeys in the borough that are made by car.

LOCAL DECARBONISATION INITIATIVES

Infrastructure for cycling has been improved, with commitments to expand the installations of bike hangars. In September 2022, Committee approved the consultation on and installation of 35 additional bike hangars: 20 were installed in Q4 2022/23 and the remaining 15 will be installed by end summer 2023.

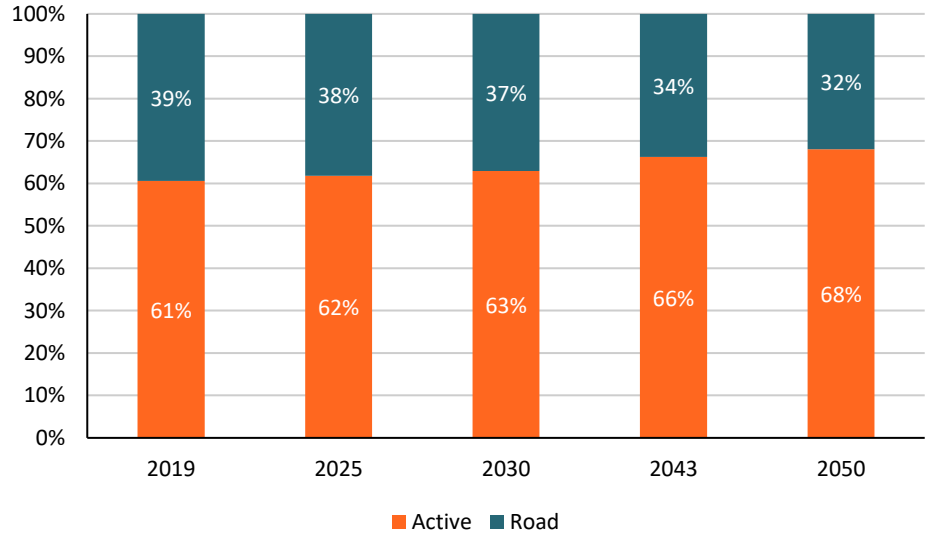


Figure 4.2.4 : Modelled changes in mileage share for different modes of transport along the High Ambition Pathway. The data from the 2019 Richmond Upon Thames Third Local Implementation plan.

Current Statistics	Percentage Change	Trend
In 2019, the proportion of people that actively travelled at least 5 times per week was 49.7%. This has decreased to 44.5% in 2021. (Source)	-10.45%	
In 2019, the number of passenger bus journeys was 2,116m. This has decreased to 1,785m journeys in 2022. (Source)	-15.67%	

4.2 TRANSPORT
INTERVENTION MILESTONES

2.3 Switch to electric vehicles (EV)

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

Data from the DfT and DVLA indicates that in 2019, 1.4% of all registered vehicles were plug in electric, of which, 13% (161 vehicles) were company vehicles, with the other 87% being privately owned.

In London, the ULEZ expansion will have a significant impact on driving forward the phase out of ICE vehicles. The ambition for this intervention, shown in figure 4.2.5 could be achieved as a result of this expansion.

LOCAL DECARBONISATION INITIATIVES

The council has already installed 420 EV charging points. It is increasing the number of public charging points, with 525 to be installed by the end of 2023, and is investigating the provision of cable channels in pavements to allow EV charging at home.

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
PiV - Plug in electric vehicles, these can be hybrid or full electric vehicles.

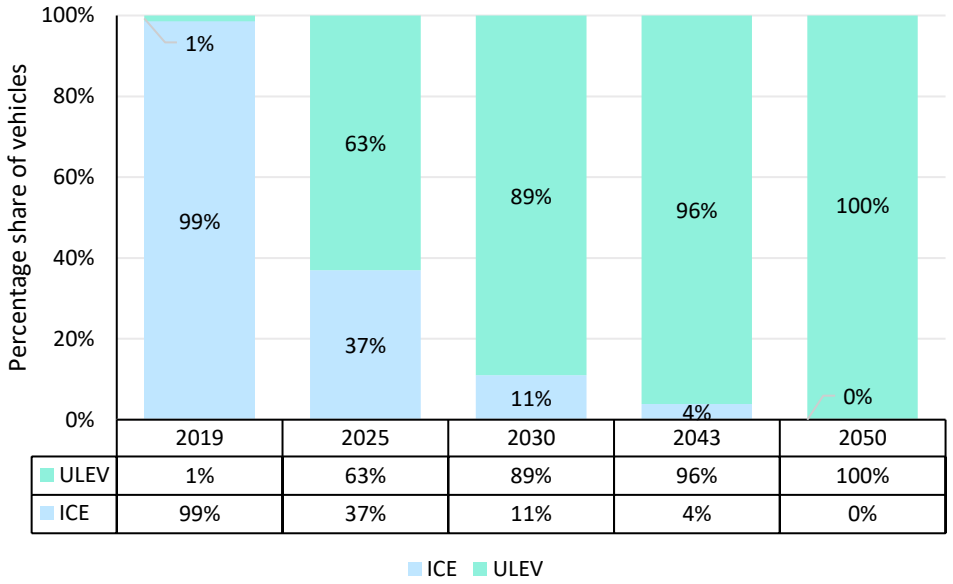


Figure 4.2.5 : Transitioning away from fossil-fuel powered internal combustion engines (ICE) private vehicles to ULEV.

Current Statistics	Percentage Change	Trend
In 2019, 1.4% of all registered vehicles were plug in electric. This has increased to 5% in 2022. (Source)	253%	
In the FY 2019/20, the number of public EV charging points available was 284. This has increased to 390 by Apr-2023. (Source)	37%	
In the FY 2019/20, the number of charge points installed under the Home charging scheme was 150. This has increased to 215 by Apr-2023. (Source)	168%	

4.2 TRANSPORT
INTERVENTION MILESTONES

2.4 Freight emissions

Freight emissions are difficult to tackle, posing challenges both in terms of operational technology and emissions accounting. SCATTER operates on three metrics 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 modal shift from road freight to waterborne transport.

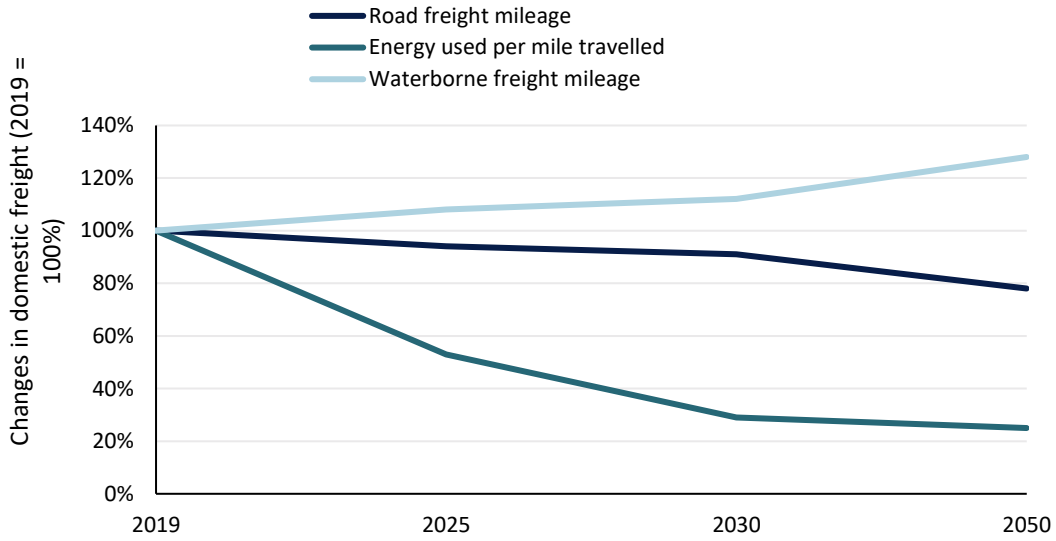


Figure 4.2.6: Improving freight emissions across three areas of activity. Percentage changes are relative to a 2019 baseline at 100%.

LOCAL DECARBONISATION INITIATIVES

Richmond Upon Thames is supporting the use of e-cargo bikes across the borough. The council successfully applied for grant from DfT for nine cargo bikes for local businesses for use for deliveries and other services. This included a cargo bike for Achieving for Children and cargo bikes for the Inspection and Enforcement, Trees and Libraries teams. These bikes have helped take hundreds of miles of motor traffic off the roads.

Current Statistics	Percentage Change	Trend
In 2019, 0.4% of all registered HGVs/LGVs were plug in electric. This has increased to 1.4% in 2022. (Source)	256%	

4.2 TRANSPORT
IMPACT OF ACTION

The below summary highlights the cumulative costs and cumulative carbon savings associated with achieving the High Ambition Pathway in Richmond Upon Thames. The below table highlights these costs and carbon savings for all interventions within this sector.

Year	Carbon Savings	Capex	Opex
2025	123 ktCO2e	£75.76m	-£38.62m
2030	411 ktCO2e	£178m	-£173.24m
2043	**1,199 ktCO2e**	**£479.09m**	**-£1.04bn**
2050	1,560 ktCO2e	£643.04m	-£1.26bn

Important Method Notes and Highlights

Costs associated with the transport intervention are based on the CCC's total marginal capital and opex costs report. These UK-wide costs have been adjusted to fit the SCATTER interventions and scaled down to Richmond Upon Thames based on the proportion of registered vehicles and vehicle types within the borough.

These costs cover capital infrastructure costs for personal vehicles, freight vehicles and rail, the capital costs of these new vehicles, and operational savings from reduced mileage, efficiencies in newer models, and modal shift. A significant portion of the costs savings come from switching to electric cars.

Fuel cost savings from transitioning to electric vehicles is estimated to save around **£879.9m** by 2043.

Co-benefits of action in this sector

2.1 Travel shorter distances:

- **Economic security:** Improved connectivity brings increases to land value as well as reach of local businesses. Supports economic growth of local businesses and could provide more local jobs.
- **Council services:** Decreased congestion and delays from more efficient use of transport networks. Improved resident participation in the community and improved access to services locally.
- **Public health:** Reduction in air pollution related illnesses. Poor air quality has been shown to cause at least 4,000 pre-mature deaths annually in London Increased uptake in active travel improves public health.

2.2 Drive less:

- **Public health:** Public transport provision improves accessibility of the borough for more people. Active transport provision reduces burden on healthcare (physical inactivity is associated with 1 in 6 deaths in the UK) and improves health outcomes.

2.3 Switch to electric vehicles & 2.4 Reduce freight emissions:

- **Local environment:** Decreased use of ICE vehicles has direct benefits to air quality, and in reductions in noise.
- **Public health:** Reduced air and noise pollution brings improvements to physical and mental health outcomes.
- **Council services, economic security:** Improvement in affordability of EVs over time brings operational financial savings.
- **Economic security:** Opportunities for investment and new jobs in businesses supplying low carbon transport options e.g. e-cargo bike deliveries.

4.2 TRANSPORT
POLICY & STRATEGY REVIEW (1)

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	2.1 Travel shorter distances	2.2 Drive Less	2.3 Switch to electric vehicles	2.4 Reduce freight emissions
National	Transport Decarbonisation Plan: Represents the Government's plans to decarbonise the transport system nationally.	**Lower Impact:** Some exploration of the role of place in decarbonisation. Less practical action to drive change.	**Moderate Impact:** Commitments around walking and cycling infrastructure. It aims that "half of all journeys in towns and cities will be cycled or walked by 2030".	**Higher Impact:** Commits to phasing out of all new non-zero emissions road vehicles by 2040.	**Moderate Impact:** Plans for a decarbonised freight system, incentivising low emissions freight vehicles. "Last mile" explored at high level.
Regional	Mayor's Transport Strategy: Aims for 80% of all London journeys to be completed on foot, by bike or public transport by 2041. The three key themes of the strategy focus on healthy streets and healthy people, good public transport experience and new homes and jobs.	**Higher Impact:** Active travel and creating high-density, mixed-use spaces are considered in planning. "Liveable Neighbourhoods" is improving conditions for walking, cycling, and public transport use at a neighbourhood level.	**Higher Impact:** Reducing car use is a key tenet, with the goal of 80% of all London journeys to be completed on foot, by bike or public transport by 2041.	**Moderate Impact:** Some plans to improve electric vehicle infrastructure.	**Higher Impact:** More efficient freight is considered in new developments. Using local access and loading restrictions is also considered.
	London Plan: Spatial development strategy for the Capital, including frameworks for development of transport infrastructure.	**Higher Impact:** Plan aims to rebalance transport system towards travelling walking cycling and public transport. Focus on car alternatives are more affordable and appealing. Further detail provided in Mayor's transport strategy.		**Moderate Impact:** Scheme in place to improve electric vehicle charging infrastructure. Policy T7C supports charging infrastructure.	**Moderate Impact:** Acknowledges need to minimise freight. Freight consolidation programme 2017-2041 in place.
	TfL's Walking Action Plan sets out actions to reduce reliance on cars and public transport in the city	**Higher Impact:** Includes exploration of options for planning and infrastructure to make neighbourhoods more walkable.		**Lower Impact/ Not applicable**	**Lower Impact/ Not applicable**

4.2 TRANSPORT
POLICY & STRATEGY REVIEW (2)

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	2.1 Travel shorter distances	2.2 Drive Less	2.3 Switch to electric vehicles	2.4 Reduce freight emissions
Regional	TfL's Healthy Streets Approach: Outlines an approach to London to prioritise active travel and public transport, promoting healthy outcomes	**Higher Impact:** Outlines plans to help London become a city where residents can choose to walk, cycle and use public transport. Explores policy and planning options, referencing the London Plan.		**Lower Impact/ Not applicable**	**Moderate Impact:** Come consideration of lowering freight impact
	LEZ, ULEZ, CC Zones: Transport for London zones regulate vehicle usage and emissions within London. Zero Emission Zones: Tools supporting boroughs to create town centres zero emission zones (ZEZ). Plan to create central London a ZEZ from 2025.	**Lower Impact:** Low emissions zones may disincentivise shorter journeys.	**Moderate Impact:** Low Emissions Zones may disincentivise car journeys, where alternatives exist.	**Higher Impact:** Electric vehicles are exempt from all low emissions zones.	**Moderate Impact:** Larger vehicles, including those used for freight, will need to pay for the LEZ, when it comes in.
Richmond Upon Thames	The Council's new Local Plan will set out policies and guidance for the development of the borough over the next 15 years.	**Higher Impact:** Includes the goal of improving designing and planning for walking, to reduce journey distances and the need for cars.		**Lower Impact/ Not applicable**	**Lower Impact/ Not applicable**
	Richmond Upon Thames Climate Emergency Strategy (RCES) (2019-2024) summarises the council's priorities in addressing climate change across a range of themes, including transport.	**Moderate Impact:** Some consideration of accessibility of public transport, lower level of commitment here.	**Higher Impact:** Commits to driving a shift in residents away from private cars	**Higher Impact:** Commits to developing electric vehicle charging infrastructure	**Lower Impact/ Not applicable**
	The Air Quality Action Plan covers the actions intended to tackle air pollution in the Borough from 2019-2024.	**Higher Impact:** Multiple related commitments. Includes introduction of a clean air zone in Richmond Town Centre, along with investments in cycling infrastructure.		**Moderate Impact:** Advocates for continued roll out of EV infrastructure	**Lower Impact/ Not applicable**

4.2 TRANSPORT
POLICY & STRATEGY REVIEW (3)

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	2.1 Travel shorter distances	2.2 Drive Less	2.3 Switch to electric vehicles	2.4 Reduce freight emissions
Richmond Upon Thames	The Electric Vehicle Charging Strategy sets out steps to increasing charging availability in the borough, from 2016-2026	**Lower Impact/ Not applicable**	**Lower Impact/ Not applicable**	**Higher Impact:** Outlines specific vision and actions to drive EV uptake.	**Lower Impact/ Not applicable**
	Richmond Cycling Strategy sets out the borough's approach to improving cycling rates, from 2016-2026	**Lower Impact/ Not applicable**	**Higher Impact:** Includes actions and Implementation plan to drive cycling uptake.	**Lower Impact/ Not applicable**	**Lower Impact/ Not applicable**
	The Active Travel Strategy promotes and enable space-efficient, non-polluting modes of travel.	**Lower Impact/ Not applicable:** Less consideration of reducing journey times overall.	**Higher Impact**: Multiple measures outlined to improve access to, and use of, low carbon transport.	**Lower Impact/ Not applicable**	**Lower Impact/ Not applicable**
	Policy Gap Summary: Interventions around driving shorter distances and reducing car usage are well supported, particularly at the regional and local level, looking to go beyond national policy. Many strategies offer solutions which address both needs together, but reducing car use and increasing active travel is particularly well supported. There are opportunities to go further in developing policies which support a reduced need for travel, for instance through consideration of "liveable neighbourhoods" in planning. Policies to drive electric vehicle uptake are seen at all levels, but generally the former interventions take precedent in a bid to reduce congestion and given the accessibility of public transport in the borough. The is an opportunity to develop more policy to support reductions in freight emissions.				

4.2 TRANSPORT
COSTS AND FUNDING

Funding gap defined as the likelihood of the necessary level of funding being achieved	Lower Funding Gap	
	Medium Funding Gap	
	Higher Funding Gap	

	Funding Gap Analysis				
	Public funding: historic	**Private funding: historic**	Public funding: challenges/ opportunities	Private funding: challenges/ opportunities	Funding Gap
Travel shorter distances and decrease number of driving trips	Previous investment has come from Transport for London (include comment on scale) for active travel measures.	N/A	Reliant on TfL funding which is insufficient for proposed works in the Third Local Implementation Plan	N/A	HIGH
Switch to electric vehicles (purchase of electric vehicles)	Public grant support for electric vehicles (Plug-in Car Grant) was removed in 2020. TfL offering scrappage scheme for ULEZ.	There has been significant investment in electric vehicles from households throughout the country (including Richmond Upon Thames).	ULEZ scrappage scheme potentially not generous enough. Benefit in Kind opportunities of company cars also creating a second-hand market.	Private purchases should continue to be strong due to ULEZ and national policy. Public perception of electric vehicles could hold back investment (i.e. EV reliability).	MEDIUM
Switch to electric vehicles (charge-points)	Investment in charging devices has come from the public (EV Chargepoint Grant) and private sector across the UK. Richmond Upon Thames is ahead of the national average.	Investment in charging devices has come from the public and private sector across the UK. Richmond Upon Thames is ahead of the national average for charge points.	Competitive national investment funding pots make sourcing public funding challenging.	Increased private funding likely to take place due to positive business cases of charging provision.	MEDIUM
Reducing freight emissions	Historically there has been little evidence of investment to reduce freight emissions from the public or private sectors. There has been some investment in 'last mile' delivery to lower freight emissions.		Public investment is required from national government (e.g. for low carbon trains)	Phase-out dates of zero emissions HGVs will stimulate private investment.	Unable to assess
	Summary	Relative to the rest of the country, there has been a proportionately higher level of public and private funding into electric vehicles and their infrastructure in London. This is true of Richmond Upon Thames. However, to achieve the 'Higher Ambition' pathway for the borough there will need to be a significant further increase in investment. The greatest funding gap relates increasing rates of active travel and reducing average driving distances, this is contingent on TfL funding and many important projects in the borough remain unfunded.			

4.3 Industry

4.3 INDUSTRY
INTRODUCTION

Industrial process emissions represent around 5.5% of emissions in the borough, with industrial buildings representing 10.3% of all emissions. The emissions associated with industrial buildings are considered here and not in the buildings sector as the industrial interventions, highlighted below, apply to industrial buildings, rather than the typical interventions for domestic and non-domestic sites. Industrial buildings, as classified by DESNZ, cover SIC codes 02-32, 35-39 and 42. This covers some areas of section A (Forestry and Fishing), section B (Mining and Quarrying), section C (Manufacturing of goods), section E (Water supply, Sewerage, Waste Management and Remediation) and some of section 4 (Construction).

Industry in Richmond Upon Thames:
Our research showed that while the borough contains several small industrial estates, In this chapter, we therefore present the outputs of the SCATTER modelling for completeness but there are no major energy intensive industrial activities locally. SCATTER also apportions IPPU emissions based on national data. Given the research into the types of industry within Richmond Upon Thames, it is likely these emissions, shown in figure 4.3.2, are ***not occurring*** within the borough. As a result, we have not explored the implementation (policy gap, etc.) of such interventions. It should also be noted that tackling industrial emissions can be very challenging, particularly the decarbonisation of very energy-intensive processes and reducing the emissions from the processes themselves.

Interventions Overview: 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").

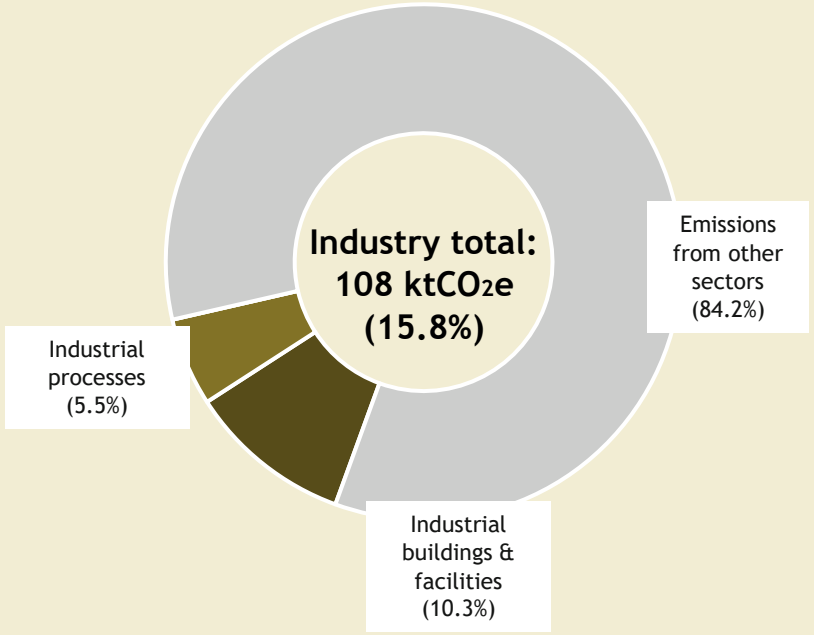


Figure 4.3.1: SCATTER 2019 inventory for the industry sector in the borough.

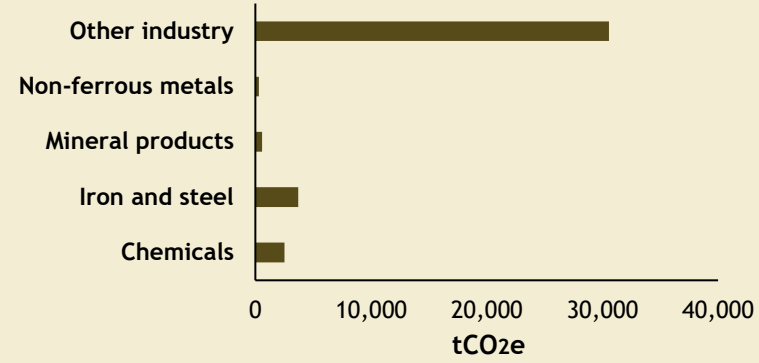


Figure 4.3.2 : Emissions in the borough's SCATTER 2019 inventory, associated with industrial processes, which use nationally apportioned data.

4.3 INDUSTRY
INTERVENTION MILESTONES

3.1 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]

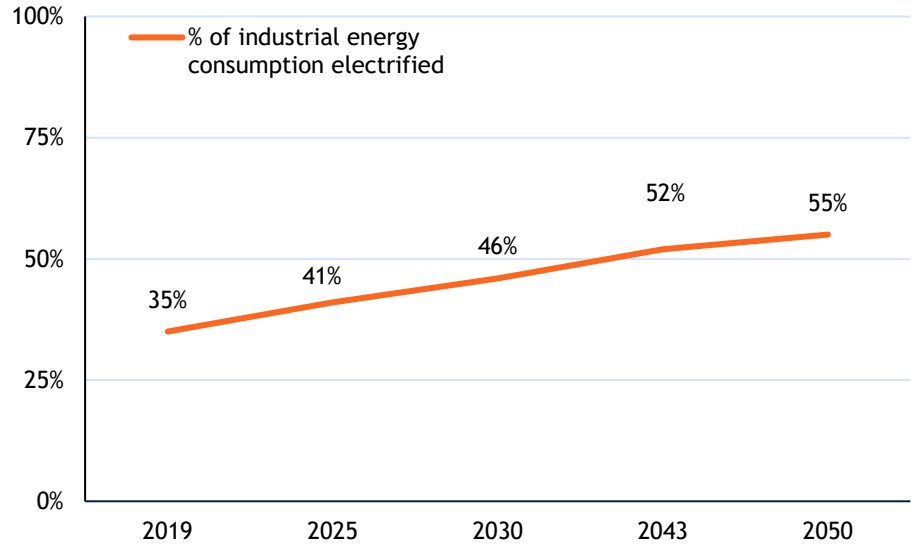


Figure 4.3.3 : Modelled changes in industrial fuel use. Percentage figures relate to emission reductions or increases against the 2020 baseline.

3.2 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 the borough 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). The council can ensure that the council has a programme in place for supporting efficiency improvements within local industry. Across the borough, 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.

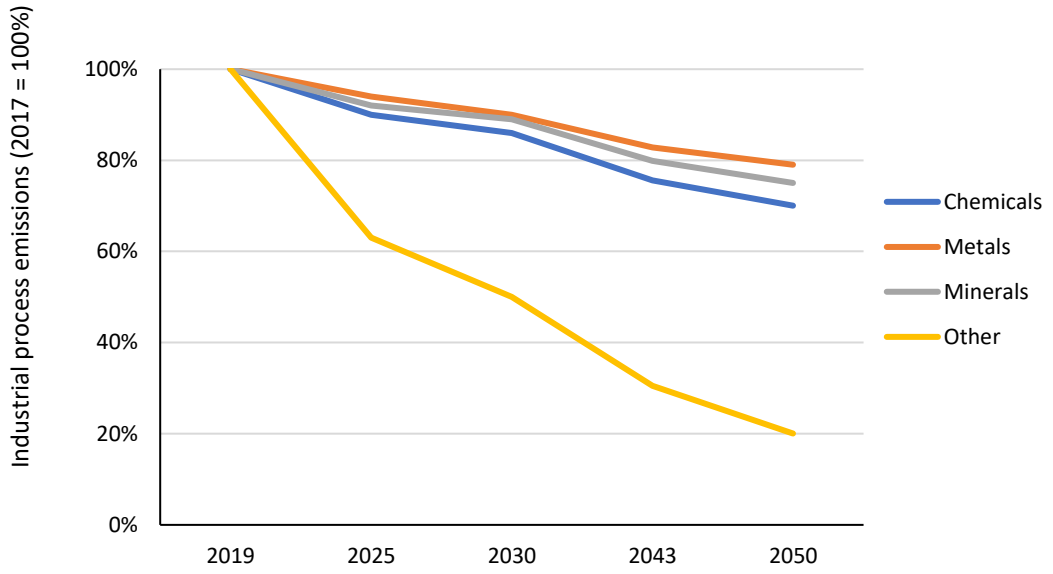


Figure 4.3.4 : Modelled changes in industrial process emissions. Percentage figures in the data table relate to emission reductions against the 2020 baseline.

[1] DUKES Energy Consumption by final user

4.3 INDUSTRY
IMPACT OF ACTION

The below summary highlights the cumulative costs and cumulative carbon savings associated with achieving the High Ambition Pathway in Richmond Upon Thames. The below table highlights these costs and carbon savings for all interventions within this sector.

Year	Carbon Savings	Capex	Opex
2025	37,197 tCO2e	£0.42m	NE
2030	125,193 tCO2e	£0.77m	NE
2043	**495,455 tCO2e**	**£1.69m**	**NE**
2050	759,118 tCO2e	£2.18m	NE

Important Method Notes and Highlights

Carbon Savings are associated with the reduction in industrial buildings emissions, with the largest savings coming from the decarbonisation of industrial gas. Savings are significant here as SCATTER models an increase in industrial production in a Business-As-Usual scenario. This also includes the reduction in industrial process emissions, the largest of which being 'Other Industry'.

The costs estimated here are scaled-down costs based on the Industrial Decarbonisation & Energy Efficiency Roadmap to 2050, using the proportion of industrial fuel consumption in Richmond Upon Thames. This industrial fuel consumption equates to 0.021% of the UKs industrial fuel consumption.

Operational costs are not estimated for this sector.

4.4 Waste

Anthesis

4.4 WASTE
INTRODUCTION

Waste management represents a much smaller proportion of Richmond Upon Thames's emissions than the sectors previously discussed, representing 1.3% 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 borough boundary, whether treated inside or outside the borough boundary, to be included within the inventory and pathways analysis for the borough. This covers all waste generated across the borough excluding business waste collected by private organisations.

KEY LOCAL CONTEXT

- The borough is part of West London Waste Authority (WLWA), which also disposes of waste and recycling collected by the London boroughs of Brent, Ealing, Harrow, Hillingdon and Hounslow.
- Richmond Upon Thames is home to Townmead Road Reuse and Recycling Centre, a recycling centre that can be used by residents from Richmond upon Thames and other West London Waste Authority (WLWA) boroughs (Brent, Ealing, Harrow, Hillingdon, Hounslow).
- The new pay-as-you-feel community café aims to combat food waste by taking surplus food from local restaurants, supermarkets, and food suppliers and turning it into meals to be distributed back into the local community. This is now the second pay as you feel community café.
- The council offers on-street textiles and electricals collection for recycling. The council has also introduced a food waste recycling scheme.

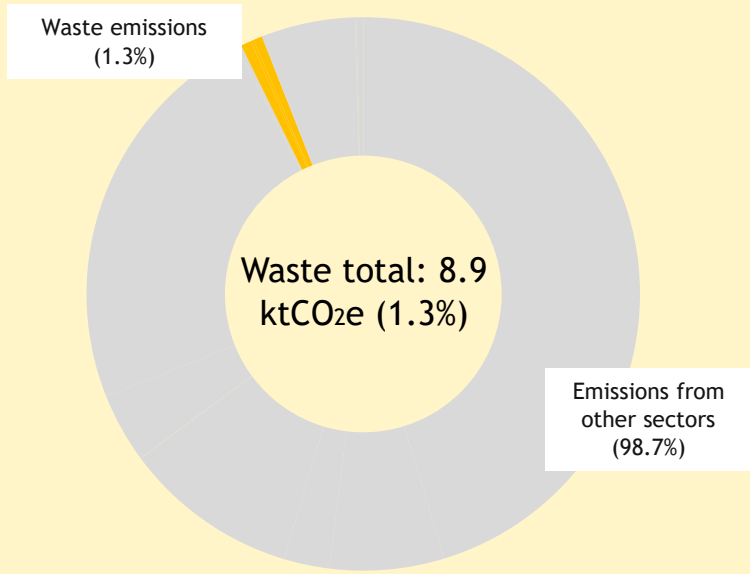


Figure 4.4.1: SCATTER 2019 inventory for the emissions from waste from households, any commercial or institutional sites, and construction and demolition waste collected by the Council.

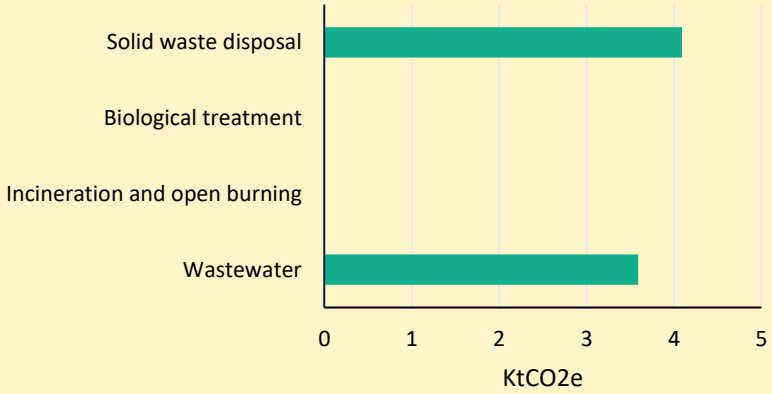


Figure 4.4.2: Scope 1 emissions in the borough's SCATTER 2019 inventory for the waste sector.

4.4 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.

4.1 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.

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

THE COUNCIL VIEWS

What factors are considered as barriers to action in this sector?

- The council has cited its procurement process as playing an important role in developing and promoting a Circular Economy by working with partner suppliers.
- Richmond Upon Thames has a growing population, which brings more waste into the borough.

What factors are considered enablers of action in this sector?

- Political will amongst councillors in relation to the topic of waste is considered strong.
- Waste contracts could be combined to increase efficiencies and savings rather than separate as they currently are, which is a benefit of having the separate service agreements
- The introduction of the Environment Act is expected to improve waste collection processes

4.4 WASTE
INTERVENTION MILESTONES

4.1 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 the borough, each resident generated an estimated 911kg of household waste from April 2020 to March 2021. Across the borough, 44% 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.

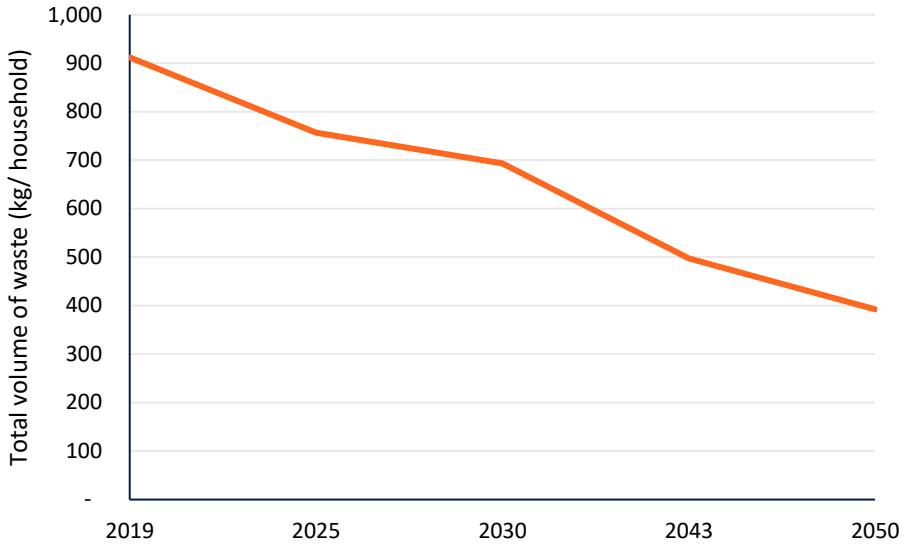


Figure 4.4.3 : Modelled changes in volume of waste in kilograms per household.

LOCAL DECARBONISATION INITIATIVES

Richmond Upon Thames has been working on campaigns to reduce waste and encourage the circular economy in recent years. A “Love Food, Hate Waste” campaign was launched in 2019 whilst the council itself has banned single use plastics from its sites.

Additionally, Richmond Upon Thames is leading on London-wide plastics work as part of the One World Living London Councils climate programme reducing consumption-based emissions.

Current Statistics	Percentage Change	Trend
In FY2019, the total household waste produced amounted to 75,172 tonnes. In FY2021, this total reduced to 73,377 tonnes. (Source)	-2.39%	
In FY2019, the total non-household waste produced amounted to 12,384 tonnes. In FY2021, this total reduced to 6,776 tonnes. (Source)	-45.28%	

4.4 WASTE
INTERVENTION MILESTONES

4.2 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. Current recycling rates in Richmond Upon Thames are relatively low, this is in part due to the makeup of the residential building stock (flats with minimal space for recycling.

SCATTER trajectories incorporate ambitious EU targets for recycling rates (65% by 2035 and 85% by 2050). The High Ambition scenario projects a more rapid transition to increased rates of recycling. The growth in recycling rate across the borough that is required in order to follow the High Ambition pathway is illustrated in Figure 3.1.

LOCAL DECARBONISATION INITIATIVES

Richmond Upon Thames adopted a supplementary planning document which seeks to ensure that all new developments have sufficient and suitable space for the separate storage of waste and recycling within developments along with suitable collection access to that space.

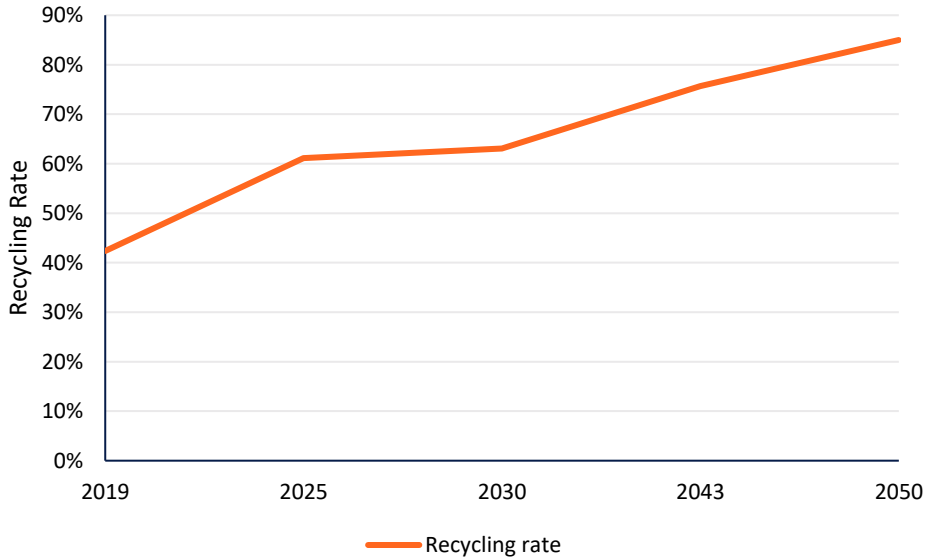


Figure 4.4.4 : Modelled changes in the areas household recycling rate.

Current Statistics	Percentage Change	Trend
In FY2019, the household recycling rate was 43.6%. In FY2021, this reduced to 40.8%. (Source)	-6.42%	
In FY2019, there were 2,887 fly tipping incidents. This has decreased to 2,569 reported incidents in 2021. (Source)	-11.01%	

4.4 WASTE
IMPACT OF ACTION

The below summary highlights the cumulative costs and cumulative carbon savings associated with achieving the High Ambition Pathway in Richmond Upon Thames. The below table highlights these costs and carbon savings for all interventions within this sector.

Year	Carbon Savings	Capex	Opex
2025	924 tCO2e	NE	-£1.84m
2030	5,219 tCO2e	NE	-£7.82m
2043	**39,352 tCO2e**	**NE**	**-£54.55m**
2050	73,993 tCO2e	NE	-£106.91m

Important Method Notes and Highlights

The costs savings are associated with the reduction in gate fees for disposal to Landfill, Recycling sites (MRF) and Incineration sites (for EfW). Gate fee costs are modelled using average historic costs.

Capex and other costs associated with the refuse collection and waste management facilities are not estimated. The carbon associated with waste treatment facilities is included in withing buildings emissions and therefore nor accounted for here.

Co-benefits of action in this sector

4.1 Reducing the quantity of waste and wastewater:

- **Public health:** Improvements in health due to reduction in flow of waste into the environment.
- **Local environment:** Improved air quality and reduced water and land contamination. Reduction in use of natural resources to develop products.
- **Economic security:** More circular local economy provides financial relief to lower-income residents and businesses. Opportunities for investment in circular economy business.

4.2 Increasing recycling rates:

- **Local environment and public health:** Improved air quality and reduced water and land contamination.
- **Economic security:** Reduced demand for raw materials yields cost savings through efficiency gains. Improved efficiency of processing can reduce energy demand resulting in lower bills for businesses. Friends of the Earth estimate that if a target of 70% recycling rate is reached across the UK it could create 50,000 new jobs in the UK.

4.4 WASTE
POLICY & STRATEGY REVIEW

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	4.1 Reduce quantity of waste and wastewater	4.2 Increase recycling rates
National	Waste Prevention Programme for England: Reduce quantity and impact of waste produced, whilst promoting sustainable economic growth.	**Higher Impact:** Focus of the programme is on preventing waste, with actions around driving better product design, and extended producer responsibility.	**Low Impact/Not Applicable:** In line with the waste hierarchy, focus is on preventing waste to avoid the need to recycling, rather than improving recycling infrastructure.
	Our waste, Our resources: A Strategy for England: Sets out how the country will preserve resources by minimising waste, promoting resource efficiency and moving to a circular economy.	**Higher Impact:** Chapters 1 and 2 advocate for changes among both producers and consumers to reduce waste production in line with the waste hierarchy.	**Moderate Impact:** Chapter 3 sets out aspirations around driving improved household recycling rates, with the goal of helping rates increase, but the focus is on reduction.
Regional	London Environment Strategy is an integrated environment strategy setting out actions for achieving improvements in London's environment.	**Higher Impact:** Outlines the Mayor's approach to municipal waste management. Promotes a circular economy approach.	**Higher Impact:** Sets out a pathway to achieving a municipal recycling target of 65 per cent by 2030
	London Plan: Spatial development strategy for the Capital, including exploration of options for reducing waste and supporting the circular economy.	**Moderate Impact:** Advocates for implementation of circular economy principles. Includes consideration of municipal and business waste, and construction waste. No exploration of wastewater.	
Richmond Upon Thames	Richmond Upon Thames Climate Emergency Strategy (RCES) (2019-2024) summarises the council's priorities in addressing climate change across a range of themes, waste.	**Moderate Impact:** Outlines high level plans to reduce council organisational waste, and to work with stakeholders across the borough to reduce the overall quantity of waste generated. No indicators for progress in circular economy set.	**Higher Impact:** Outlines a commitment to put in place a new waste and recycling contract from 2020 which will offer improved recycling collections, including for household waste, and bulky and electronic items.
	Policy Gap Summary: The council has taken an active role in applying the principles of the circular economy in the borough with a view to reducing the quantity of waste, including through resident engagement, and looking at the council's own direct impact. There is a lack of quantitative indicators of progress in this space at all levels. These could be implemented to help drive further ambition. With a focus on reduction, recycling rates could be considered secondary, particularly at national level. Regionally, there are targets set to improve uptake, and some action by the council to improve rates. There may be an opportunity to lobby government for further support and ambition in this space.		

4.4 WASTE
COST AND FUNDING

Funding gap defined as the likelihood of the necessary level of funding being achieved	Lower Funding Gap	
	Medium Funding Gap	
	Higher Funding Gap	

		Funding Gap Analysis			
	Public funding: historic	**Private funding: historic**	Public funding: challenges/ opportunities/ considerations	Private funding: challenges/ opportunities/ considerations	Funding Gap
Reducing quantity of waste	If measures in RCES have been carried out, then past/ current funding should have been sufficient.	N/A	The funding will come from the Richmond Upon Thames's budget, there are no available government grants as in other sectors.	N/A	Not enough evidence to determine if there is a funding gap
Increasing recycling rates	If measures in RCES have been carried out, then past/ current funding should have been sufficient.	N/A	The funding will come from the Richmond Upon Thames's budget, there are no available government grants as in other sectors.	N/A	Not enough evidence to determine if there is a funding gap
	Summary	Funding to decarbonise the waste sector will come almost exclusively from the borough itself. In order to achieve the significant reductions in the quantity of waste and increases in recycling rates necessary to achieve the sector's emissions reductions, high levels of investment will need to be made by the borough.			

4.5 Natural Environment

Anthesis

4.5 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 the borough, such as net biodiversity gain, improved air quality and improving quality of place. Natural infrastructure also plays an important role in ensuring that the borough is reliant to climate risks of flooding and can lower the urban heat island effect.

The net contribution of emissions from the natural environment to the borough's overall emissions total is negative. Just over **3,000 tCO2e** are sequestered through open grassland, with just under **2,900 tCO2e** being sequestered through land use classified as forestry.

KEY LOCAL CONTEXT

- The borough is one of the greenest London boroughs with over 57% of the borough as green open space, including over 130 Council owned and managed parks. 27 Council owned sites are managed primarily for nature conservation and many more are partially managed for biodiversity and wildlife. The Council Parks Service is directly responsible for the management of over 25% of this land.
- Although it is host to a large area of parkland, the council has limited control over the management of all of these- Richmond Park, and Bushy Park, for instance, are managed by The Royal Parks.
- A period of significant investment has seen the standard of parks and facilities improve, as recognised by a series of awards including the Green Flag award. There are currently over seventy Friends' groups in the borough.
- There are increasing demands on land for new housing, schools, industry, commerce and recreation which could potentially threaten habitats and species.
- There are twenty-four allotment sites across the borough.
- Within its highways and parks the Council is responsible for over 25,500 trees, 107 hectares of woodland and 12.5 kilometres of wooded towpath.

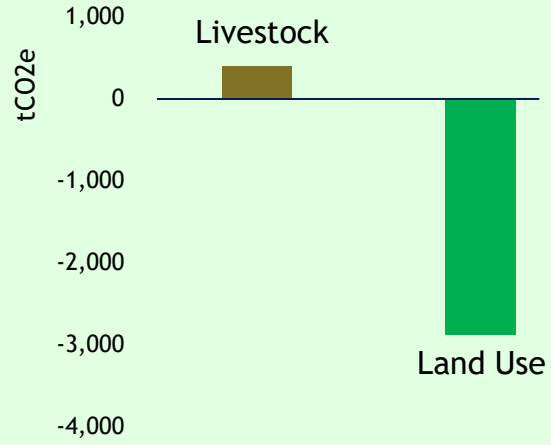


Figure 4.5.1 : SCATTER 2019 inventory for the natural environment in the borough. This is not visualized as a pie chart due to the negative emissions.

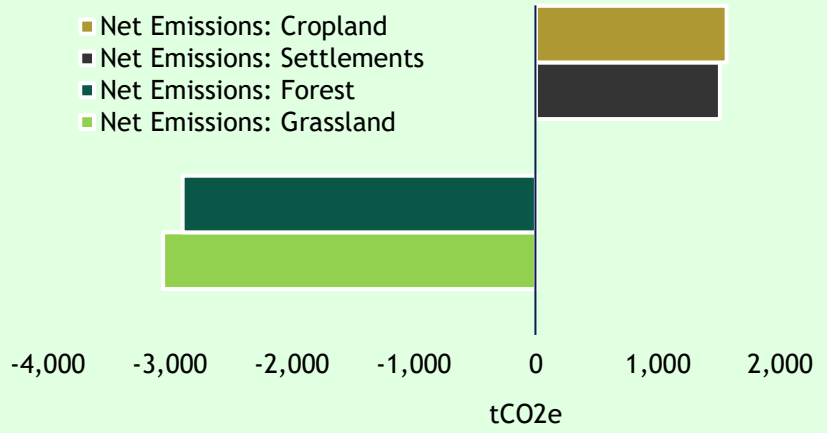


Figure 4.5.2 : SCATTER 2019 breakdown of land use emissions

[1] Urban Extent of Local Authorities, ONS

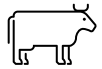
[2] Department for Environment, Food and Rural Affairs - Structure of the agricultural industry

4.5 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:

5.1 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.

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



5.3 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.

THE COUNCIL VIEWS

What factors are considered as barriers to action in this sector?

- As a built-up London borough, there is a lack of space within existing streetscapes and developments to enable installation of features such as green walls and verges, and even plant new trees.
- Demand from key infrastructure (requirements such as transport and utilities) presents competing priorities when taking local action.
- A shortage of available land for development in the borough can put pressure on existing green space to be developed.
- With a growing population, parks and other parts of the natural environment are under increasing usage and vulnerable to damage.

What factors are considered enablers of action in this sector?

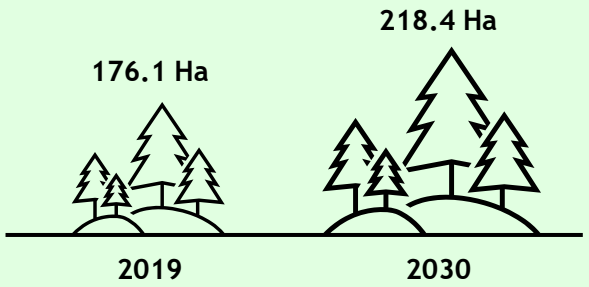
- The role of community groups such as Habitats and Heritage, can play a strong role in driving improvements to the natural environment.
- Growing awareness of social value and health benefits of access to parks and open spaces upon the health and wellbeing of the population helps to build the case for protecting and enhancing them.
- Improved information around the health of the natural environment based on local wildlife surveys can help to show the current health of ecological assets and develop an evidence base for protecting and enhancing these areas.

4.5 NATURAL ENVIRONMENT
INTERVENTION MILESTONES

5.1. Increased tree coverage and tree planting

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 tree estimates have been removed from SCATTER modelling due to an issue in the underlying assumptions.*

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.



The SCATTER intervention for forestry and woodland results in a **24%** increase in coverage by 2030. Figure 4.6.3 shows this increase of **42.26Ha** of woodland. **Note, the 2019 starting point for Ha of woodland is based on 2018 data. SCATTER models increases up to 2030 only, and remains constant to 2043 and 2050 respectively.*

5.2. 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 the DECC 2050 emissions calculator have been mapped to the borough, which includes a **7%** decrease in grassland by 2050.

This intervention is not visually presented due to the lower impact of other land use types outside of woodlands, highlighted in the first intervention, but its implementation is explored on the following pages.

5.3. 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. The intervention models a **0.5%** decrease in livestock annually.

This intervention is covered here for completeness but is not visually presented or explored further due to its low impact, and limited livestock across the borough of Richmond Upon Thames.

Current Statistics	Percentage Change	Trend
In 2018*, the total land area classified as Forestry or Woodland totalled 176.1 Ha. This decreased to 172.9 Ha in 2022. (Source)	-1.82%	↘
In 2018, there were a recorded 21,991 Local Authority maintained trees in Richmond Upon Thames. (Source)		
In 2018, the proportion of land classified as 'Non-Developed' was 72%. This has decreased to 71.3% in 2022. (Source)	-0.96%	↘
In 2018, the proportion of land classified as 'Agricultural' was 0.6%. This has increased to 4.2% in 2022. (Source)	601%	↗

**At the time of this analysis, Land Use data was only available for 2018 and 2022 from DLUHC.*

4.5 NATURAL ENVIRONMENT
IMPACT OF ACTION

The below summary highlights the cumulative costs and cumulative carbon savings associated with achieving the High Ambition Pathway in Richmond Upon Thames. The below table highlights these costs and carbon savings for all interventions within this sector.

Year	Carbon Savings	Capex	Opex
2025	414 tCO2e	£0.51m	£0.04m
2030	1,759 tCO2e	£1.03m	£0.13m
2043	**8,899 tCO2e**	**£1.47m**	**£0.34m**
2050	14,937 tCO2e	£1.71m	£0.40m

Important Method Notes and Highlights

Cumulative sequestration from land use classified as forests accounts for **9,743** tCO2e by 2043. This increases to **17,463** tCO2e by 2050. The resulting cumulative emissions savings being smaller than this value is the result of emissions savings from grassland reducing to account for an increase in woodland. Cumulative emissions savings from livestock is roughly **787** tCO2e by 2043 under the High Ambition scenario.

Capital costs are associated only with the planting of new trees. Costs include fencing, gating and planting of new trees and do not include access to grant funding. These costs are estimated based on the Woodland Creation and Maintenance Grant (Now Woodland Creation Offer). *Costs are not estimated for livestock management*.

Co-benefits of action in this sector

5.1 Increased tree coverage and tree planting:

- **Public health:** Provision of shade and cooling. Physical and mental health benefits associated with exposure to green space.
- **Economic security:** Improved quality of place in developed commercial areas. Improved house prices- estimated increases of 5-18% when a property is associated with mature trees.

5.2 Land management:

- **Public health:** If everyone had sufficient access to green space, the NHS could save up to £2.1 billion per year.
- **Council services:** Improved land quality in terms of water retention and ecosystem development.
- **Economic security:** Improved land value. Living near urban green spaces has been shown to raise nearby house prices by an average of £2,500.
- **Local environment:** Improved resilience to extreme weather events and shocks. Conversely, unhindered development has been shown to increase risk.

4.5 NATURAL ENVIRONMENT
POLICY & STRATEGY REVIEW (1)

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	5.1 Increased tree coverage and tree planting	5.2 Land management
National	National Planning Policy Framework (2021): Sets out planning policies for England which covers meeting the challenge of climate change, flooding and coastal change and conserving and enhancing the natural environment.	**Moderate Impact:** Advocates for inclusion of trees in new developments, ensures that they are maintained, and ensures existing trees are retained.	**Moderate Impact:** Sets out requirements for efficient use of land in new developments. New developments should secure measurable improvements in biodiversity and enhance public access to nature.
	Eco-Towns Planning Policy: A Government document outlining how to plan for biodiversity net-gain within developments meeting the eco-town standard.	**Lower Impact/ Not applicable:** Tree coverage not addressed.	**Higher Impact:** Eco-towns should demonstrate a net gain in biodiversity
Regional	London Environment Strategy is an integrated environment strategy setting out actions for achieving improvements in London's environment.	**Higher Impact: Outlines** measures to "protect, enhance and increase green areas in the city", largely referencing policies in the London Plan. Commitments are underpinned by the goal of becoming the world's first National Park City.	
	London Plan: Spatial development strategy for the Capital, including frameworks for the protection and enhancement of green spaces in the city.	**Moderate Impact:** Some opportunities for new tree planting is explored, for new developments only. Outlines protections for ancient and established woodlands.	**Higher Impact:** Outlines protections for London's green spaces, along with policies to increase green space, such as through urban greening requirements on new developments. Biodiversity and access to nature is also considered.
	Greener City Fund: A £12m fund, now closed. New funding opportunities listed here.	**Higher Impact:** Funding to support community initiatives, green infrastructure, woodland development and community engagement.	
	TfL's Healthy Streets Approach: Includes provision for improvements to the city's green infrastructure.	**Moderate Impact:** Transport focussed paper, acknowledges the of importance of trees in public spaces	**Lower Impact/ Not applicable**

4.5 NATURAL ENVIRONMENT
POLICY & STRATEGY REVIEW (2)

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	5.1 Increased tree coverage and tree planting	5.2 Land management
Richmond-Upon-Thames	Richmond Upon Thames Climate Emergency Strategy (RCES) (2019-2024) summarises the council's priorities in addressing climate change across a range of themes, including the natural environment.	**Higher Impact:** Focus on identifying areas of opportunity for tree planting which create other benefits, such as flood resilience. Encouraging resident action and launching tree warden scheme.	**Higher Impact:** Sets out the goal of supporting development further green infrastructure in the borough.
	The Local Flood Risk Management Strategy (LFRMS) is to set out a plan of action for managing local flood risk within the borough.	**Moderate Impact:** The council is working to incorporate Natural Flood Management (NFM) to build flood resilience. NFM practices will naturally incorporate the tree coverage and land management interventions advocated for in this chapter.	
	This Local Biodiversity Action Plan (LBAP) for the borough.	**Moderate Impact:** Sets out the framework for the protection, conservation and enhancement of wildlife within the borough, intended to inform planning decisions. Includes strategic approach to protection of historic trees. Does not outline plans for significant expansion of existing green spaces.	
	Richmond-Upon Thames's Tree Policy seeks to protect and enhance the borough's treescape	**Higher Impact:** Commits to increasing the number of trees, replacing any trees that have to be felled with new trees, introducing species that will be tolerant to future environmental conditions, and increasing overall resilience of trees by prioritising species diversity.	**Lower Impact/ Not applicable**
	Policy Gap Summary: Nationally and in the borough, the policy focus is on maintaining, protecting and exploring opportunities to expand green spaces. There could be an opportunity to partner with regional stakeholders, who are looking to expand green spaces, to drive more ambition locally. Given space constraints in the borough, the local focus has typically been on opportunities to enhance consideration of green spaces in planning and developing synergies with flood management.		

4.5 NATURAL ENVIRONMENT
COSTS AND FUNDING

Funding gap defined as the likelihood of the necessary level of funding being achieved	High Funding Gap	
	Medium Funding Gap	
	Low Funding Gap	

	Funding Gap Analysis				
	Public funding: historic	**Private funding: historic**	Public funding: challenges/ opportunities	Private funding: challenges/ opportunities	Funding Gap
Increased tree coverage and tree planting	Limited evidence about levels of investment from public sector.	Limited evidence about scale of private investment in trees	Opportunity to use the planning system to raise money for tree planting. Funding available through Urban Tree Challenge Fund.	There may be an opportunity for private investment in tree planting through local offsetting/ insetting. However, there isn't much available land.	Not enough evidence to determine if there is a funding gap
	Summary	There are a large number of trees in the borough of Richmond Upon Thames, however it is unclear whether this is a result of investment by the public sector or due to the history of the borough. There are opportunities to apply for grant funding for tree planting from central government, however it isn't possible to give a clear assessment of the size of the funding gap for this sector.			

4.6 Energy Supply

Anthesis

4.6 ENERGY INTRODUCTION

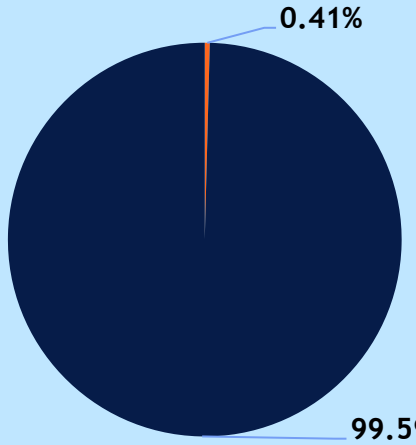
Throughout this chapter reference has been made of the importance of providing decarbonised electricity to the borough. This is to ensure the benefits of moving away from fossil fuels and switching to electric supply are fully realised. The following analysis provides details for the scale and ambition required to meet the borough'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.

One argument against installing local renewables has been that the grid will decarbonise at a sufficient rate to hit net local net zero targets. However, Graph 4.6.2 shows the U.K Grid factor for the past 5 years, published by DESNZ. It's important to see here that, the grid did not reduce it's carbon intensity in 2023. At this rate, using a 5-year average, the grid will not be zero carbon by 2043, emphasising the importance of local renewables.

KEY LOCAL CONTEXT

- The borough was involved in the development of the renewable power for London Councils' Action Plan and is part of the ongoing steering group.
- There was planning application submitted in 2015 for the demolition of a section of Teddington Weir and installation of three reverse engineered Archimedean screw turbines to generate hydroelectricity at Teddington Weir.



By 2043, local renewables are expected to generate **2.62%** of total electricity demand, an increase of **10x** the current local renewable generation. This is as a result of increase demand through electrification, mainly the electrification of heating in domestic and non-domestic buildings.

Figure 4.6.1: As of 2019, local renewable generation accounts for **0.41%** of total electricity consumption.

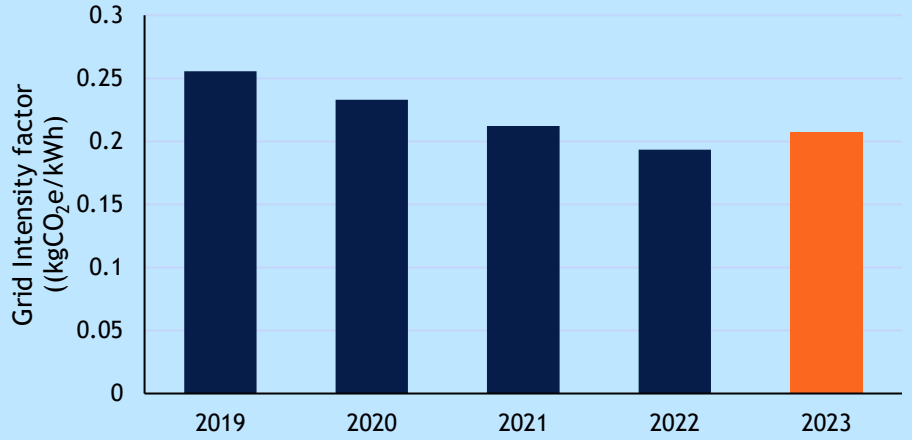
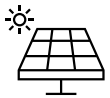


Figure 4.6.2: Showing the changes to U.K Grid factor from 2019 to 2023. *Note, The 2023 grid factor increased due to an increase in natural gas being used to power the grid.

4.6 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, of which, for reasons of feasibility, Solar PV is reviewed in this report:



6.1 Solar photovoltaics (PV): Both Major Power Producer (large-scale) sites and small-scale sites are considered for the borough. Local capacity is defined as the overall maximum output of other renewable energy installations of any size within the borough. It is expected that there will be more small-scale solar in Richmond Upon Thames.

Please note: Due to Richmond Upon Thames only producing solar as a form of local renewable energy, no other technologies are modelled within SCATTER to safeguard against recommending unfeasible renewable technologies. Despite this, it is still recommended that the council explores other renewable energy technologies and their feasibility to meet the 2043 ambition. This is often done through the development of a Local Area Energy Plan (LAEP).

THE COUNCIL VIEWS

What factors are considered as barriers to action in this sector?

- Richmond Upon Thames has a high proportion of listed and heritage buildings. This may have impacts on where renewable installations can be installed in the borough.
- The council has a lack of direct control over energy supply infrastructure, and has cited a need for quicker delivery of this in partnership with DNOs in order to support greater renewable generation

What factors are considered enablers of action in this sector?

- London Solar Opportunity Map shows Richmond is in the higher tier of potential solar generation, with an average solar potential of 905-915 kWh m2 on viable surfaces. Potential is slightly lower compared to most other boroughs for land generation.

4.6 ENERGY
INTERVENTION MILESTONES

6.1 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.

LOCAL DECARBONISATION INITIATIVES

The council is involved in Solar Together London scheme and liaising with the GLA to ensure all homeowners signed up to receive solar panels under phase 4 and 5 of Solar Together have received these.

The council has set the goal of developing improvements to planning rules and guidance on solar panels to enable easier installation of solar PV for residents.

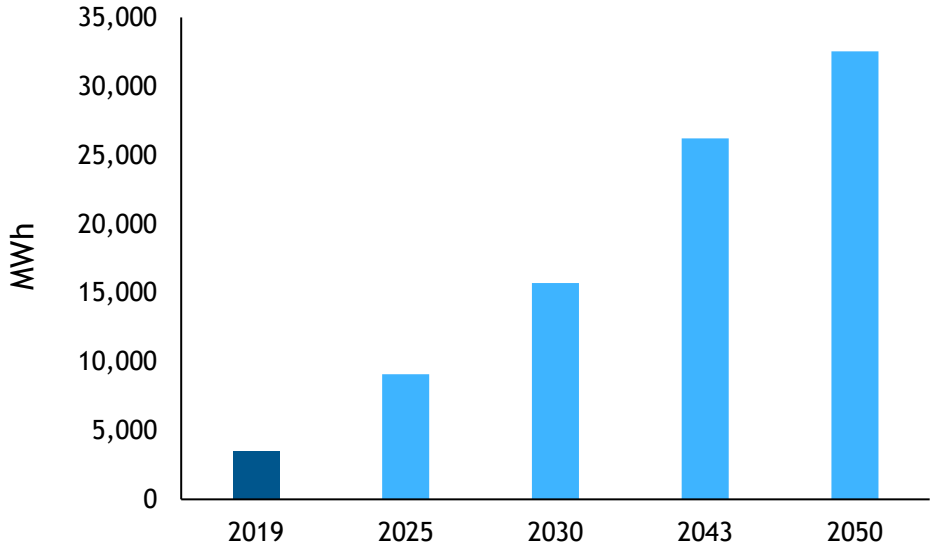


Figure 4.6.2 : Comparing the SCATTER targets against the recorded installed capacity (MW) from BEIS renewable energy statistics for energy generated from solar PV in the borough.

Current Statistics	Percentage Change	Trend
In 2019, the total small-scale renewable capacity was 4.15MW. This increased to 4.74MW in 2021. (Source)	14.22%	
In 2019, there 1,208 Solar PV sites. This has increased to 1,379 in 2021. (Source)	14.16%	
Total renewable generation in 2019 was equal to 3,522MW. This increased to 3,620MW in 2021. (Source)	2.78%	

4.6 ENERGY
IMPACT OF ACTION

The below summary highlights the cumulative costs and cumulative carbon savings associated with achieving the High Ambition Pathway in Richmond Upon Thames. The below table highlights these costs and carbon savings for all interventions within this sector.

Year	Carbon Savings	Capex	Opex
2025	3,784 tCO2e	£3.3m	£0.7m
2030	8,354 tCO2e	£6.6m	£1.4m
2043	**14,350 tCO2e**	**£24.5m**	**£4.9m**
2050	15,684 tCO2e	£34.1m	£6.8m

Important Method Notes and Highlights

The impact of renewable energy on Domestic lighting and appliances, under the SCATTER High Ambition scenario would save **7,912** tCO2e by 2043.

Capex costs include the construction and capital cost associated with new small-scale solar panels (<10kW). Opex costs refer to fixed operation and maintenance costs for these solar panels.

These costs assumptions come from a BEIS (now DESNZ) report on Electricity Generation Costs 2020.

Co-benefits of action in this sector

6.1 Solar photovoltaics (PV):

- **Increased grid resilience and energy security:** Increased ability to cope with increases in future energy prices. Can provide long term return on investment and reduced energy bills for consumers- some estimates suggesting savings of up to £400 on energy bills
- **Economic security:** Increased grid resilience and energy security. Improved asset value and means of income for businesses and other stakeholders. Creation of new jobs for installation and maintenance. Over 200,000 FTE jobs in renewable energy in 2021.
- **Local environment:** Reduction in air pollution associated with fossil-fuel based energy generation.

4.6 ENERGY
POLICY & STRATEGY REVIEW

How much do these policies and strategies impact implementation of the SCATTER interventions?	
	Lower Impact/ Not applicable: Does not meaningfully impact intervention, or is not relevant/applicable
	Moderate Impact: Contains some acknowledgement of, and support for implementation of, the intervention
	Higher Impact: Is supportive of, and highly relevant to, implementation of the intervention

	Key Policy/Strategy	6.1 Solar photovoltaics (PV)	6.2 Other renewable technologies
National	Net Zero Strategy 2021: Lays out the Government's key policies for net zero, including plans for delivering a decarbonised power system. See also: Energy White Paper: Powering our Net Zero Future	**Moderate Impact:** Outlines the commitment that by 2035 all electricity should come from low carbon sources, subject to supply security assurances. Some support measures outlined, such as the Public Sector Decarbonisation Scheme (PSDS), and the Rural Community Energy Fund (RCEF).	
Regional	Solar Action Plan: Sets out how residents, businesses and community groups will be supported to help achieve 1GW of solar capacity by 2030; 2 GW by 2050.	**Higher Impact:** Outlines several actions to increase solar energy in London. Relevant to the borough, this includes support through planning, support and information for homeowners, and lobbying of national government.	**Lower Impact/ Not applicable**
	London Plan: Spatial development strategy for the Capital, including frameworks for development of sustainable energy infrastructure.	**Higher Impact:** Outlines support to local authorities to help establish greener energy infrastructure. Acknowledges the importance of new, decentralised sources of energy, such as Solar PV, to creating a resilient future energy system in the city. Advocates for development proposals to maximise local production.	
Richmond Upon Thames	The Council's new Local Plan will set out policies and guidance for the development of the borough over the next 15 years.	**Moderate Impact:** Advocates for inclusion of renewables in development in line with the London Energy Planning Guidance.	
	Richmond Upon Thames Climate Emergency Strategy (RCES) (2019-2024) summarises the council's priorities in addressing climate change across a range of themes, including renewables.	**Lower Impact:** Commits to generating renewable energy for council buildings, only. Wider actions contained in Local Plan.	
	Policy Gap Summary: There is some national level leadership on the roll out of renewables, but a limited range of funding options available to support implementation in built up boroughs such as Richmond Upon Thames. Most policy to support increases in renewable energy are coming from the regional level. There is an opportunity for the council to go further in driving uptake, particularly in going beyond new developments and the council's own buildings.		

4.6 ENERGY
COSTS AND FUNDING

Funding gap defined as the likelihood of the necessary level of funding being achieved	
	High Funding Gap
	Medium Funding Gap
	Low Funding Gap

	Funding Gap Analysis				
	Public funding: historic	**Private funding: historic**	**Public funding: challenges/ opportunities/ considerations**	**Private funding: challenges/ opportunities/ considerations**	**Funding Gap**
Solar PV	Public funding is available for low-income households through ECO, it is not clear how much has been installed. The amount of solar capacity in Richmond Upon Thames is low relative to London boroughs.	Higher income households are expected to pay privately (significant amount of these in Richmond Upon Thames). Amount of solar capacity in Richmond Upon Thames is low relative to London boroughs.	Funding will only remain available for low-income households through ECO, there is no additional public funding.	Upfront costs are high which discourages investment (Solar Together addresses this). Solar has a positive pay-back period (6 – 10 years) which can incentivise investment. Can use the planning system to encourage investment in Solar PV.	MEDIUM
	Summary	There is a 'medium' funding gap for the energy supply sector in Richmond Upon Thames. There has been pre-existing investment in household solar PV, however it is not clear to what extent it came from the public or private sectors. Looking forward, it is likely that private investment into Solar PV will come from households that are able to cover the upfront capital costs, as the technology has a positive payback period.			

05 Conclusions

5. CONCLUSIONS
RECOMMENDATIONS

Using this report

This report sets out a pathway to net zero for the borough of Richmond Upon Thames. As a next step, the council will seek to update its local climate action plan for net zero, using these findings to provide an evidence base informing what needs to happen.

Key Findings

Our modelling shows the **potential emissions reduction that could be achieved under a highly ambitious climate strategy**. This is supplemented by commentary around the costs, benefits, and other practical considerations. The pathway presented does not account for potential shortcomings in supporting policy or finance which could challenge implementation, and the borough is dependent on national policy to drive and support many of the interventions outlined.

- If Richmond Upon Thames successfully implements the High Ambition pathway, there would be an **86% reduction in emissions by 2043**, compared to the 2019 baseline. The biggest emissions savings result from actions associated with domestic buildings, and the transportation sector.
- The cumulative investment required to achieve the high ambition pathway would be in excess of **£2.1 billion between now and 2043**, although a substantial portion of this could be offset by significant savings in operational expenditure across the borough.
- To go beyond the reductions achieved through the High Ambition pathway, and achieve net zero, the council can explore deploying decarbonisation interventions at a **faster rate** than outlined in SCATTER, and **new innovations** not modelled by SCATTER. **Carbon offsets** can also be explored as a way of tackling residual emissions, and the council is participating in Anthesis' Area Based Insetting (ABI) initiative.

Recommended next steps

To achieve net zero, stakeholders in Richmond Upon Thames should pursue all the opportunities presented in this report. However, given the number of interventions presented, and possible limitations in resource, they may seek to prioritise certain areas for immediate action. In this chapter we summarise the factors to consider when prioritising action, along two axes:

1) The potential **impacts of the interventions** (explored further on pg. 76), considering carbon impact, and co-benefits. Based on our assessment, particular priority areas for action based on these are:

- Improving **domestic building efficiency**, and **decarbonising domestic heating.** This represents substantial emissions savings opportunities of over 3,000 ktCO2e by 2043. It can also result in improvements to public health (such as reductions in summer and winter mortality), and reductions in fuel poverty rates.
- A broad suite of interventions to address **transportation** emissions. This could result in emissions savings approaching 1,200 kt CO2e by 2043. Promotion of active travel in particular results in strong health and environmental benefits.
- An ambitious plan for **local renewables**, focussing on **solar PV**, to supplement any national improvements in grid energy efficiency, and support the borough in it's net zero target should these not occur. This will provide reductions in impact across the energy system, and could result in emissions savings of over 23,000 tCO2e by 2043.

2) Stakeholders' **ability to implement the actions** (explored further on pgs. 77 and 78), considering costs and funding availability, and policy and strategy support or gaps, and the council's ability to influence action. On the latter point, the council should use its unique role in the borough as an "enabler" of action, and can focus on specific actions, such as lobbying of national government, to maximise its influence.

As a next step, the council should review these findings to determine on which basis to prioritise action and consider this in the development of its action plan.

Conversely, the council may also consider the areas where there will be the least benefit, or it will be hardest to achieve action. The lowest carbon savings arise from action addressing waste and the natural environment.

5. CONCLUSIONS
INTERVENTION IMPACT

Below is a summary of the relative impacts of implementing the interventions outlined in this report. Each impact area is rated “Higher”, “Medium” or “Lower”, relative to the impact of other interventions or sectors in the borough. This simplified view is intended to support decisionmakers with prioritisation of actions. It should be considered in conjunction with the full analysis presented in Chapter 4, along with an awareness of the factors influencing the ability of stakeholders in the borough to implement the actions, summarised on page 78. Action across all sectors is imperative to achieve the High Ambition Pathway.

Sector	SCATTER Intervention	Carbon Impact	Co-benefits
Buildings	1.1 Improving building efficiency- Domestic	Higher	Higher
	1.2 Shifting off gas heaters- Domestic		Lower
	1.3 Improving lighting and appliance efficiency- Domestic	Lower	Lower
	1.1 Improving building efficiency- Non-Domestic	Medium	Higher
	1.2 Shifting off gas heaters- Non-Domestic		Lower
	1.3 Improving lighting and appliance efficiency- Non-Domestic	Lower	Lower
Transport	2.1 Travel shorter distances	Higher	Higher
	2.2 Drive less		Higher
	2.3 Switch to electric vehicles		Medium
	2.4 Reduce freight emissions		Medium
Industry	3.1 Shifting away from fossil fuels	Medium	Lower
	3.2 More efficient processes		Lower
Waste	4.1 Reducing the quantity of waste and wastewater	Lower	Medium
	4.2 Increasing recycling rates		Medium
Natural Environment	5.1 Increased tree coverage and tree planting	Lower	Higher
	5.2 Land management	Lower	Higher
	5.3 Livestock management	Lower	Lower
Renewable Energy	6.1 Solar PV	Higher	Medium

The table (left) shows a summary of impacts of carbon saving interventions in Richmond Upon Thames. Ratings are based on the following logic:

Carbon Savings: Interventions are rated based on their percentage contribution to all emissions savings achieved at 2043. >10%=Higher, 9.99%-1%=Medium, <0.99%=Lower. For example, interventions associated with transportation contributed to around 12% of all emissions savings achieved at 2043, and so are rated “Higher” impact. Renewable energy is also considered a higher impact intervention owing to its unique status as an enabler of emissions savings across the energy system.

Co-benefits: The co-benefits of delivering the actions are assessed based on Anthesis’ judgement of the range and scale of co-benefits yielded. More co-benefits contribute to a higher impact rating.

Costs of achieving the SCATTER High Ambition Interventions have not been included within this table. Assigning an Impact Rating does not provide a meaningful indicator, as the impact of that cost is shown through the carbon and co-benefits. The council could explore creating £/tCO2e based on these figures, which would help the council where they can reduce emissions for the least amount of investment.

5. CONCLUSIONS
SUMMARY OF COSTS

The total estimated capital expenditure required by 2043 to achieve the interventions outlined SCATTER's High Ambition pathway in Richmond Upon Thames is in excess of **£2.1bn**. Revenue costings analysis indicates that over **£0.9bn** worth of potential savings may also be realised by 2043, 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 borough's emissions reductions, bearing the cost of the transition to net zero is the responsibility of the entire borough.

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 can be valuable to consider the "cost of inaction" in alongside the costs presented here. 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 CO2 added into the atmosphere. UK Government no longer estimates the SCC, but guidance and calculators are available to those looking to calculate this.

The table (right) shows a summary of cost estimates. Negative values 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 6 for details on the methodology.

Cumulative Costs to 2043			
	Description of cost	**Capital**	**Revenue**
Buildings	Retrofitting existing households with wall insulation	£1280.4m	NE
	Retrofitting household heating systems with electrified systems over gas boilers	£113.4m	£87.6m
	Retrofitting non-domestic buildings with energy efficiency measures	£173.2m	£3.3m
	Constructing new-build homes to PassivHaus standard, rather than Part L	£61.1m	NE
	Retrofitting non-domestic heating systems with electrified systems over gas boilers; revenue represents maintenance but not fuel costs	£26.8m	NE
	Additional fuel bills as a result of switching to electrified cooking systems in domestic households	NE	£6.4m
Transport	New on-road vehicles and rail transport	£321.1m	-879.8m
	New transport infrastructure for on-road vehicles and rail	£59.9m	
	Demand reduction and efficiency gains in the transport sector	-	£-163.1m
Industry	Scaled portion of UK-wide action for decarbonising industry	£1.7m	NE
Waste	Savings in gate fees as a result of increased recycling and reduced overall volume of waste	-	£-54.6m
Natural Environment	Planting & maintenance of additional new woodland	£1.5m	£0.3m
Energy	Installation & maintenance of local renewable energy sources	£24.5m	£4.9m
	Total estimated cumulative costs by 2043:	**£2,161.6m**	**£-969.3m**

5. CONCLUSIONS
IMPLEMENTING THE INTERVENTIONS

Any prioritisation of actions should also take account of the ability of the council, and stakeholders in the wider area, to implement the interventions described. This includes both barriers to action and enabling factors. In this report, we have explored 3 key factors which influence this:

Policy and strategic support

We have reviewed the extent to which each intervention modelled is supported national, regional, and local policy, along with any key relevant strategies or plans. This highlights the breadth of policy support- we found particular gaps in support at all levels around energy efficient appliances and lighting, and freight emissions. More significantly, there are variations in the level at which policy was identified for each intervention. In using this analysis, we envisage the council:

- Identifying **policy and strategic gaps** around interventions less supported at a national or regional level. This can inform where there are opportunities for local leadership, acknowledging that there are challenges in undertaking action without higher level policy support. In some instances, where it is considered a prerequisite for local action, a lack of national leadership will indicate a need for lobbying for more powers (for example, increased planning powers can be used to drive up standards in new builds).
- Identifying intervention areas which are **currently well supported** by ambitious policy at a national or regional level. Particularly where action is taking place in London already, this may free up council resources to focus on other, less supported themes. Conversely, where the ambition is already high, the council may build on this enabling influence to increase the ambition further.

Funding availability and funding gaps

Our assessment found there to be either a 'high' or 'medium' funding gap in every sector where action needs to take place to get Richmond Upon Thames onto the high ambition pathway. Funding will need to come from both the public and private sectors in order to achieve the council's ambitious climate targets.

- Where funding will come from the **private sector**, Richmond Upon Thames should ensure that citizens and businesses are aware of the benefits of investing in interventions with positive returns (i.e. solar panels, EV charge points and energy efficiency). Through Richmond Upon Thames's involvement in Area Based Insetting, greater amounts of private funding may be leveraged into projects.
- For interventions requiring investment from the **public sector,** Richmond Upon Thames should continue to consider how to allocate CIL and s106 funding most effectively. In addition, the council should apply for government funding where available and encourage residents and businesses to do so as well.

The council's ability to influence the actions

Typically, a local authority is only directly responsible for in the region of 5%-10% of emissions in an area (i.e. those associated with its own operations). Beyond these emissions sources, the council's ability to directly implement the interventions can often be low. Therefore, the ability of the council to drive action may be a factor when choosing what to prioritise, and by whom. This also highlights that the council alone is cannot be responsible for delivering Net Zero.

Nevertheless, any strategy outlining steps to Net Zero in the borough is expected to highlight the council's leadership role in facilitating change across the borough, and in influencing others. This may, for instance, be through "Enabling" actions which focus on making the area more conducive to climate action, and support others in taking impactful action, rather than targeting any specific intervention. Such actions where the council can exert its influence include:

- Lobbying national government for better policy and financial support
- Bringing stakeholders together to encourage collaboration and partnerships
- Collaborating with local education centres to help resolve skills shortages

06 Glossary

GLOSSARY OF ABBREVIATIONS

ABI: Area Based Insetting

AFOLU: Agriculture, forestry & land use

BAU: Business as Usual

BEES: Buildings Energy Efficiency Survey

BEIS: Department for Business, Energy & Industrial Strategy

BUS: Boiler Upgrade Scheme

Capex: Capital Expenditure

CCC: Committee on Climate Change

CC Zones: Congestion-Charge Zones

CHP: Combined Heat and Power

CIL: Community Infrastructure Levy

CO_2: Carbon Dioxide

DECC: Department for Energy and Climate Change

DESNZ: Department for Energy Security & Net Zero

DEFRA: Department for Environment, Food & Rural Affairs

DESNZ: UK Government Department for Energy Security and Net Zero, the successor to the Department for Business, Energy and Industrial Strategy

DfT: Department for Transport

DVLA: Driver and Vehicle Licensing Agency

ECO: Energy Company Obligation

EfW: Energy from Waste

EPC: Energy Performance Certificate

EU: European Union

EV: Electric Vehicles

FTE: Full Time Equivalent

GPC: Global Protocol for Community-Scale GHG Emissions

GLA: Greater London Authority

GW: Gigawatt

Ha: Hectares

HEV: Hybrid Electric Vehicles

HGVs: Heavy Goods Vehicles

HUG: Home Upgrade Grant

ICE: Internal Combustion Engine

IPCC: Intergovernmental Panel for Climate Change

$KtCO_2e$: Kilo Tonnes of Carbon Dioxide Equivalent

kW: Kilowatts

kWh: Kilowatt hours

LAD: Green Homes Grant, Local Authority Delivery Scheme

LBAP: Local Biodiversity Action Plan

LEDs: Light-Emitting Diode

LEGGI: London Energy and Greenhouse Gas Inventory

LEZ: Low Emissions Zone

LFRMS: Local Flood Risk Management Strategies

LULUCF: Land use, land use change & forestry

MRF: Material Recovery Facility

$MtCO_2e$: Mega Tonnes of Carbon Dioxide Equivalent

MW: Mega Watts

Opex: Operational Expenditure

PiVs: Plug-In Vehicles

PSDS: Public Sector Decarbonisation Scheme

PTALS: Public Transport Accessibility Levels

RCEF: Rural Community Energy Fund

RCES: Richmond Upon Thames Climate Emergency Strategy

RHI: Renewable Heat Incentive

SCATTER: Setting City Area Targets and Trajectories for Emissions Reduction

SIC Codes: Standard Industrial Classifications

SLA: Service Level Agreement

Solar PV: Solar Photovoltaics

tCO2e: Tonnes of Carbon Dioxide Equivalent

TfL: Transport for London

ULEV: Ultra Low Emissions Vehicles

ULEZ: Ultra Low Emissions Zone

ZEZ: Zero Emissions Zone

GLOSSARY OF TERMS

Basic+: BASIC+ involves more challenging data collection and calculation processes, and additionally includes emissions from IPPU and AFOLU and transboundary transportation. Therefore, where these sources are significant and relevant for a city, the city should aim to report according to BASIC+. The sources covered in BASIC+ also align with sources required for national reporting in IPCC guidelines.

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 are typically used interchanegably in the context of reducing emissions. Carbon Neutrality typically refers to CO_2-only emissions, whereas net zero accounts for all GHG 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.

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.

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'.

Passivhaus: Passivhaus is a leading global design standard for buildings, focusing through a whole-building approach, which provides an approach to achieving net-zero-ready new builds and retrofitting solutions for existing buildings.

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

07 Appendices

APPENDICES CONTENTS

APPENDIX 1: SCATTER FAQS

For any questions relating to SCATTER please visit the FAQs page on the SCATTER website link can be found here. Below are the top FAQs:

What does SCATTER stand for?
- Setting City Area Targets and Trajectories for Emissions Reduction

Why was it created and who developed the tool?
- SCATTER was created to offer local, unitary and county councils the ability to report on authority wide emissions to carbon reporting frameworks, inform the setting of carbon reduction targets and to understand potential pathways to meeting commitments in line with national and international objectives
- Anthesis built the tool with support from national and local government and academics.

Who can use SCATTER?
- Anybody with a .gov.uk email can use SCATTER for free at any time. Each Authority will have an account which multiple users from that authority can access upon registration. Those without a -.gov.uk email addresses are not currently allowed access to the online tool.

How many users can we have?
- There is no limit to the number of users per account.

I am part of a consultancy, university or other organisation that works with local authorities – can I have access to SCATTER?
- SCATTER was built to support local authorities to freely access emissions data and create carbon reduction pathways. Where local authorities are working with external bodies in developing climate plans, they can export data from the tool and share as necessary. Only users with a valid local authority .gov.uk email domain will be able to login to the online tool. Information on how to use the tool is freely available through the help videos and webinars for all organisations to see.

What does the tool do? How will it help us to reduce our carbon footprint?
- SCATTER has two main functions: calculating greenhouse gas inventories with carbon reporting outputs, and modelling carbon reduction pathways. Creating a greenhouse gas inventory for a Local Authority allows an organisation to identify the sources of their emissions and where to focus action. SCATTER Pathways outputs are intended to benefit engagement as part of developing a collaborative low carbon plan.

What is its goal?
- The goal of the tool is to provide a freely accessible, easy way for a Local Authority to:
    - Calculate the area's current emissions
    - Aid emissions reporting to international standards
    - Develop emissions scenarios to 2050 and identify ways in which to reduce emissions
    - Save these results to the users of the specific Local Authority account.

The online tool should be intuitive to use and can calculate the current inventory and scenarios via a user-friendly interface.

Are there any costs associated with using the tool?
- No, the tool is free to use for local, unitary, combined and county authorities in the UK.

APPENDIX 2: RICHMOND UPON THAMES'S SCATTER INVENTORY DATA

Notes:

- SCATTER calculates a territorial emissions profile and therefore excludes emissions from goods and services generated outside the borough (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 2019 reporting year as emissions are reported two years in arrears.

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

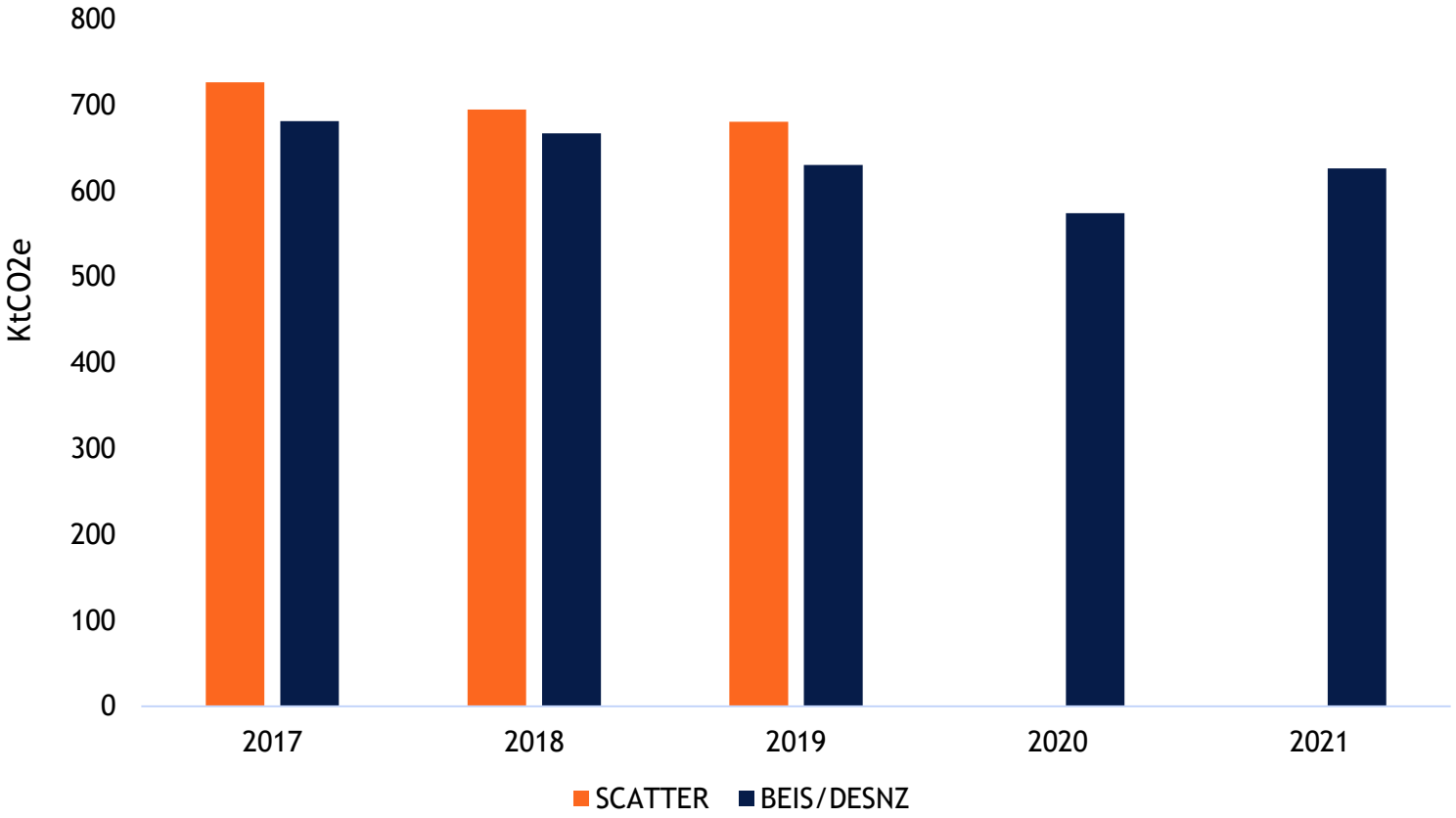
Sub Sector	DIRECT Scope 1 $ktCO_2e$	INDIRECT Scope 2 $ktCO_2e$	TOTAL $ktCO_2e$
Residential buildings	225.71	85.01	310.71
Commercial buildings & facilities	14.11	31.83	45.94
Institutional buildings & facilities	11.46	6.91	18.37
Industrial buildings & facilities	31.49	38.77	70.26
Agricultural fuel use	0.28	<0.01	0.28
Fugitive emissions	27.95	-	27.95
On-road	161.49	IE	161.49
Rail	0.02	IE	0.02
Waterborne navigation	NO	IE	-
Aviation	NO	IE	-
Off-road	1.61	IE	1.61
Solid waste disposal	4.09	0	4.09
Biological treatment	NO	0	-
Incineration and open burning	1.23	0	1.23
Wastewater	3.59	0	3.59
Industrial process	37.71	0	37.71
Industrial product use	0.00	1	0.00
Livestock	0.40	0	0.40
Land use	- 2.88	1	- 2.88
Other AFOLU	NE	2	-
Electricity-only generation	NO	0	0
CHP generation	NO	0	0
Heat/cold generation	NO	0	0
Local renewable generation	<0.01	NO	<0.01
TOTAL:	**518.26**	**162.52**	**680.79**

APPENDIX: 3 COMPARING BEIS AND SCATTER INVENTORIES

Figure 7.3.1 compares emissions data for Richmond upon Thames, using SCATTER (Direct and Indirect emissions only) and DESNZ data. The starting points vary due to methodology differences in emissions factors and scope. The key takeaways are;

- The average annual reduction rate between 2017 and 2019 was **3.15%** for SCATTER data and **3.75%** for DESNZ data.
- From 2017 to 2021, the average Annual Reduction Rate for DESNZ data was **2%**.
- From 2019 to 2021, the average Annual Reduction Rate for DESNZ data was **0.3%**. This data was highly impacted by COVID, and particularly the lack of transport emissions as a result of travel restrictions during 2020.

Comparing all available SCATTER inventories to DESNZ inventories, including 2020 and 2021. This will provide more insight into the expected reduction rate of emissions through 2020/2021 and highlight the difference between DESNZ and SCATTER data.



Data was taken from here in July, prior to an error being spotted by DESNZ, this does not have a significant impact on this comparison.

APPENDIX 4: DERIVING THE CARBON BUDGET

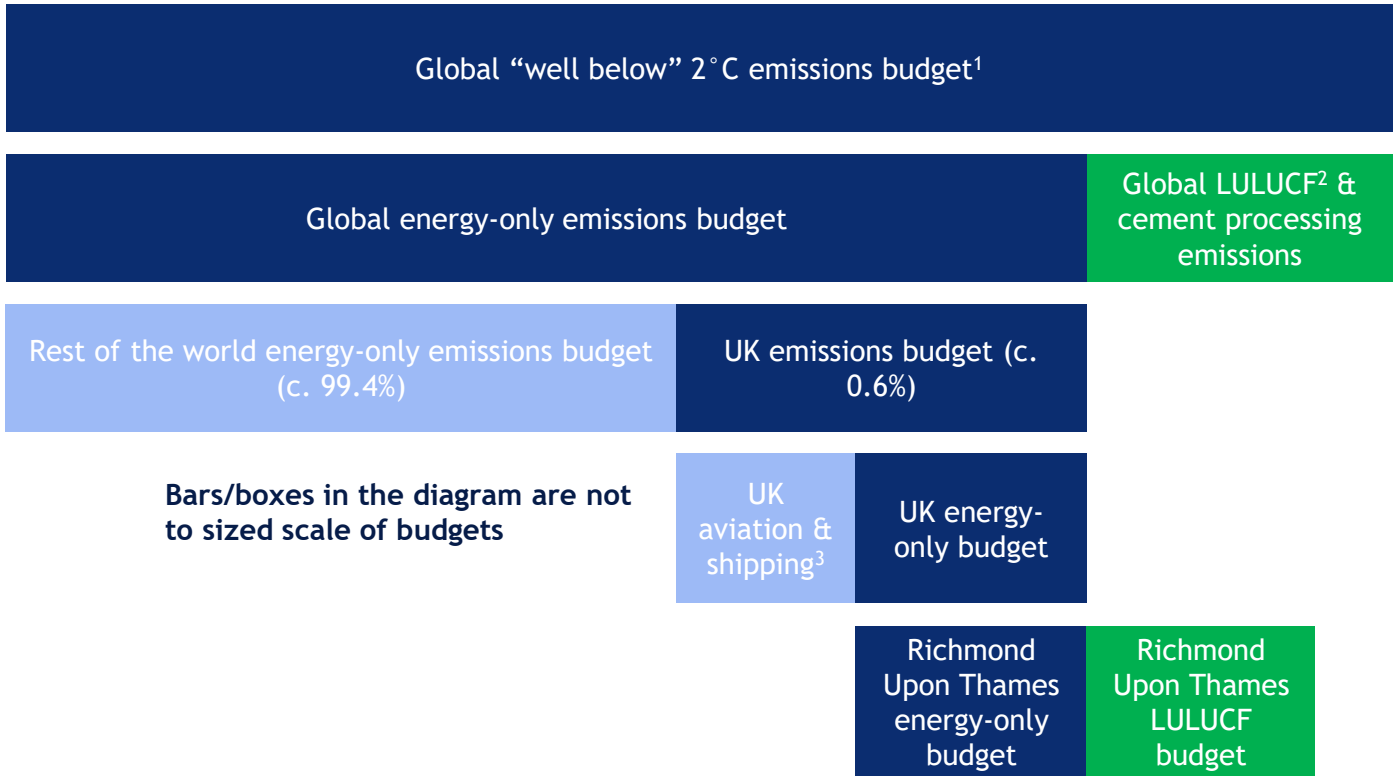
Richmond Upon Thames's carbon budget

The carbon budget sets out a finite emissions limit that the borough 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 the borough 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 the borough 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 5: 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 7.5.1.

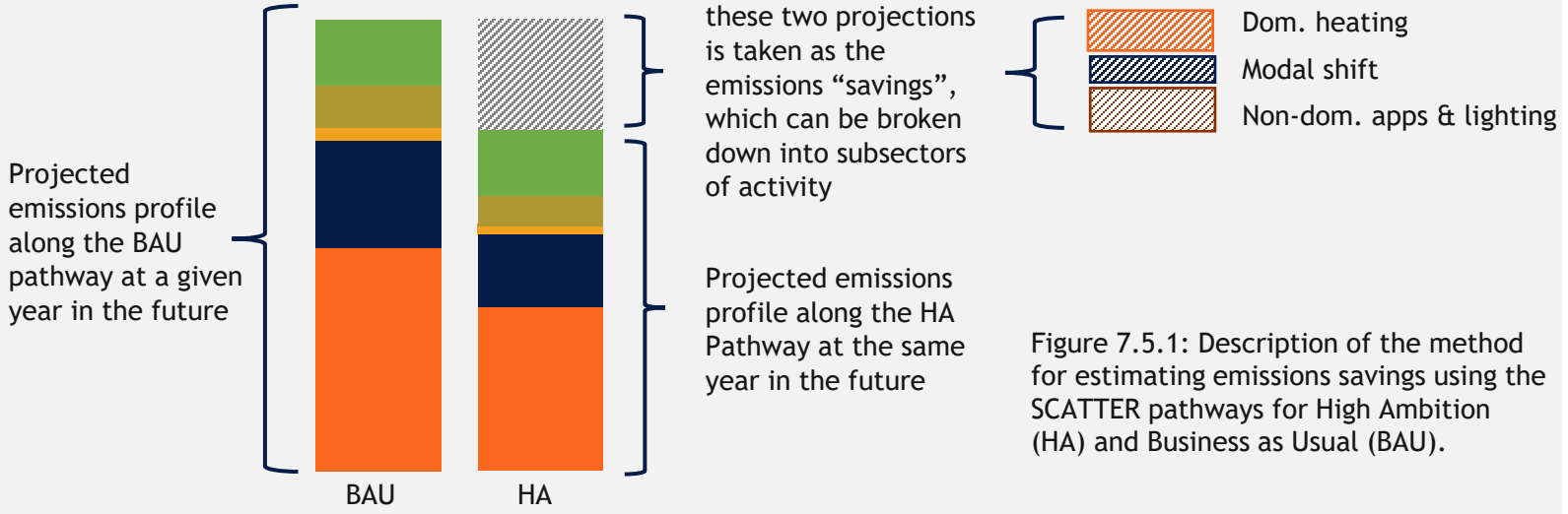


Figure 7.5.1: Description of the method for estimating emissions savings using the SCATTER pathways for High Ambition (HA) and Business as Usual (BAU).

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 6: 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 6: 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 Richmond Upon Thames.
- 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 6: 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 6: 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 Richmond Upon Thames.
- 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 6: 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 Richmond Upon Thames 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

APPENDIX 7: TYNDALL, GLA AND SCATTER

	Emissions Methodology notes	Ambition Level
Tyndall	Aviation and shipping emissions remain within the national UK carbon budget and are not scaled down to sub-national budgets. Land Use, Land Use Change and Forestry (LULUCF) and non-CO_2 emissions are considered separately to the energy CO_2 budget in this report. In short, the Tyndall Carbon Budget relates to Energy only CO2 emissions.	This report presents climate change targets for Amber Valley that are derived from the commitments enshrined in the Paris Agreement , informed by the latest science on climate change and defined in terms of science-based carbon setting . The carbon budgets are based on translating the "well below 2°C and pursuing 1.5°C" global temperature target and equity principles in the United Nations Paris Agreement to a national UK carbon budget.
GLA Pathways Tool	Uses LEGGI data, which accounts for all GHG emissions, and breaks down emissions through Domestic and Non-Domestic Buildings, Industry, Aviation, Waste, Transport and AFOLU. These emissions have been modelled form a 2018 starting point. *Full methodology notes have not been made publicly available.*	Accelerated Green, the next most ambitious pathway, is therefore considered the preferred pathway for achieving net zero emissions by 2030 as it balances urgency, ambition, social justice and deliverability. It is considered deliverable if London's key institutions (e.g. the GLA, the London Boroughs, London's businesses, Anchor Institutions etc.) can quickly access the funding and powers needed and work together towards agreed goals. Delivering on this pathway will require co-ordinated action from the Mayor, boroughs, communities, businesses, financiers and the public sector. Every Londoner will have a role to play.
SCATTER	The inventory is presented according to the Global Covenant of Mayors' Common Reporting Framework. This report models data from a 2019 starting point. The SCATTER inventory starting point goes further than BEIS emissions, by including IPPU, generation of grid-supplied energy, various waste treatment emissions and more. A full methodology breakdown can be seen here for local authorities. The following breakdown also includes a further split of non-domestic buildings as well as further breakdowns of different transport types. Scope 1 (Direct emissions) - GHG emissions from sources located within the city boundary Scope 2 (Indirect emissions) - GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary Scope 3 - All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary	SCATTERs High Ambition pathway aims to provide a decarbonisation route that is deemed feasible for local authorities, rather than achieving 0 emissions by 2050. SCATTER acknowledges many challenges with current government policies, as well as the limited influence of the council on the entire area. As a result, the High Ambition pathway acknowledges that all local authorities will likely miss their net zero targets, without significant changes from central government. Many of these assumptions were built in its initial development in 2018, and have not been updated to reflect updates to national policy.

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