WOKING BOROUGH COUNCIL

Carbon Emissions Baseline and Reduction Pathways

Version 2.0

September 2022

Anthesis

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Anthesis

01 Background & Context

1. BACKGROUND & CONTEXT
INTRODUCTION

Overview & Scope

In July 2019, Woking Borough Council declared a climate emergency and set its aim to become a carbon neutral organisation by 2030. This led to the Climate Emergency Action Plan (CEAP) which defines key priorities for the council regarding emissions reporting and policy development for emissions reduction.

This report has been commissioned in response to those priority needs and offers a roadmap to carbon neutrality by 2030. This report estimates the council's current emissions baseline and provides options for reduction with forward-looking modelling, as well as an appraisal of the CEAP.

The report is structured as follows:

- **Chapter 1** introduces the work and the context around the council's 2030 carbon neutral target.
- **Chapter 2** describes in detail the current emissions baseline for the council and identifies which activities have been included within the scope of the 2030 target. Further method details and process documentation of this analysis have been provided in an accompanying guidance document to the council.
- **Chapter 3** shows future emissions pathways for the council based on programmes of activity designed to decarbonise its operations and assets.
- **Chapter 4** discusses the implications of residual emissions in the council's footprint in 2030 and different means of reaching carbon neutrality.
- **Chapter 5** provides guidance to the council as it looks ahead toward the implementation of low-carbon projects. It also includes commentary on the CEAP and financial cost implications of the pathways discussed in Chapter 3.
- **Chapter 6** gives summary recommendations for the council.

Objectives

- Provide an external assessment of the council's operational emissions based on accepted best practice and available data.
- Provide guidance to the council which allows for robust reporting in future years.
- Demonstrate the scale and nature of actions required to reach the council's ambitious 2030 target.
- Provide commentary on the Climate Emergency Action Plan.

This helps the council by:

- Providing tangible suggestions for low-carbon projects that can be explored.
- Providing methodology to enable the council to repeat the inventory process in future years.
- Creating a robust evidence basis for future reporting of emissions.

1. BACKGROUND & CONTEXT
A CALL TO ACTION

Climate change poses a critical threat to all aspects of human society and the natural world. To combat it, extensive change is required at every level of business, government, and civil society.

Most recently, this was communicated by the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report, which states that current policies put us on track for a catastrophic 3°C warming. However, with more radical and ambitious targets, temperature rise can be limited to between 1.5°C-2°C. Temperature rise within this range is still very likely to result in significant negative impacts across nations and ecosystems all around the world.

The recognition of urgency to act and limit emissions is no longer solely a message from environmental groups, but is being reiterated across a variety of sectors:

- **UK Local Authorities:** The majority of Local Authorities in the UK have now declared a climate emergency or a motion on climate change - 78% of councils now have a climate plan.
- **National Governments:** At the 2021 UN Conference of Parties (COP) meeting in Glasgow, governments made pledges to strengthen their action, and better align with the reductions targeted in the Paris Agreement.
- **Environmental Groups:** Continue to seek a more sustainable economy in the borough.
- **Businesses:** 3,000+ companies globally are setting Science Based Targets, including around one fifth of the Fortune Global 500.

Dangerous Impacts

Under a range of scenarios described in the Climate Change Committee (CCC) 2021 Risk Assessment, it is expected that average winter precipitation will increase, both in terms of the intensity of the rainfall and the number of wet days. Summers are expected to be drier, but the intensity of summer precipitation (when it does occur) will increase.

More properties will face the risk of flooding, and areas already at risk will face more frequent flooding. Extreme heat events are far more likely, particularly in urban environments, and will have damaging effects on health, wellbeing and productivity. Alongside this, the IPCC warns of extensive economic damages, increasing non-linearly with every degree of warming.

Local Action

The above impacts further underscore the urgency with which action needs to be taken.

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

1. BACKGROUND & CONTEXT
CONTEXT AND COMMITMENTS

Contextualising this report

Following the declaration of a climate and ecological emergency, the council set out their vision for a sustainable borough in the Woking 2050 Climate Change Strategy. This was in turn followed by the Climate Emergency Action Plan (CEAP) published in February 2020. The CEAP sets out priority areas for action toward the longer-term ambitions of the Strategy.

The council has also historically reported some of its emissions annually, as part of its Greenhouse Gas Report. This report builds on that past work by consolidating data under a consistent, robust reporting boundary, set in collaboration with council officers.

A primary objective of this report is to detail the footprinting process to enable the council to confidently report its emissions in future years against a robust baseline. This process documentation has been summarised in Appendix 2 and more detailed notes surrounding specific data have been included in a supplementary document attached to this report.

At the regional level, the Surrey Climate Change Delivery Plan (CCDP) describes county-wide targets for emissions reduction and the transition to low-carbon. The CCDP has an interim target of a 40% reduction in emissions by 2025 across the public estate, compared to 2018 levels. The pathways in Chapter 3 have been designed with actions set out in the CEAP in mind and the projects that have been considered overlap strongly with those suggested in the CEAP.

National, Regional and Local Commitments

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

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

Surrey County Council have aligned regional efforts to the national net zero target of 2050, targeting net zero for the council's own organisational emissions by 2030 or sooner.

Woking Borough Council have declared a climate emergency aligned to the national 2050 target, as well as committing to a 2030 carbon neutral target for the council's own activities.

02 Council Emissions Footprint

2. COUNCIL EMISSIONS FOOTPRINT
INTRODUCTION

Boundary considerations

Woking Borough Council have committed to achieving carbon neutrality as an organisation by 2030. Reaching this ambitious target first means establishing exactly which council assets and operations fall within this target. To do this, we have applied best practice guidance for organisational emissions reporting as set out by the Greenhouse Gas Protocol (GHGP). The GHGP defines how different assets and operations should be grouped and reported against.

Which activities should be included under the council's target?

In the climate emergency declaration, the council *"[pledges] to become carbon neutral by 2030 across its own estate and operations"*. This commitment serves as the basis for which activities to include within the scope of the 2030 target. The emissions in this report have been assessed according to an *operational control* boundary and therefore include the energy networks operated by Thameswey. Full details of the process behind boundary-setting can be found in Appendix 1.

Figure 2.1 (right) summarises how council operations and assets have been grouped according to the GHGP and which have been included within the 2030 carbon neutral target. The pathways analysis in Chapter 3 only considers the emissions sources included within the remit of the council's 2030 target, though recommendations on the reporting and treatment for "out-of-scope" emissions can be found on page 14.

The rest of this chapter describes the emissions footprint of the council for the financial year 2021/22.

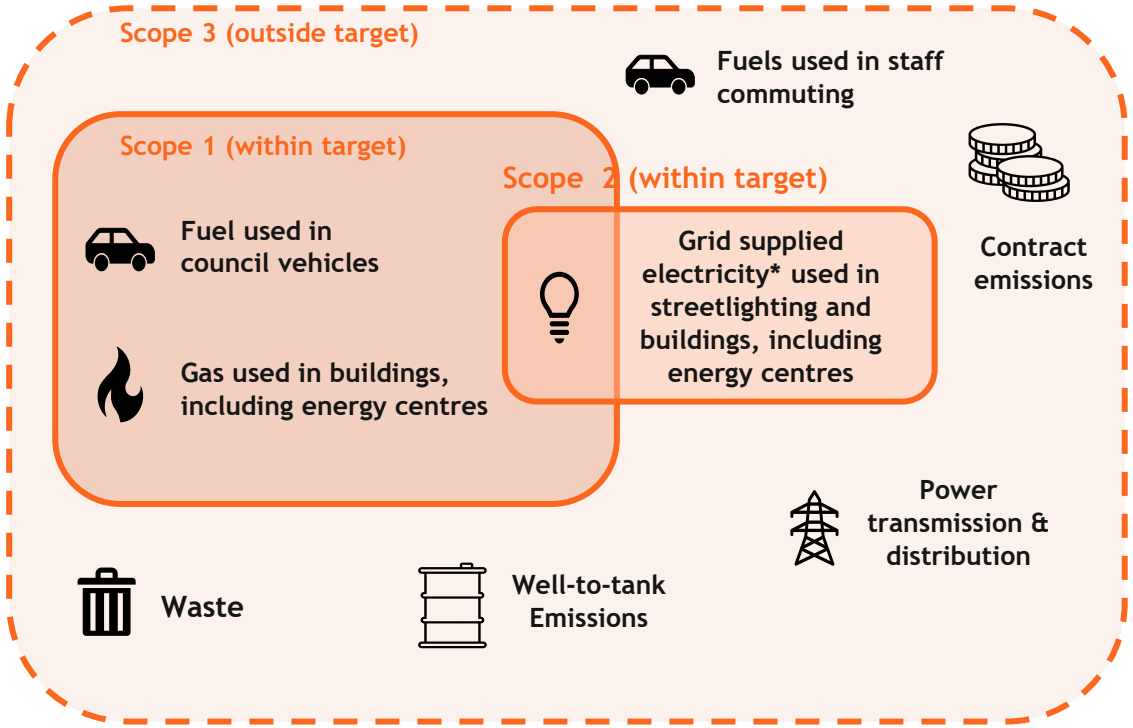


Figure 2.1: Diagram showing which emissions sources have been covered by the emissions footprint of the council for the financial year 2021/22 and how the level of control differs across sources. *Grid-supplied electricity has been included within the council target.

The Greenhouse Gas Protocol Corporate Standard recommends that emissions are reported using both a location-based and market-based assessment:
- ***Market-based emissions*** account for any low carbon energy products such as green electricity tariffs or power purchase agreements.
- ***Location-based emissions*** calculates emissions according to the UK's national grid factor based on a typical energy mix.

2. COUNCIL EMISSIONS FOOTPRINT
SCOPE 1 AND 2 EMISSIONS ANALYSIS

Figures at a glance

- Total Scope 1 emissions for Woking Borough Council are 14,464tCO_2e; location-based Scope 2 emissions are 4,939tCO_2e; market-based Scope 2 emissions are 2,258tCO_2e. This includes two energy networks within the council's reporting boundary (see page 11).
- The majority (>80%) of Woking Borough Council's emissions come from energy use in its energy centres. % of emissions are associated with its fleet. A very small proportion (<0.1%) comes from the council's fleet and limited council-operated streetlighting.
- When excluding the energy centres, electricity from building use contributes 63% to the council's footprint and gas contributes 37%.

Category	Emissions total (tCO_2e)			
	Including energy centres		Excluding energy centres	
	tCO_2e	%	tCO_2e	%
Scope 1	**14,464**	**74.5%**	**1,346**	**37.3%**
Gas	14,346	73.9%	1,227	34.1%
Fleet	119	0.6%	119	3.3%
Scope 2 (location-based)	**4,939**	**25.5%**	**2,258**	**62.7%**
Building use (electricity)	4,939	25.5%	2,258	62.7%
Streetlighting	<0.5	0.0%	<0.5	0.0%
Electric vehicles	<0.1	0.0%	<0.1	0.0%
Scope 2 (market-based)	**2,258**	**13.5%***	**-**	**-**
Building use (electricity)	2,258	13.5%	-	-
Streetlighting	<0.5	0%		
Electric vehicles	<0.1	0%		
Total (location-based)	**19,402.92**		**3,604**	**100%**
Total (market-based)	**16,722.11**		**3,604**	

Table 2.1: Woking Borough Council's Scope 1 and 2 emissions, shown with and without the contribution from the energy centres. *of the market-based total.

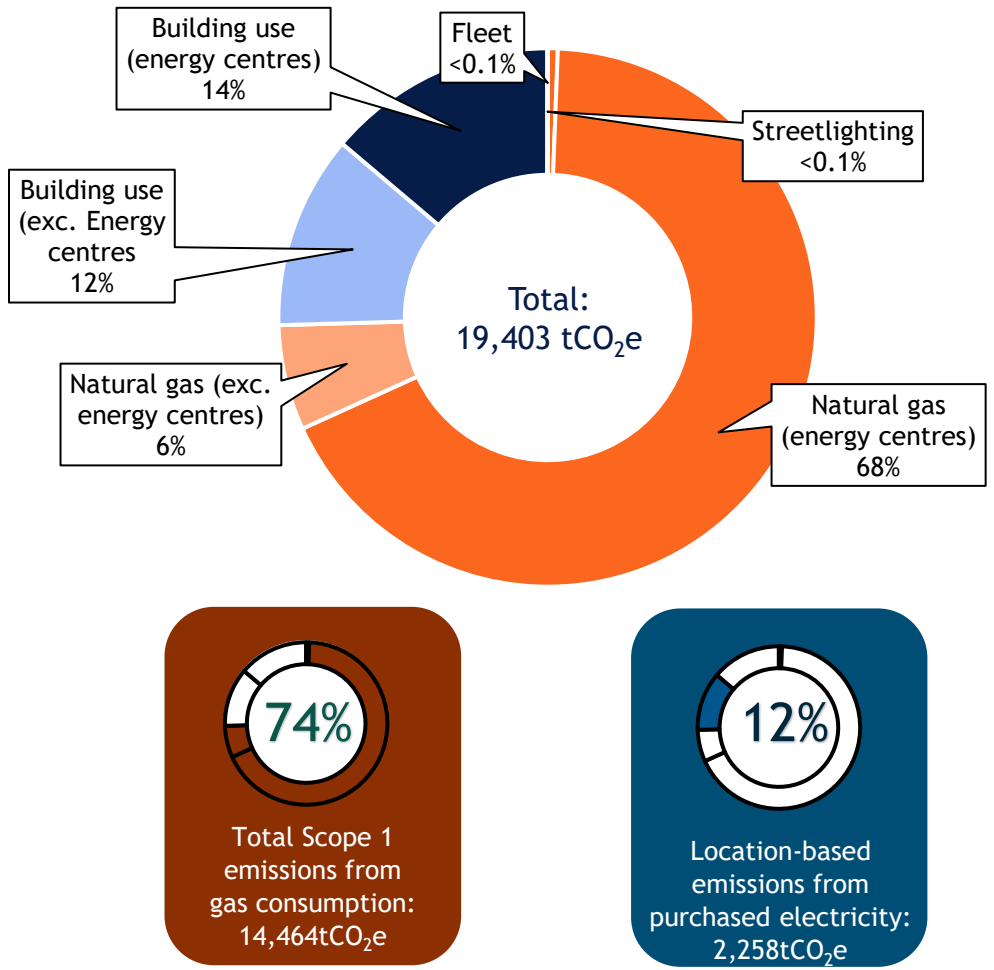


Figure 2.2: Woking Borough Council's Scope 1 and 2 footprint including energy centres for FY 2021/22.

2. COUNCIL EMISSIONS FOOTPRINT
DEFINING SCOPES AND BOUNDARIES

Location-based accounting and operational control

The council's footprint has been calculated according to an *operational control* boundary, defined using the council's corporate asset register. This includes all activities that are under the council's authority, including the activities of its wholly-owned companies and contractors. Social housing was judged to have fallen outside of this definition and has been excluded from this analysis.
As well as sites that the council owns and operates (i.e., those on its corporate asset register), this also includes sites owned and operated by Thameswey Group, most notably its energy centres. These are discussed in more detail overleaf.
Emissions have also been reported using a *location-based* accounting approach; this calculates emissions according to the UK's national grid factor based on a typical energy mix.

Leased sites in the council's asset register

The council owns a large number of sites across the borough that are leased to commercial tenants. This includes notable sites such as the industrial estates on Monument Way, as well as parades on Commercial Way, Princess Road and Dartmouth Avenue.

These sites have been included as part of the council's Scope 1 & 2 emissions following discussion with officers which verified the extent of the council's operational control. Social housing has **not** been included under Scope 1 & 2 estimates.

More details on emissions boundaries, electricity emissions reporting and Scope definitions can be found in Appendix 1.

Accessing leased site data

Leased sites are managed by external property management companies, who have responsibility for liaising with tenants. The council retains ownership of the assets, as well as responsibility for maintaining and/or retrofitting medium/large-scale retrofits on these sites.

Accessing tenant data and bills for this reporting cycle was not possible. Instead, proxy data has been used based on building type and size, in combination with industry-recognised measurements for building energy performance.

Accessing metered tenant data should be prioritised for next year's reporting cycle.

Renewable energy and REGOs

The location-based accounting approach records emissions from electricity according to a grid-average emissions factor, based on the amount of grid-supplied electricity that is drawn to council sites.

The council owns several solar PV assets across various sites in its portfolio. Around 260MWh of on-site generation was recorded across these sites, which corresponds to an equivalent of around 55tCO_2e if the same quantity of energy was drawn from the national grid. This figure is roughly equivalent to the electricity consumed by the Peacocks Centre each year. Thameswey also hold additional PV assets which generate a further ~1,000MWh each year, though these are not situated at sites on the council's corporate asset register.

Thameswey sites are also covered under *renewable energy guarantees of origin* (REGO) certificates, which certify supplied energy as having come from low-carbon sources. Both renewable energy displacement and REGO-backed electricity consumption should be reported separately alongside the location-based total given in Figure 2.1.

2. COUNCIL EMISSIONS FOOTPRINT
THAMESWEY ENERGY NETWORKS

The vast majority of the council's Scope 1 & 2 emissions are the result of activity at three energy centres; two in Woking Town Centre and the other in central Milton Keynes. Together, these energy centres are responsible for over 80% of emissions across the council's assets.

The energy networks serve a significant number of sites, providing efficient heat and power through large-scale underground infrastructure. This infrastructure is *technology-agnostic*, meaning that it can be supplied using a range of source fuels. At present, this is natural gas, though flexibility in the underlying infrastructure means that in the future, the heat networks can be supplied by low- or zero-carbon fuels at its energy centres.

The majority of connected sites on the networks lie outside of the council's asset portfolio. In the case of the Milton Keynes network, none of the network sites are within the council's asset portfolio. Thameswey retains operational control of the energy centres, including ownership of the assets themselves, and manages both facilities. Since these fall under the remit of the council, WBC is subsequently responsible for their emissions, including from assets outside of Woking.

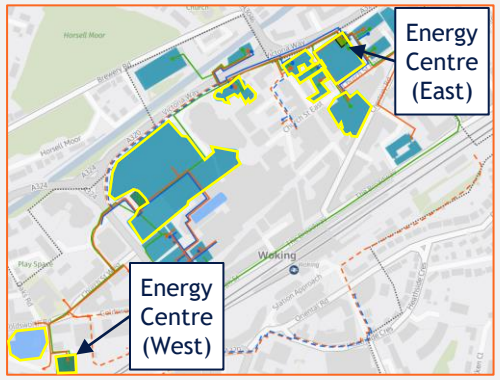


Figure 2.3: Woking Town Centre energy network. Sites connected to the network are shown in teal, with those that are in the council's asset register outlined in yellow. Source: Thameswey

How do the energy centres produce emissions?

The energy centres presently use gas-fired combined heat and power (CHP) generators. CHP generators are an efficient means of converting fuel into energy by simultaneously producing heat and electrical power. This energy is then transferred around a network of buildings via underground pipes, typically in an area where there is a high density of buildings that use a lot of energy. This makes CHP an attractive and efficient set up in town centres.

As heat and power are co-generated locally by one system, CHP plants use less energy overall to meet demand compared to conventional heating systems. In turn this means that gas-fired power stations which supply the gas and electricity grid are used less frequently. Subsequently, this results in lower carbon emissions when compared to independently drawing gas and electricity from the grid.

Thameswey's CHP plants also draw electricity from the grid when required; around 75% of network demand is met by the CHP facilities, with the remaining 25% drawn from the grid. At peak times, a large quantity of surplus electricity (c. 85% of the amount drawn down from the grid in the case of the Milton Keynes network) is exported back to the grid.

As the national energy grid becomes less dependent on gas-fired power plants, the emissions savings from gas-fired CHP are expected to diminish, though the underlying infrastructure will still be a highly valuable asset capable of delivering low-carbon heat and power. See Appendix 4 for more details.

Council assets on the energy networks

Several council sites are connected to the Woking Town Centre network; analysis shows that the demand from connected corporate assets is around 17% of the total heat and power supplied by the network. A map of these is shown opposite in Figure 2.3. It should be noted that activity at the Milton Keynes network is significantly larger than the Woking network.
The network also has plans to grow; both Export House and Midas House are expected to be added to the Woking Town Centre network by 2023. Additional connections to the network will increase the amount of grid energy required to meet demand, subsequently increasing emissions.

2. COUNCIL EMISSIONS FOOTPRINT
SCOPE 3 EMISSIONS ANALYSIS

The following analysis reviews some of the council's Scope 3 emissions, which have been estimated using high-level methodologies and readily available data. This analysis does not represent a full baselining exercise for every Scope 3 emissions category but indicates emissions hotspots within council operations outside of its direct fuel consumption.

Whilst Scope 3 emissions are not included in the council's commitment or the pathways, we have provided an estimate for some Scope 3 categories to support the council in understanding their scale and encourage best practice reporting.

Scope 3 emissions breakdown by source

Under the Greenhouse Gas Protocol, there are fifteen categories of Scope 3 emissions to assess for corporate organisations, though not all of these are materially relevant to council operations. The following categories have been assessed as part of this benchmarking exercise:

- **Staff commuting:** Staff commuting emissions are recorded under Scope 3 categories and have been shown as a single bar on this graph.
- **Waste treatment:** Waste generated by the council through its operations creates Scope 3 emissions when they are collected and treated.
- **Transmission and distribution (T&D)** and **"well-to-tank" (W-T-T) emissions:** These emissions are from created "upstream" in energy supply infrastructure and essentially account for the activities required to supply energy from its source to council assets. These form the most significant contribution to the council's Scope 3 footprint.
- **Contracts:** A proportion of council expenditure data has been assessed for Financial Year 21/22, using contractual spend data. These are shown in more detail overleaf.

The total from Scope 3 emissions (excluding contracts) is 434tCO_2e:

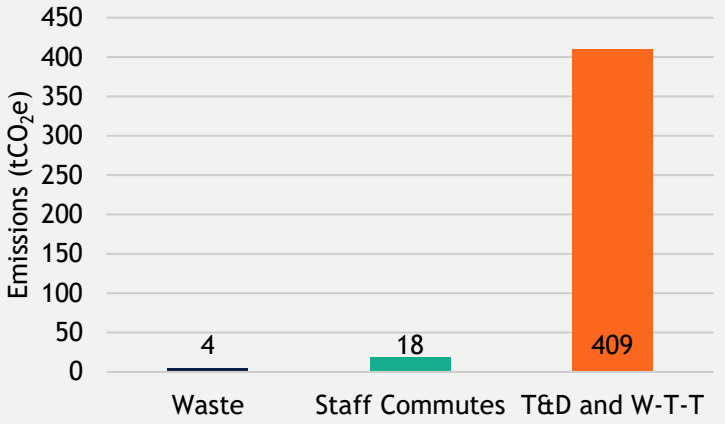


Figure 2.4: Scope 3 emissions estimated as part of this analysis. Procurement emissions are shown on the next page.

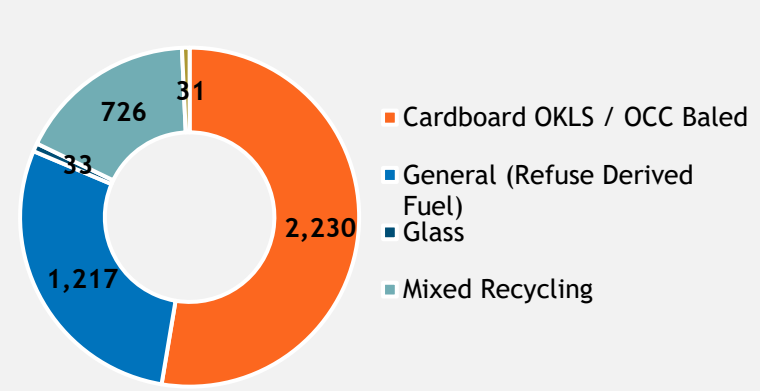


Figure 2.5: Waste breakdown by type (kgCO_2e). RDF refers to waste processed as refuse derived fuel, avoiding landfill.

2. COUNCIL EMISSIONS FOOTPRINT
SCOPE 3 EMISSIONS ANALYSIS

Council Expenditure

Here we explore in more detail the emissions created through council expenditure on external contracts, which have been estimated in excess of 223 tCO_2e for financial year 2021/22.

These emissions are the result of fossil fuel consumption stimulated by council expenditure e.g., building construction and maintenance, street cleansing and grounds maintenance, and facilities management services bought by the council.

The most significant contributor to the council's Scope 3 emissions is construction and building works.

Findings

The graphs opposite provide a breakdown of council expenditure as it relates to emissions (full data shown in Appendix 2). The analysis indicates:

- **Emissions by industry category (Figure 2.6):** The most significant contributors to emissions based on industry sector are buildings and building construction works (34.2%), services to buildings and landscape (27.9%) and waste collection, treatment and disposal (13%). Smaller contributions come from other professional, scientific and technical services (9.4%) and computer programming, consultancy and related services (3.8%).
- **Services to buildings and landscape**: one large contract for facilities management contributes >75% to this industry category.

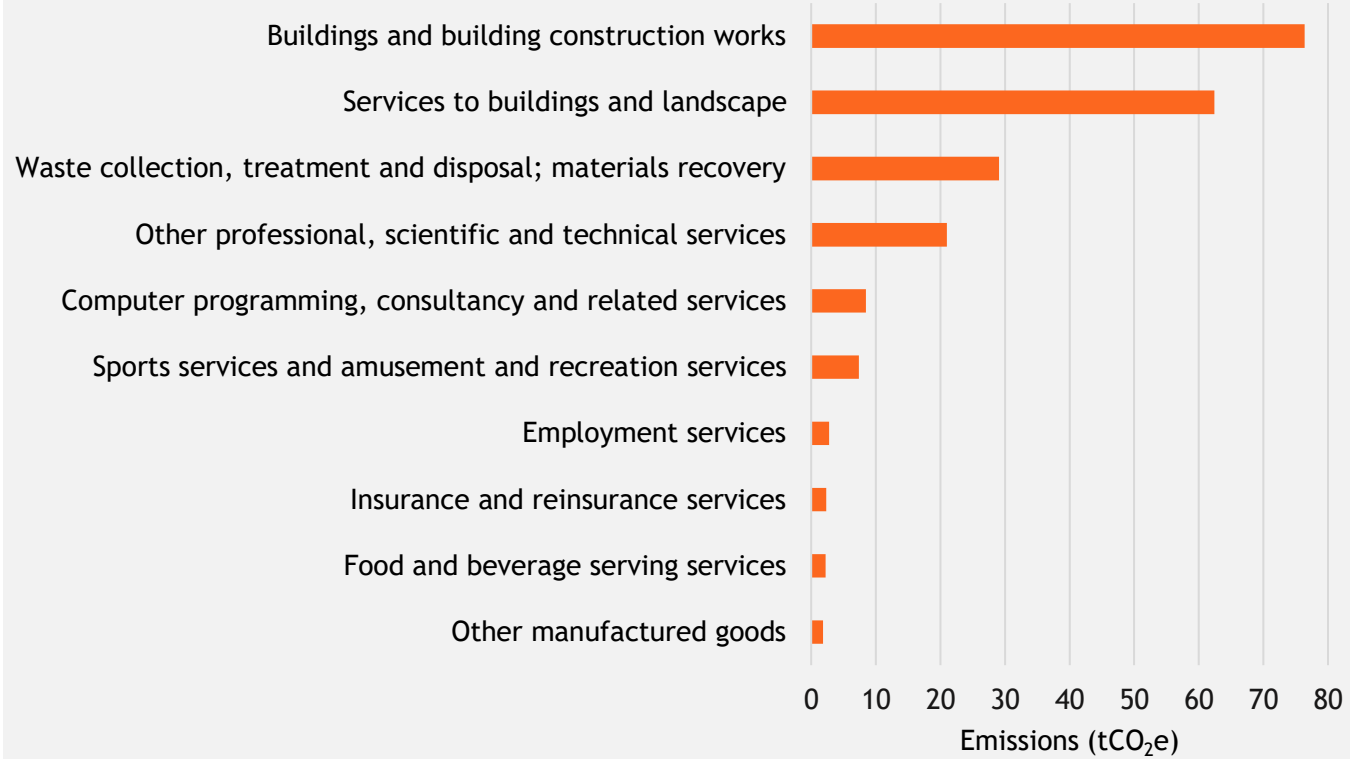


Figure 2.6. Procurement emissions estimates by industry category.

Procurement emissions estimates: method overview

The methodology used to estimate emissions from procurement is a high-level assessment, based on the broad application of industry sector emissions factors. Expenditure is categorised according to its industry sector before being converted into emissions using flat factors i.e., there was no allowance made for suppliers being above or below average performance in terms of their emissions. This means that the actual footprint from these contracts is likely to differ from this estimate.

2. COUNCIL EMISSIONS FOOTPRINT
DATA RECOMMENDATIONS

Alongside this report, the council has also been supplied with the underlying assumptions and calculations that have been made in its writing. This document documents the footprinting process that the council may improve its reporting ahead of future reporting cycles.

We also encourage the council to implement the following recommendations:

Reassessing activity and asset boundaries

- **Reassess activities within the operational boundary each year** – having a full and clear understanding of the council's operations is an important prerequisite for accurately reporting emissions. Changes to contractual arrangements may warrant the amendment of some activities into Scope 1 emissions categories. There may also be justification to include some activities currently under Scope 3 as Scope 1 in the future, on the basis of demonstrating council leadership and maximising emissions reductions.
- **Maintain an up-to-date, centralised asset register for all sites within the operational boundary** – some sites listed on the asset register were demolished or under new development. Keeping an exhaustive, up-to-date list of the council's assets, which centrally records activity data from the various data managers (council corporate estate team, property management partners, Thameswey) is a valuable resource. Any assets added after the baseline year of 2020/21 should also be included, such as Victoria Place. This will also allow for consistent reporting between years and facilitates progress monitoring.
- **Engage with external energy network tenants on energy demand reduction initiatives -** this will allow the council/ Thameswey to better understand where opportunities for demand reduction exist at those sites, mitigating emissions within the council footprint.

Closing inventory data gaps

Scope 1 & 2 data

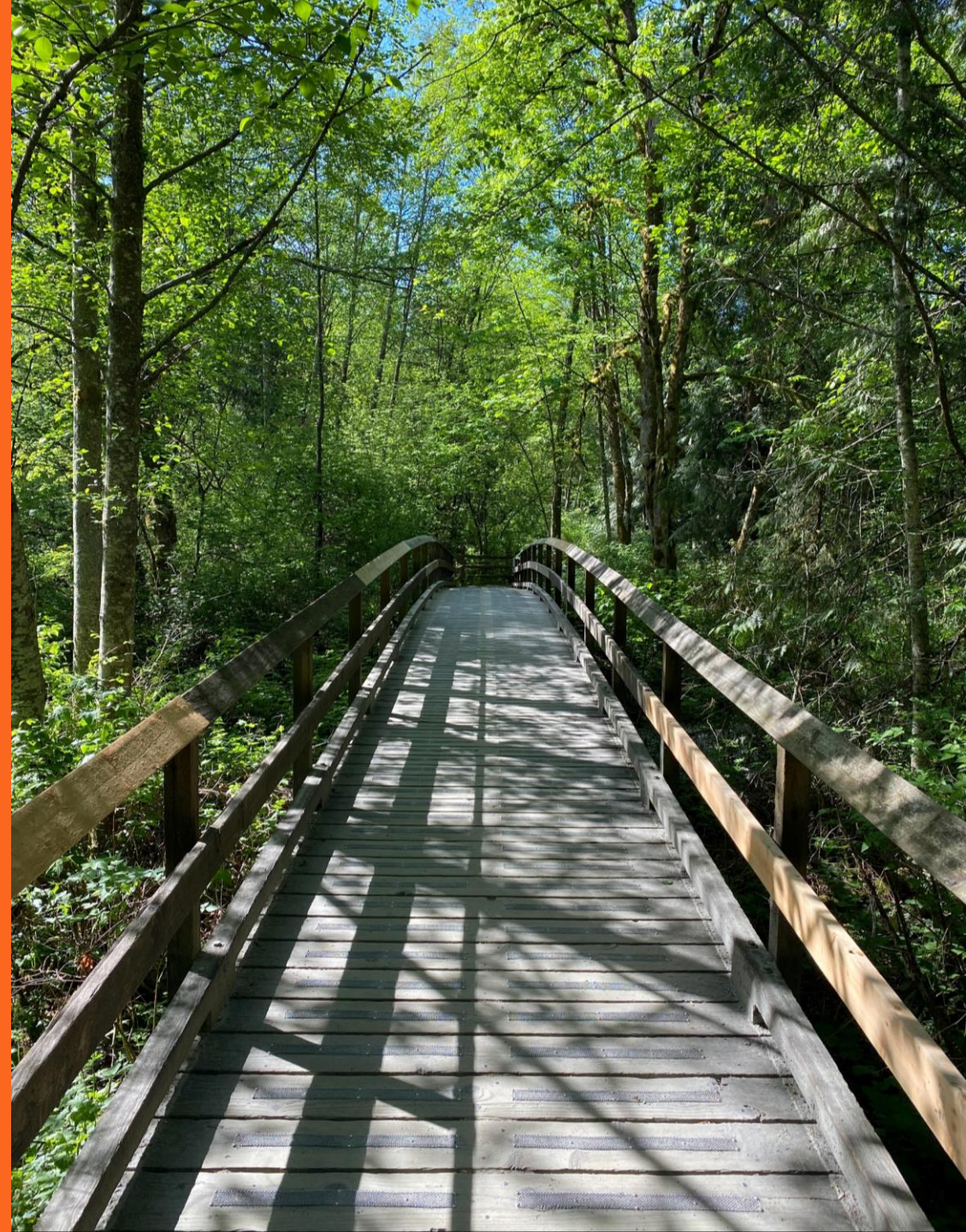
- **Collect data from tenant sites via management companies** – accurate energy usage for all buildings under the council's operational control should be collected. This will allow the removal of proxy data from the footprint in favour of real activity data.
- **Record mileage for all council vehicles** – mileage for all vehicles falling under the council's scope 1 and 2 emissions should be recorded per vehicle for the financial year.

Scope 3 data

- **Include purchase orders in analysis of emissions from procurement -** purchase orders can also be included alongside contracts to provide a more complete picture of the council's overall procurement emissions, which usually contribute a significant proportion of a council's Scope 3 profile. This may also facilitate future engagement with suppliers on their emissions which bears relevance to borough-wide targets for emissions reduction.
- **Survey employees on commuting at a more granular level** – the survey should ask employees to specify the approximate number of miles per specific mode (e.g. train, bus, car) per an average number of days per week.
- **Ensure that the council's sustainable procurement guidelines encourage suppliers to measure and manage their emissions where feasible.**
- **Lead by example and publicly report on the council's Scope 3 emissions -** encourage other local organisations to do the same. Consider adding a Scope 3 reduction target to the council's existing commitments.

03

Emissions Reduction Pathways



3. EMISSIONS REDUCTION PATHWAYS
INTRODUCTION

Achieving the council's target of carbon neutrality by 2030 will require a range of actions and activities across council operations. This chapter describes future scenarios for the council's emissions according to the implementation of different low-carbon projects.

Council emissions since the climate emergency declaration

Figures 3.1a & 3.1b opposite show the key trends in emissions from some sites in the council portfolio since 2018, based on historic energy usage data. These sites include those supplied by Thameswey as well as several sports pavilions around the borough.

Decarbonisation of the national grid has resulted in a significant reduction in emissions; since 2018, the carbon intensity of electricity has fallen by 25% due to the increased proportion of renewables producing energy nationally. COVID-19 also had a significant impact on the activity at council sites; given community leisure centres were closed for a large portion of 2020 and 2021, energy usage at these sites was much lower than in prior years.

Figure 3.1 opposite offers an incomplete picture of the council's historic emissions performance, owing to a lack of complete data for the council's corporate asset register that has been assessed for this report. However, it is highly likely that corporate sites follow the same trends; a reduction in emissions through time as a result of grid decarbonisation and a steep drop in activity as a result of the pandemic.

Forward-looking pathways for the council's future emissions are shown overleaf.

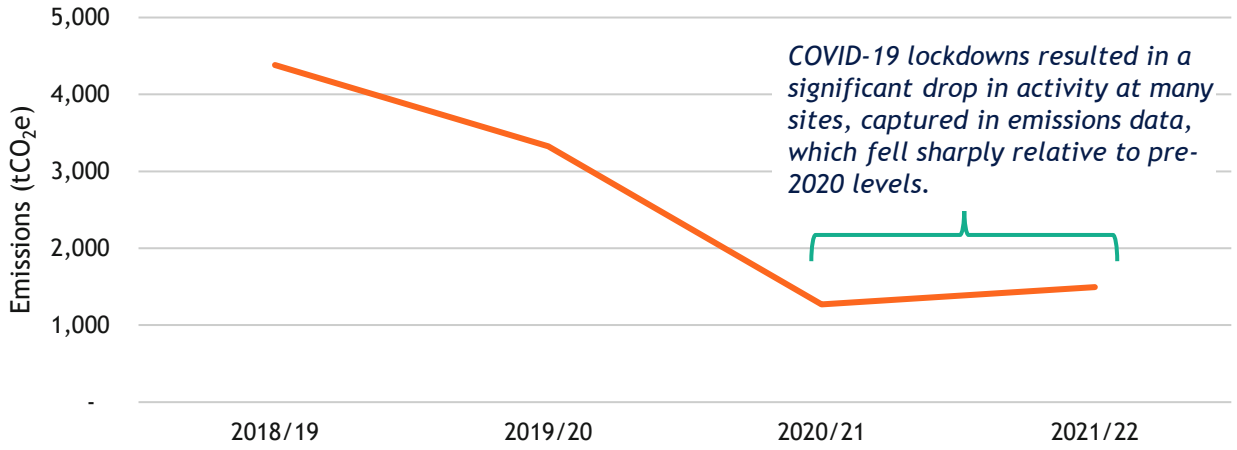


Figure 3.1a: Historic emissions from sports pavilions and Thameswey-supplied sites in the council's asset portfolio. COVID-19 closed down many council sites, which avoided a large proportion of emissions.

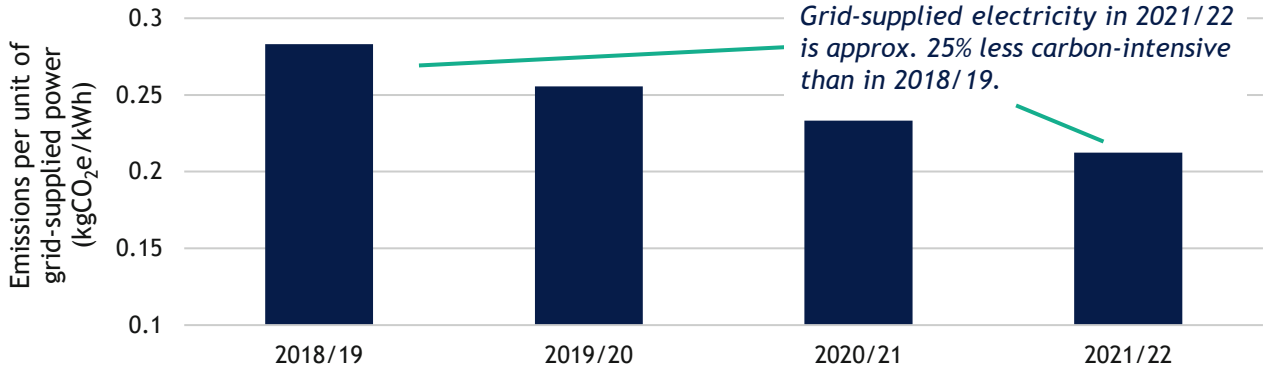


Figure 3.1b: Historic changes in the reported electricity grid factor from DEFRA, which has fallen by c. 25% since 2018 and is the second key driver behind reductions in emissions in that time.

3. EMISSIONS REDUCTION PATHWAYS
INTRODUCTION

Future pathways summary

The pathways analysis is focused on the council's Scope 1 & 2 emissions since these are covered by the council's 2030 target. We have made estimates for future emissions in each financial year up to 2030 based on differing levels of project intervention (Business-as-usual, Medium and High ambition).

Emissions from electricity have been assessed under a location-based approach.

A summary of the emissions pathways can be seen in Figure 3.2 opposite. Figure 3.2a shows emissions inclusive of the Thameswey energy networks; Figure 3.2b excludes the Thameswey energy networks. More detail on the methodology behind these pathways can be found in Appendix 3.

Science-based budgets

The Tyndall Centre findings describe what is necessary for Woking to "play its part" in meeting Paris Agreement goals. It is focused on limiting the *cumulative* amount of emissions below a defined threshold, based on historic emissions within a region. Whilst it is not based on tangible actions and interventions, it defines an upper ceiling for emissions based on a "carbon budget" approach.

To encourage the council to play its part in meeting the area-wide carbon budget, we have shown (dashed line, Figure 3.2) an indicative pathway demonstrating the annual reduction rate for the council's own emissions. See Appendix 3b for the percentage and tonnage reductions per year for these pathways.

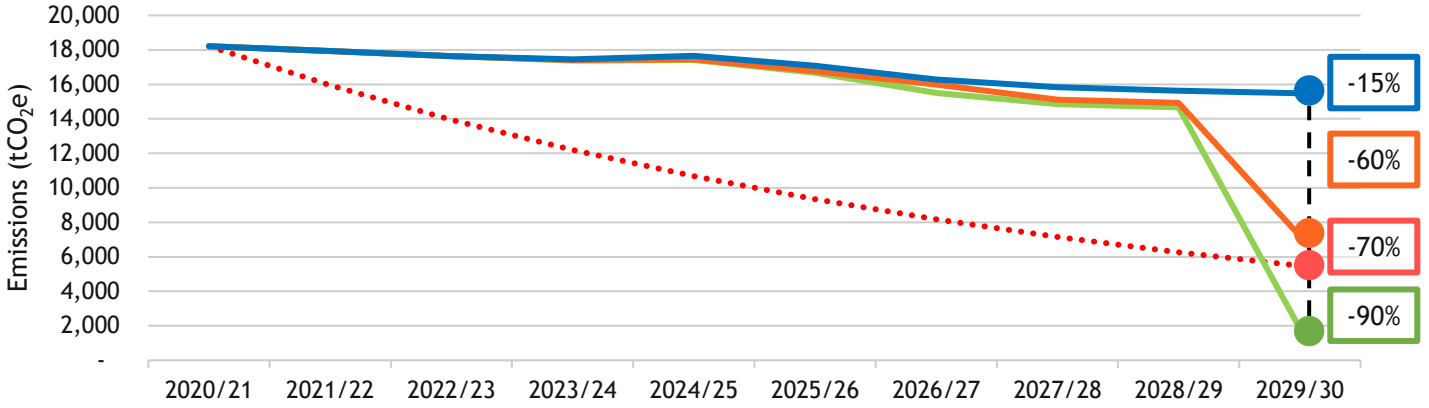


Figure 3.2a: Future emissions according to three modelled pathways scenarios – a business-as-usual case (blue), a medium ambition case (orange) and a high ambition (green) case. A science-based pathway (dashed pink) is also shown for comparison based on the recommended reduction rate for borough-wide emissions within Woking.

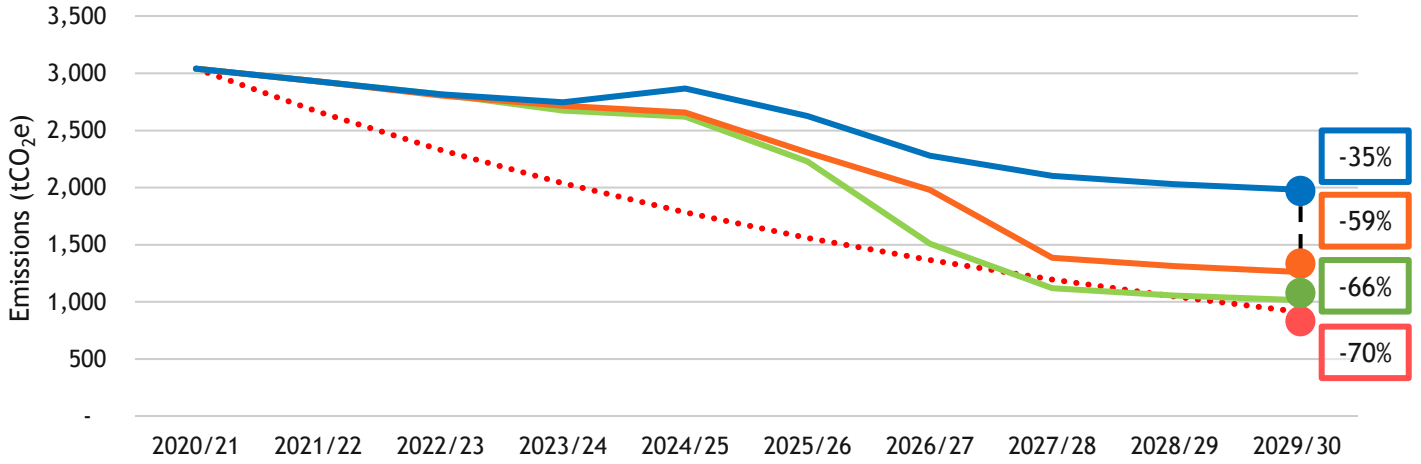


Figure 3.2b: Emissions reduction pathways for council Scope 1 & 2 emissions, excluding Thameswey energy networks.

3. EMISSIONS REDUCTION PATHWAYS
INTRODUCTION

How have these pathways been designed?

Future emissions have been estimated according to baseline statistics for activity and the impacts of a combination of potential future projects.

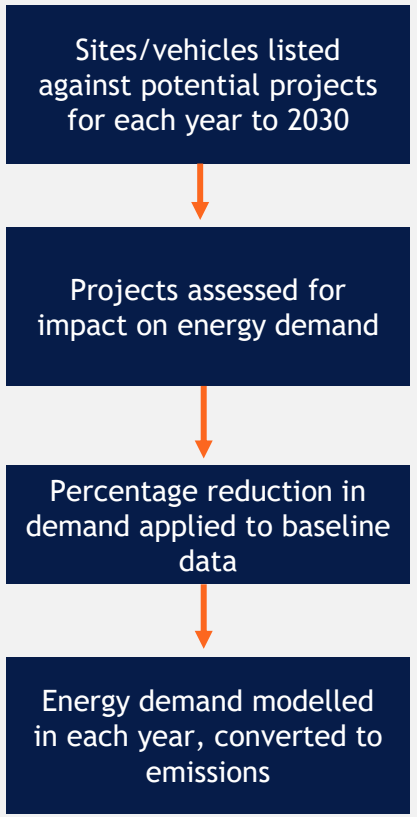
Projects were identified according to the type of building and its usage; large sites that are occupied by the council have been prioritised over leased sites with comparatively small usage, for example.

For each project, an estimate has been made of its impact on the council's emissions. These are varied; from behavioural change projects and technological upgrades to electrification and solar PV installation. All pathways have also considered the continued decarbonisation of the electricity grid.

For buildings pathways, these estimates are based on research carried out in the Buildings Energy Efficiency Survey (BEES), which serves as the technical basis for the Committee on Climate Change Sixth Carbon Budget reports. For transport pathways, varying degrees of fuel replacement and electrification in the replacement of council vehicles have been assessed. An illustrative diagram showing this process method is given opposite.

Each pathway was estimated using location-based emissions accounting, meaning grid-average value projections for electricity have been used. Thameswey's electricity procurement is covered by renewable energy guarantees of origin (REGO) which indicates electricity is sourced from low-carbon sources.

Pathways methodology



Starting point for emissions: raw energy consumption data from 2020/21 baseline year

Building and project "type" cross referenced with BEES survey

Extent of demand reduction is defined in BEES, according to the project and building type

Consumption data (in kWh) converted into tCO_2e for each year up to 2030 according to all modelled projects at all sites

This general approach was taken for all emissions sources in the built environment and transport sectors. N.B.: Mileage data was used instead of energy consumption data in the transport sector.

3. EMISSIONS REDUCTION PATHWAYS
BUILT ENVIRONMENT – PATHWAYS SUMMARY

Figure 3.3 opposite shows the three emissions pathways for the council's buildings, excluding emissions from the Thameswey energy centres. Figure 3.4 shows emissions from the energy centres in the baseline year (grey bar) and in 2030 according to different scenarios.

Delivery of an ambitious package of interventions, designed to reduce energy demand and electrify heating at key sites in the council's portfolio, achieves a 65% reduction in emissions compared to the baseline year. Switching energy centre supply onto renewable fuels could reduce their emissions by up to 95%.
In all pathways, the continued decarbonisation of the national electricity grid has been factored into calculations. If the council sources 100% of its electricity demand from renewable sources (such as through renewable energy guarantees of origin (REGOs)), the achieved reduction along the High Ambition pathway for the energy centres effectively rises to 100%.

Key

- **BAU:** Assumes very little activity to influence energy demand, with reductions in emissions the result of grid decarbonisation. Assumes energy centres remain on gas CHP.
- **Medium Ambition:** Assumes lighting and appliance upgrades at council sites, as well as improved building instrumentation and controls. Assumes energy centres switch to hydrogen CHP.
- **High Ambition:** Assumes lighting and appliance upgrades, as well as fabric upgrades at key sites and heating system replacements. Assumes energy centres switch to biomass or heat pump CHP.
- **Indicative carbon budget:** Annual reduction rate for area-wide carbon budget applied to council's own emissions.

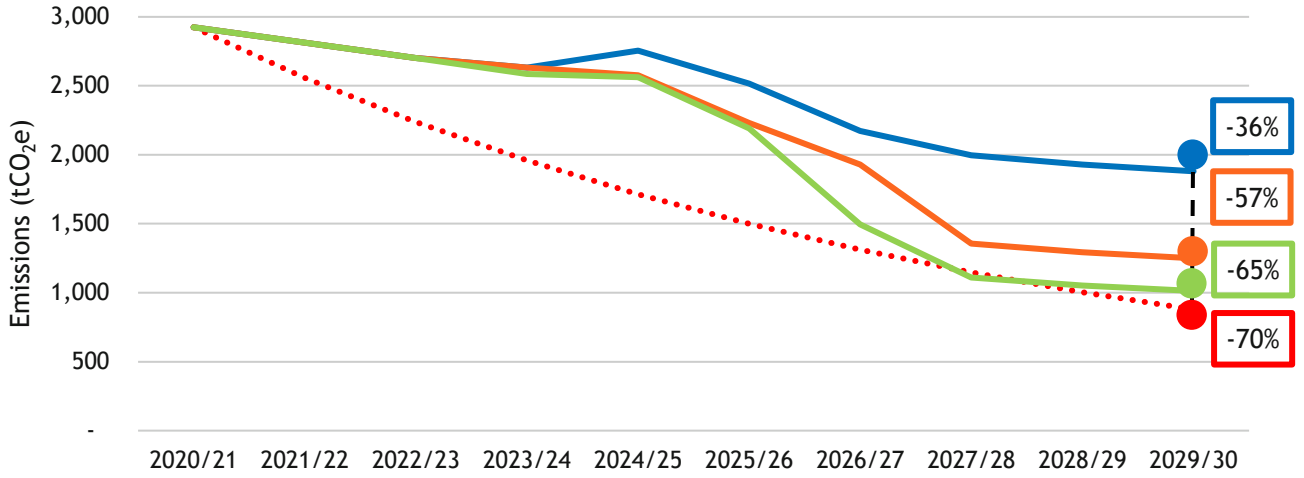


Figure 3.3: Emission reduction pathways for council Scope 1 and 2 emissions from the built environment, excluding emissions from energy centres.

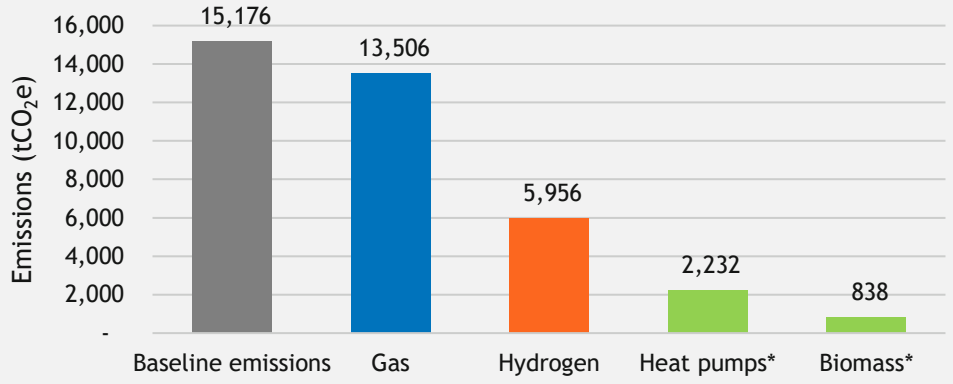


Figure 3.4: Baseline emissions from Thameswey energy centres (grey) and estimated emissions with different source fuels at 2030.

*considers electricity emissions on a location-based method.

3. EMISSIONS REDUCTION PATHWAYS
BUILDINGS – SUMMARY OF MEASURES

Pathway	Measure type	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30
Business-as-usual (BAU)	Demand reduction	Baseline year	Grid decarbonisation only, no specific changes to behaviours								
Medium Ambition	Demand reduction					Small appliances replaced & lighting upgraded	Building management controls				
	Heating retrofit									Heat pump replacements	
High Ambition	Demand reduction				Building fabric upgrades	Building management controls	Behaviour change programmes	Air conditioning & hot water system upgrades	Small appliances replaced & lighting upgraded		
	Heating retrofit							Heat pump replacements at key sites	Heat pump replacements at key sites		
	Energy Centres		Assess alternative fuel options for CHP facilities								Gas CHP replaced

3. EMISSIONS REDUCTION PATHWAYS
BUILDINGS – ALTERNATIVE PATHWAYS

What do the pathways assume?

The three pathways model varying degrees of intervention to reduce demand for energy as well as switch to low-carbon heating systems.

Demand reduction measures focus on the outright saving of energy by using more efficient lighting and appliances, as well as through behavioural changes and building fabric upgrades.

Switching to low-carbon heating systems, such as heat pumps in individual sites and biomass for Thameswey's energy centres, dramatically reduces the demand for natural gas. As the electricity grid decarbonises, the use of heat pumps results in a much smaller emissions footprint.

The key differences along the pathways are as follows:

- **Business-as-usual:** the council does not adopt any significant low-carbon projects, and reductions in their footprint are led by the decarbonisation of the national grid.
- **Medium ambition:** Wide implementation of lighting and appliance upgrades at most council sites, including leased sites. Building control and management measures are also installed. Energy centre supply is switched onto a non-natural gas source, such as hydrogen.
- **High ambition:** Lighting, appliance and building control measures applied. Additional projects aimed at upgrading building fabric and heating systems of council sites with significant energy consumption. Energy centre supply switches to a fully renewable source, such as biogas or electricity (via heat pump).

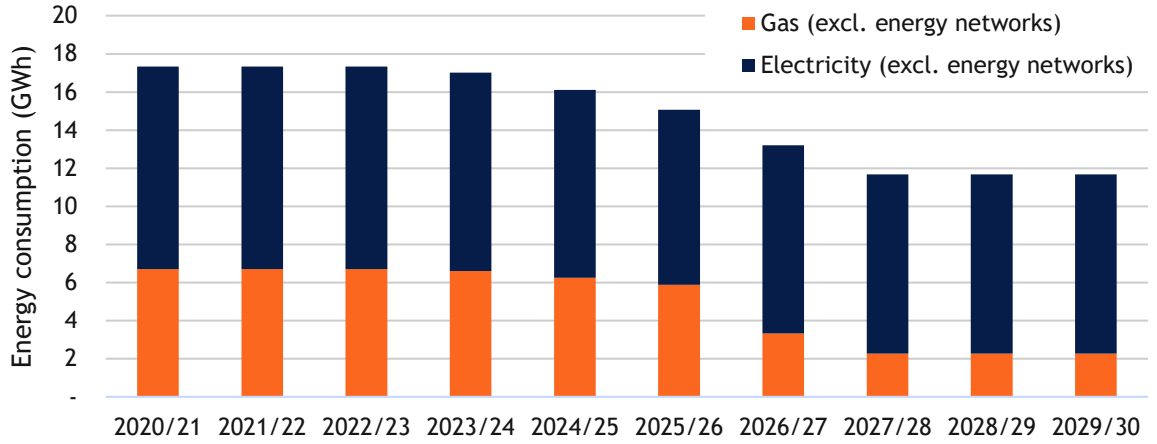


Figure 3.5: Breakdown of energy consumption in council buildings, by energy source, for the High Ambition pathway. This excludes the energy networks and centres.

Across non-network sites, overall energy demand is projected to fall by approximately one third. Gas consumption will fall significantly (around 66%) due to the transition to electric heating systems.

Demand reduction projects at sites connected to the heat network will reduce the energy consumed at energy centres, but this has not been directly modelled due to the large number of network sites that are not within the council's scope. Energy consumption on the energy networks has been modelled at a consistent level, due to lack of available data on future changes to demand. In reality, heat and power demand will increase as a result of planned future connections to the Woking Town Centre network anticipated through the 2020s.

3. EMISSIONS REDUCTION PATHWAYS
BUILDINGS – ALTERNATIVE PATHWAYS

High Ambition Pathway measures

The High Ambition pathway represents an extensive programme of carbon reduction projects. These have been split into the following types:

- **Building fabric upgrades:** improvements to insulation which reduce the demand for energy for heating a building. Typical projects include loft, wall and cavity insulation, as well as replacing glazing and draught-proofing.
- **Building control & management:** improvements to energy metering, building monitoring systems and time controls on heating and lighting. These projects fit closely with the suggested improvements to data collection and reporting.
- **Carbon and energy management:** improvements to equipment procurement policies, behaviour change and general staff awareness. These projects also relate to improved maintenance of heating and cooling equipment.
- **Air conditioning, cooling and hot water:** improvements and upgrades to cooling plant and controls.
- **Basic lighting and appliances:** upgrades to light fixtures and fittings, white goods and other electrical appliances. This also includes improved lighting controls.
- **Heating system retrofit (heat pumps):** the installation of low-carbon heating to displace boilers. These have been modelled as heat pumps, which run on electricity.
- **Heat network decarbonisation:** transitioning away from gas-fired CHP and onto alternative, low-carbon source fuels at the two energy centre sites in the council's asset register. Using renewable electricity to produce hydrogen, or directly through heat pumps, offers a means of directly reducing the emissions from CHP generation. Similarly, the emissions associated with using gaseous biomass are very low.

Which sites received which measures?

- Some measures, such as building controls, carbon and energy management, and lighting upgrades, were assumed across many sites in the council's asset register, including leased units such as those on the Monument Way and Wintonlea industrial estates.
- More substantial projects, such as building fabric retrofits and heating systems upgrades, were modelled at sites with the largest energy consumption that are **not** on the Town Centre network. Sites connected to the network would also benefit from energy efficiency measures, though these have not been modelled, owing to the focus on decarbonization of the network supply and the relatively small proportion of demand by council-owned assets on the network.
- Heating systems upgrades were only modelled for large sites **not** on the Town Centre energy network.
- Sports pavilions, car parks and other lighting-only sites received basic lighting and appliance upgrades only.

How is heat network decarbonisation modelled?

Gas CHP emissions are the major contributor to the council's footprint.
Our analysis assumes that the gas CHP facilities in Woking and Milton Keynes are ultimately replaced by low-carbon source fuels. We have considered three potential options for this; renewable electricity via heat pumps, low-carbon hydrogen, and gaseous biofuels. This replacement has been scheduled to take place in the final year of the pathway (2029/30).
The alternative to a new low-carbon source fuel is essentially a like-for-like replacement of gas CHP, which would "lock in" an relatively high-carbon gas supply.

More details on these low-carbon fuel options are given in Appendix 4.

3. EMISSIONS REDUCTION PATHWAYS
BUILDINGS PATHWAYS COSTINGS

Decarbonising the council's buildings will require significant capital investment but ultimately offers significant potential for longer-term revenue savings and paybacks.

Investment in building stock will also create positive co-benefits as a result of improved building quality. The figures shown in this section represent a lower-bound estimate for capital and revenue implications for the changes required by the High Ambition pathway. They are based on assumptions for the extent of demand reduction for each project type.

The minimum total cost of delivery for the measures described by the High Ambition pathway for buildings is estimated to be approximately £1.4m. This does not include the costs associated with the decarbonisation of energy centres. Different projects have varying payback periods, though the council should expect to recoup the vast majority of its investment within 8-10 years.

A summary breakdown of these costs according to each measure can be found in Table 3.1.

It should be noted that these estimates are not representative of a full business case and are based on broad estimates published in BEES and by the CCC, as well as estimates from local data sources, some of which are based on proxy activity data. The figures shown opposite represent a likely **minimum** capital expenditure required to deliver specific projects. Estimated payback describes the number of years over which the capital investment is returned due to lower operational costs.

Energy network decarbonisation

The cost of switching the heat networks onto low-carbon source fuel is more challenging to estimate. The most recently constructed of the three energy centres, at Poole Road required total investment in the project in excess of £20m.

Measure	Capital cost (£m)	Typical payback (years)
Small appliances and lighting upgrades across most leased sites and council-occupied sites	0.54	8-10
Building management controls at leased industrial & office units, plus council-occupied sites	>0.09	6
Behaviour change programmes across leased retail & industrial units, plus council-occupied sites	0.07	2
Air conditioning and hot water system upgrades at ten sites	0.13	10
Building fabric upgrades at ten large sites	0.25	20-22
Heat pump replacement at eight large sites	>0.31	8-10
Total	**>1.4**	

Table 3.1: Summary breakdown of the costs associated with the High Ambition pathway. For more details on these costs, please see Appendix 5.

Switching to hydrogen may not require significant additional infrastructure at the plant itself to use the fuel. However, this does rely on locally available hydrogen supply infrastructure, which is likely to lie outside of council influence and is also likely to require significant funding. Government projections predict a levelised cost estimate of c. £150/MWh of hydrogen produced, meaning the wholesale annual cost of supplying the council's two networks would be in excess of £11.5m in 2030.

Similarly, a stable biogas supply may rely on the installation of local storage tanks and a connection to local generation infrastructure, both of which carry capital investment implications. Government data on the lifetime cost of a from-scratch biomass CHP plant indicates investment in the region of £6m (assuming a 1.5MW plant).

3. EMISSIONS REDUCTION PATHWAYS
TRANSPORT – PATHWAYS SUMMARY

Figure 3.6 opposite shows the three emissions pathways as they relate to emissions from the council's owned fleet.

The High Ambition pathway (shown in green) achieves a 98% reduction against the 2020/21 baseline, whilst the BAU and Medium Ambition pathways are estimated to achieve reductions of 15% and 91% respectively.

Key

BAU: Assumes the council replaces vehicles like-for-like and continues to use forecourt diesel. Rollout of improved telemetry systems delivers some efficiency gains.

Medium Ambition - HVO fuels: Assumes the council switches to a hydrogenated vegetable oil (HVO) diesel fuel mix and petrol cars are replaced with vehicles suitable for HVO when up for renewal.

High Ambition - all electric: Assumes all vehicles are replaced with EV equivalents when up for renewal.

Indicative carbon budget: Annual reduction rate for area-wide carbon budget applied to council's own emissions.

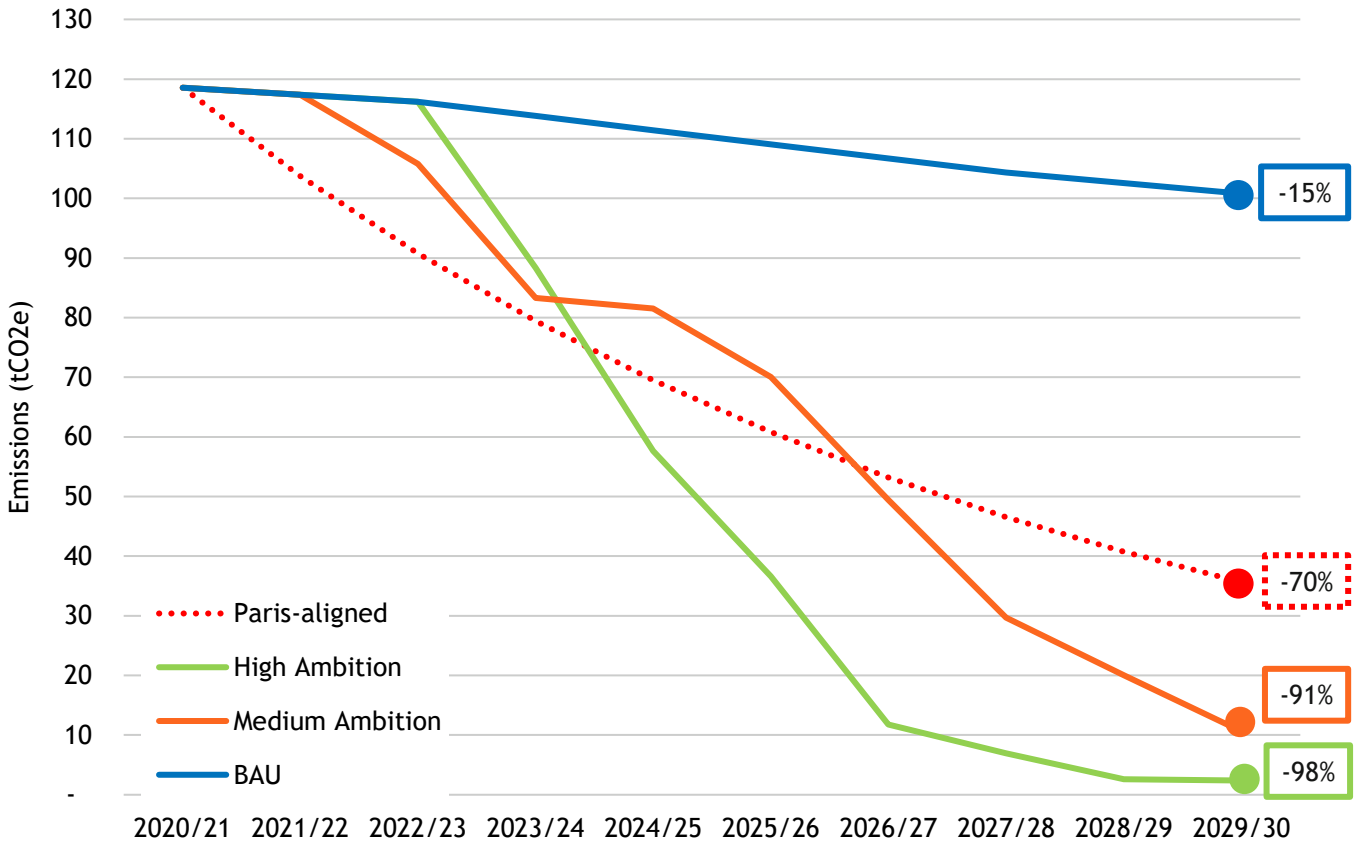


Figure 3.6: The emissions reduction pathways for the council's transport operations given BAU, Medium Ambition and High Ambition scenarios.

3. EMISSIONS REDUCTION PATHWAYS
TRANSPORT – SUMMARY OF MEASURES

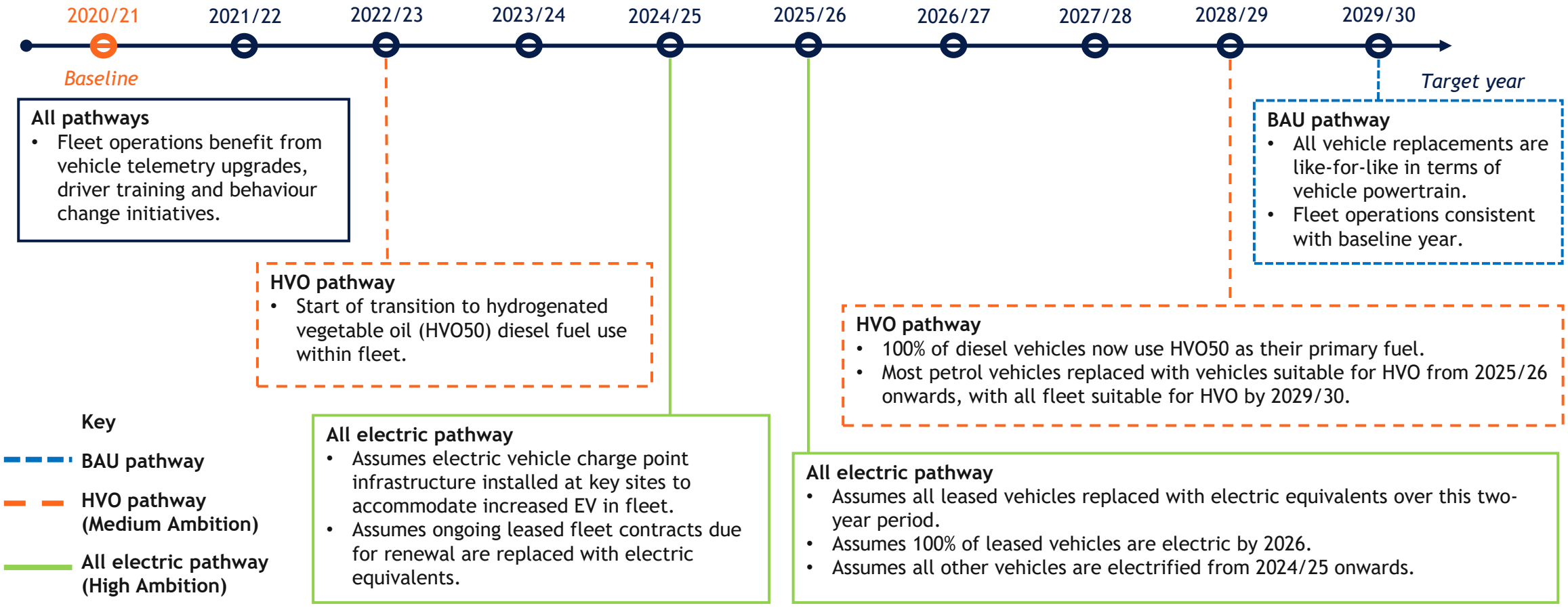


Figure 3.7: Timeline which summarises measures considered for each transport pathway scenario. Boxes indicate the year by which a given measure is completed/installed. All pathways include additional vehicle telemetry upgrades and assume operational mileage aligned to the baseline year of data.

3. EMISSIONS REDUCTION PATHWAYS
TRANSPORT PATHWAYS

What do the pathways assume?

Each pathway models a varying degree of fuel change within the council's fleet. Replacing the fuel within vehicles has the largest influence on emissions – through efficiency measures such as telemetry systems upgrades and driver training have also been factored into this analysis and applied to **all** pathways. The key differences along the pathways are as follows:

- **Business-as-usual:** Vehicles are replaced like-for-like and fleet operations continue with the present fuel and vehicle types currently in the fleet.
- **HVO fuels:** Diesel vehicles within the fleet are transitioned onto a biofuel blend, which carries a lower emissions factor than forecourt diesel. Any remaining petrol vehicles are replaced with vehicles suitable for HVO, with a full fleet suitable for HVO by 2029/30. A 50/50 blend of hydrogenated vegetable oil and diesel (HVO50) has been considered in this analysis.
- **All electric:** All leased vehicles are transitioned onto electric vehicles (EV) when fleet contracts are presumed to be renewed in the second half of the 2020s, following a period of electric vehicle charge point installation at council sites. Other vehicles follow a steady replacement trajectory with electric equivalents.

This analysis has considered vehicles within the council's leased fleet. Please see Appendix 2 for a breakdown of the current emissions baseline from the council fleet.

HVO fuels

Forecourt diesel is presently around 7% HVO. Using HVO reduces the number of emissions created by vehicles since the fuel is made from organic materials that can be renewed. HVO can be used interchangeably within conventional diesel engines. Historically, vehicle fleets with well-defined operational patterns (such as buses and refuse collection vehicles) have been identified as good candidates for fuel replacement with much higher concentrations of biofuels. This has been shown at the local authority level as well as by academic studies during on-road testing. The use of HVO allows for diesel vehicles to reduce their emissions impact but carries an associated premium in procurement costs as well as raising challenges to secure supply. The implications of this have been explored overleaf.

EV fleet & charging infrastructure

The council will need to invest in charge point infrastructure in order to support a large-scale transition to EVs within its fleet. This highlights a benefit of having on-site renewables on council premises which generate electricity to meet the growing demand for electricity.

Just under half of the council's vehicle mileage is from small-medium petrol cars, which are easier to replace with electric equivalents than larger vehicles, such as vans. Considering this, however, Class II and III vans contribute just over half (57%) of the council's vehicle mileage, meaning there may be different timeframes to convert council vehicles to electric equivalents.

Vehicle type	Recorded mileage	
	Miles	%
Small-medium cars (petrol)	50,850	38%
Small-medium cars (diesel)	4,616	3.4%
Class II van (diesel)	48,338	36.1%
Class III van (diesel)	29,464	22%
Electric vehicle	637	0.5%
	133,904	

Table 3.2: Proportion of mileages recorded for different vehicle types in the council's leased fleet for FY 2021/22.

3. EMISSIONS REDUCTION PATHWAYS
TRANSPORT PATHWAYS COSTINGS

Reaching a carbon-neutral fleet will require investment, but ultimately offers the potential for longer-term revenue savings and paybacks. The estimates shown in this section represent the *additional* cost of a particular vehicle type, compared to the business-as-usual case where vehicles are replaced like-for-like.

HVO fuel alternatives

Certain vehicles in the council fleet may be difficult to electrify and alternative options such as HVO fuel can reduce the emissions output of some vehicles by up to 90%. However, HVO is 12.5% more expensive than regular diesel on average.

For heavy-duty vehicles (such as larger vans), electrification may be less practical than using HVO fuels, as current heavy duty electric vehicles can be prohibitively expensive.

EV fleet & charge point infrastructure

To replace the council's vehicles (including lease vehicles), we estimate this would cost between £1.6m and £2.1m compared to an all-petrol/diesel replacement strategy. The upfront capital investment into EV would be paid back through cheaper refuelling costs, over a period of roughly 3 years. It is worth noting that the costs of replacing lease cars would be the responsibility of employees.

There are approximately 68 vehicles in the council's fleet in total, of which the majority are medium petrol cars. Direct electric equivalents of the same vehicles presently used by the council are more expensive in the current market, meaning that replacing cars with electric equivalents could incur a large additional cost. This cost may be reduced by going for cheaper vehicle models, rather than like-for-like.

Vehicle replacement scenario	Cost (£m)	Additional cost (£m)
Replace petrol/diesel for petrol/diesel, using same vehicle models	1.3	-
Replace petrol/diesel for electric, using same vehicle models	2.1	+0.9
Replace petrol/diesel for electric, with cheaper vehicle models, scaling down average van size	1.6	+0.4
EV charge point installation	<0.01	+<0.01

Table 3.3: Summary of costs relating to vehicle replacement in the council's fleet. More details on the methodology for these calculations can be found in Appendix 4.

A summary of the transport pathway costs are shown in Table 3.3. Accompanying methodology notes can be found in Appendix 5.

EV charge point infrastructure will also be required at council sites if the fleet is to switch fuel types. The number of charge points required will vary depending on site availability, vehicle type and the size of each charge point. A more detailed investment case would be required to accurately estimate the exact number of required charge points.

If considering existing vehicle numbers, a combination of 22kW and 3.5kW chargers would meet the vehicle demand based on research estimates. Almost every fleet vehicle would require its own charge point if using solely 3.5kW charge points.

The UK government currently offer a workplace charging scheme for public sector organisations seeking to install new charge points. The grant covers up to 75% of the total costs of purchase and installation of EV charge points up to £350 per socket up to a total of 40 sockets. The costs cited in Table 3.3 do not account for any subsidies.

3. EMISSIONS REDUCTION PATHWAYS
WATERFALL GRAPH

Figure 3.8 opposite shows a breakdown of different High Ambition pathway measures according to their estimated impact on emissions. The emissions reductions are shown in relative terms between the baseline year of 2021/22 and the goal year of 2029/30.

- **Energy Centre decarbonisation:** Given their significance to the baseline footprint, the largest reductions are related to the decarbonisation of the fuel supply for energy centres.
- **Grid decarbonisation:** Grid decarbonisation is anticipated to play a significant role in reducing the location-based emissions total as the national grid onboards increasing renewable capacity.
- **Heating systems retrofit:** Among the sites that are not connected to the energy network, the most significant opportunity for decarbonisation lies in replacing gas-fired heating with renewable fuel sources, such as heat pumps.
- **Demand reduction measures:** Other demand reduction measures related to more efficient lighting, appliances and building fabric are expected to have a more minor impact on the footprint, but these initiatives also represent the opportunity to engage with tenants on energy consumption habits, which bears significance to borough-wide targets and reducing emissions outside of the council's direct footprint.
- **Offsetting/ Insetting:** Along the High Ambition pathway, around 1,800tCO_2e residual emissions remain in the council's footprint. Chapter 4 explores ways and means of treating these emissions.

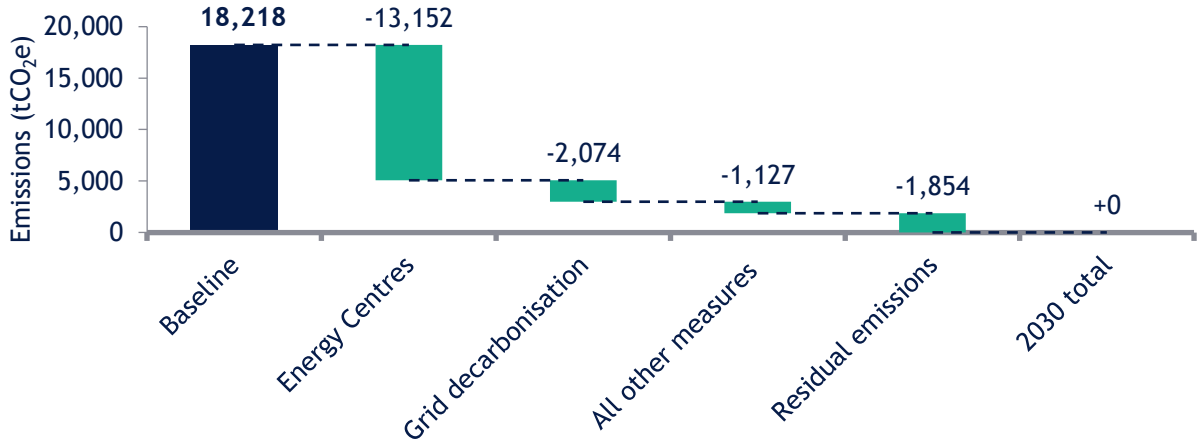


Figure 3.8a: Waterfall chart showing relative impact of different actions on the council's footprint (location based). N.B.: A varying emissions factor was used for forward-looking analysis which returns a slightly different baseline to the total in Chapter 2.

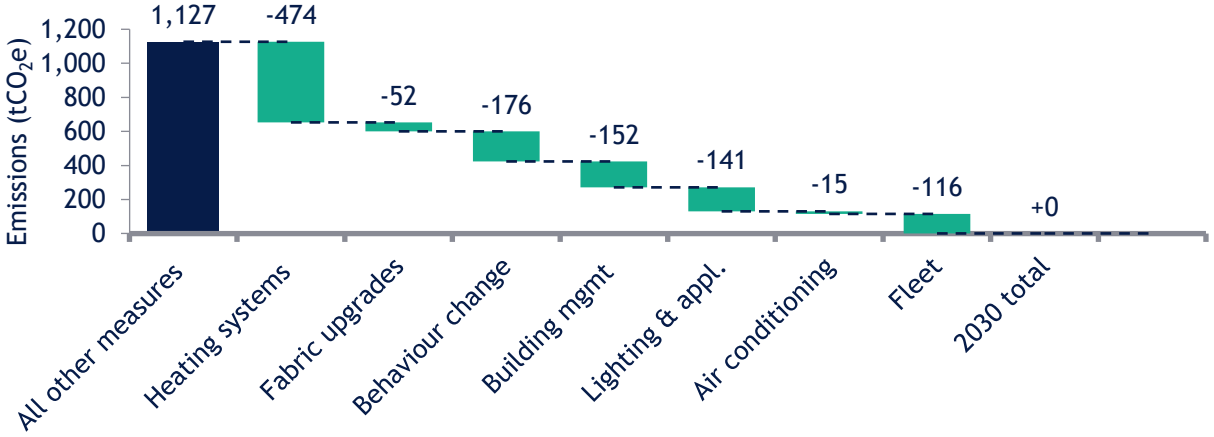
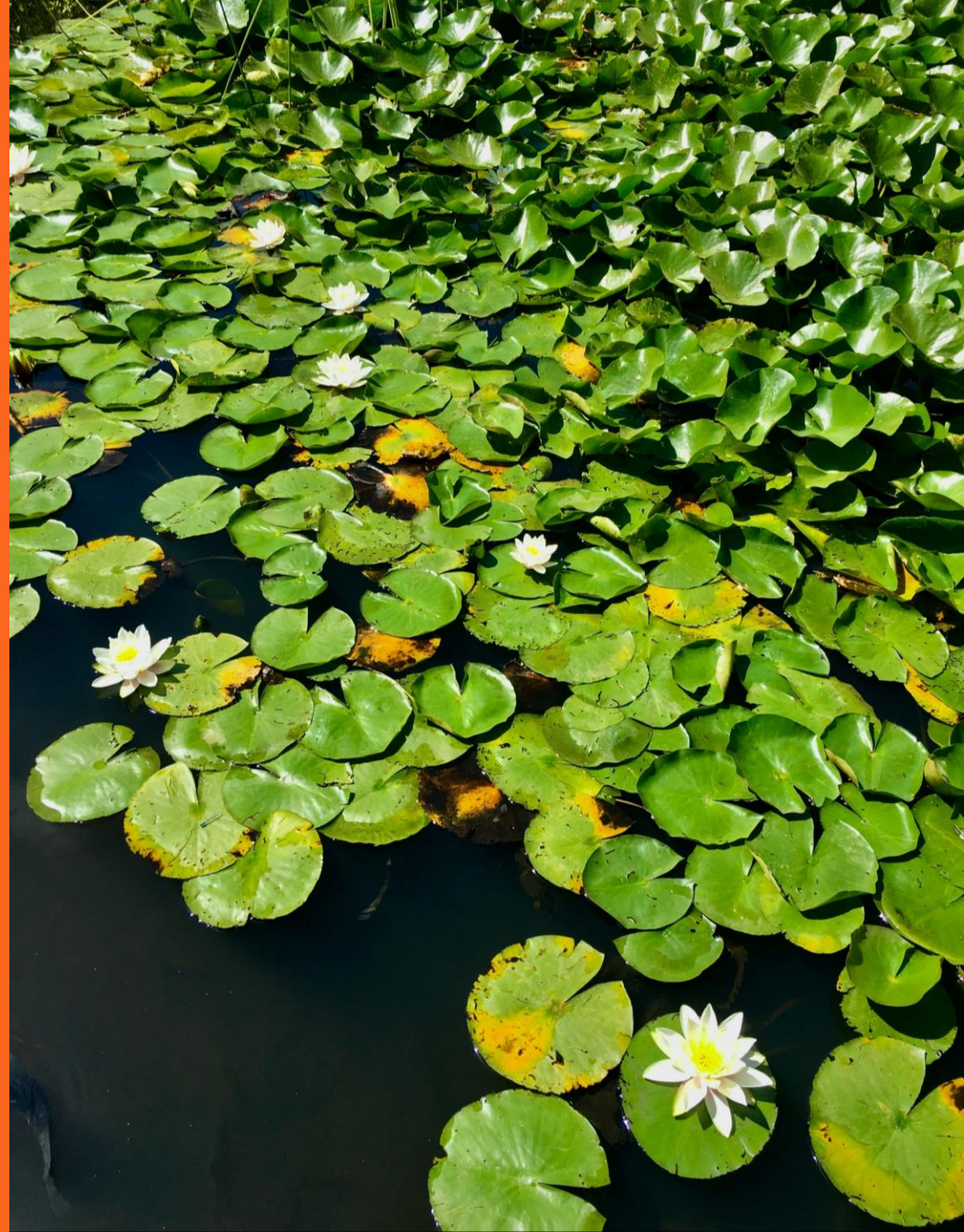


Figure 3.8b: Waterfall chart of non-energy network related measures.

04 Residual Emissions



3. RESIDUAL EMISSIONS
INTRODUCTION

Reaching towards carbon neutrality for the council will require a range of ambitious emissions reduction measures, discussed in Chapter 3. However, it may not be possible to achieve carbon neutrality before the 2030 target given financial or technical limitations.

The emissions remaining in 2030 after reduction projects have been achieved are termed *residual emissions* and are visualised in Figure 4.1 for the Medium and High Ambition pathways. The rest of this chapter discusses options available to the council in terms of treating these residual emissions. In each case, the cost and effort required to offsetting these emissions are dependent on the number of residual emissions retained by the council in 2030.

What might the council footprint look like in 2030?

To estimate the potential quantity of emissions that will remain in 2030, we have considered two scenarios; the successful delivery of the Medium Ambition pathway and the successful delivery of the High Ambition pathway.

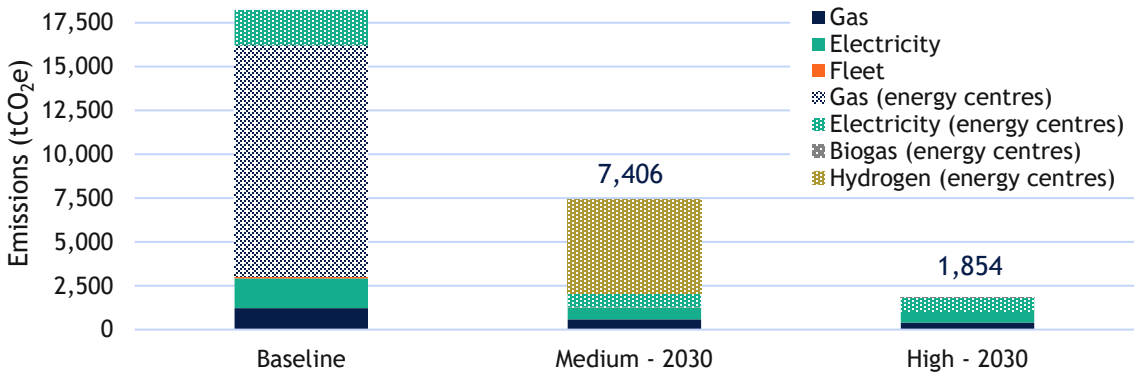


Figure 4.1: Potential quantities of residual emissions dependent on extent of decarbonisation programmes. Hatched area indicates emissions from energy network activities.

The major determinant in residual emissions is the successful decarbonisation of the energy centres. This analysis considers scenarios where the CHP plants are replaced with fossil-fuel produced hydrogen supply (Medium case) or a renewable biogas supply (High Ambition).

The emissions reduction hierarchy

Council emissions should be treated with respect to the emission reduction hierarchy (Figure 4.2) where offsetting is a last resort measure. Where possible, emissions should be prevented in the first instance. This allows emissions removal measures, such as tree planting, to be used to draw down historic emissions.

Whilst direct emissions reduction measures should be prioritised, it is also likely that despite best efforts some emissions will remain in 2030, given the hard-to-treat nature of some emissions, such as those in buildings where retrofit projects may be limited or heating systems that may be very difficult to replace.

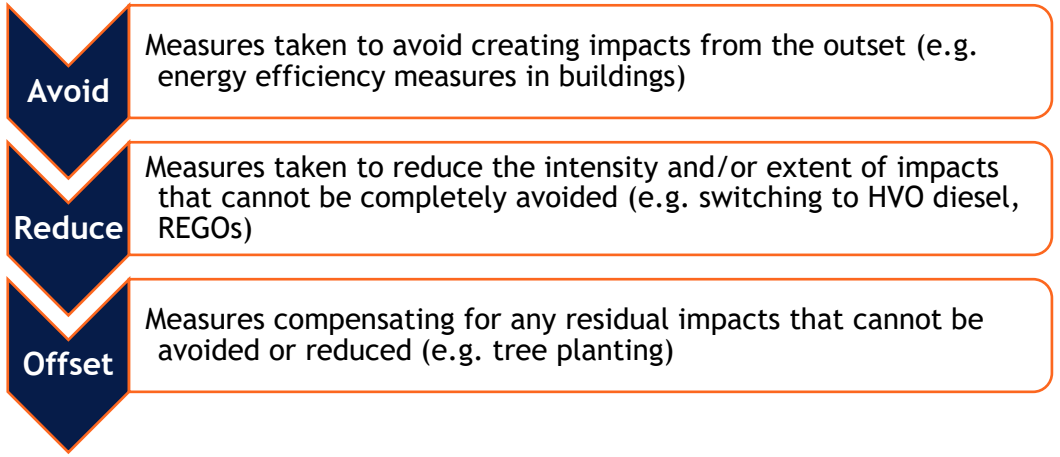


Figure 4.2: Diagram of a generalised emission reduction hierarchy, adapted from the WWF.

3. RESIDUAL EMISSIONS
CARBON OFFSETTING

Carbon offsetting

Traditionally, carbon offsetting refers to the purchase of a tradeable unit which represents an emissions reduction, which balances the climate impact of an organisation, activity or individual. There are different varieties of offsets, namely:

- **Carbon removal offsets** support projects that physically draw carbon out of the atmosphere. Examples include nature-based solutions such as tree-planting, carbon capture and storage (CCS) and negative emissions technologies (NETs).
- **Carbon avoidance offsets** support projects that prevent carbon which otherwise would have been released into the atmosphere. Examples include installing renewable energy or preventing deforestation.

The principles of offsetting can also be applied beyond just the purchase of carbon credits, and many local authorities are now exploring opportunities to support decarbonisation initiatives more locally. This can help to tackle some challenges inherent in the purchase of carbon credits – these are explored further in Appendix 6.

We have considered three offsetting options to treat the council's residual emissions. These are not mutually exclusive, and the council may choose to apply more than one in seeking to make the final steps to carbon neutrality:

1. **Market-based Offsets:** Purchasing verified UK carbon credits from the Woodland Carbon Code and/or the Peatland Carbon Code (see page X).
2. **Local nature-based solutions:** Delivery of nature-based offsetting projects locally, such as through tree planting initiatives (see page 32).
3. **Authority Based Insetting (ABI) projects:** Where the council supports delivery of carbon reduction or avoidance projects within the borough. This includes projects such as retrofitting local housing and local energy installations. This could be achieved via Anthesis' Authority Based Insetting (ABI) framework.

3. RESIDUAL EMISSIONS
MARKET-BASED OFFSETS

Purchasing verified UK carbon credits from the Woodland Carbon Code and/or the Peatland Carbon Code.

Market-based offsets work via the transactional purchase of "carbon credits" with finance. Each credit represents a specified amount of emissions that can then be claimed against an organisation's footprint. Usually, carbon credits are expressed in terms of a pound-per-tonne (£/tCO_2e) unit.

The current cost of Woodland Carbon Code credits is between £7-£20 per tCO_2e, excluding additional administration fees. These prices depend on the costs of creating and managing the woodland and any co-benefits the project may provide.

The costs of voluntary carbon credits are extremely liable to change and are almost certain to increase in value significantly as demand grows. Market-based offsets have increased in price over the past 12 months year and research by Trove Research and UCL predict further increases in the next 20 years, potentially rising to £38 per tCO_2e in 2030.

Market-based offsets must be purchased *annually* to meet residual emissions. This poses a significant challenge looking beyond the 2030s, with the cost per credit currently forecast by the UK government to increase as high as £163 per tCO_2e by 2040 in their lowest-cost projections.

The Woodland Carbon Code and the Peatland Carbon Code are the predominant suppliers of based market offsets in the UK.

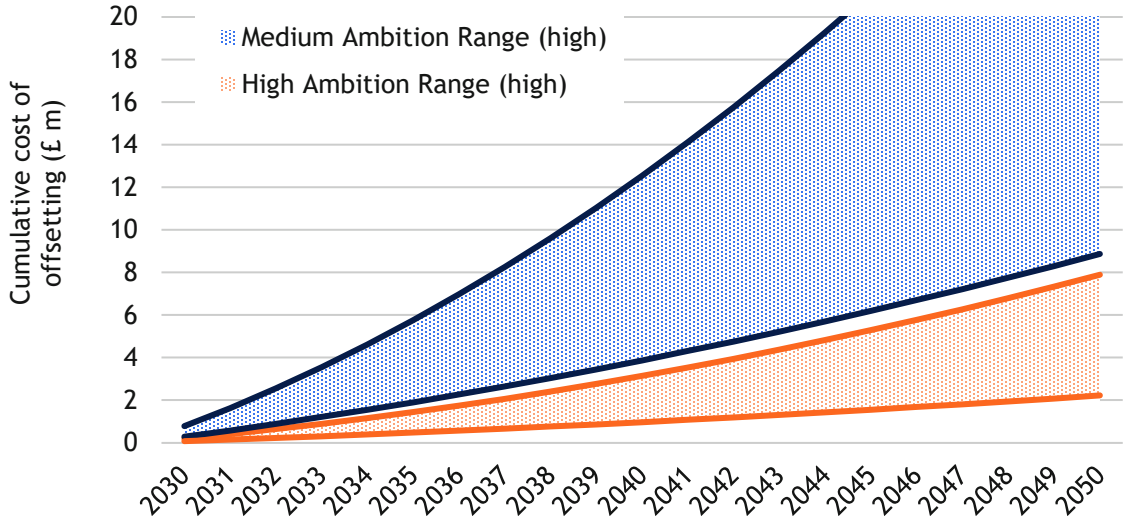


Figure 4.3: Indicative cumulative costs of offsetting residual emissions along Medium and High Ambition pathways. The shaded area denotes the potential range in cumulative offset costs based on potential market changes, which very quickly reach a scale of millions of pounds each year beyond 2030.

Offset amount required (tCO_2e/year)	Predicted annual cost in 2030 to offset
High Ambition – 1,854	£70,000 - £195,000
Medium Ambition – 7,406	£280,000 - £780,000

Table 4.1: Current and predicted cost to offset Medium & High Ambition pathways in 2030. As the cost per tonne increases over time, the annual cost to offset residual emissions is anticipated to grow significantly.

Please see Appendix 6 for more details on the challenges of market-based offsetting.

3. RESIDUAL EMISSIONS
TREE PLANTING

Investing directly in nature-based solutions.

To avoid some of the challenges faced with purchasing market-based offsets (i.e. carbon credits), nature-based projects offer an alternative means of locally-based offsetting.

Tree planting is commonly cited as a popular means of sequestering carbon and offsetting residual emissions, though accurately claiming carbon savings can prove challenging. Trees must grow sufficiently (c.10 years, see Figure 4.4) before they can reliably be used to claim carbon savings and it is usually the case that a scheme will plant a "buffer" of around 20% extra trees to account for some trees failing to reach maturity.

Carbon savings should also only be claimed for carbon sequestered by the trees *as they grow*, as opposed to claiming savings in advance before the trees reach maturity. This combination of factors can often mean a large volume of trees is required to offset residual emissions to the scale of thousands of tonnes. In Woking's case, the relatively high amount of expected residual emissions means that the area of required tree planting is also very high compared to available land in the borough.

Emissions scenario offset (tCO_2e)	Minimum hectares of trees required (planted no later than 2026)	Equivalent number of trees	Estimated cost (£m)
High: 1,854	730	1,168,000	up to 6.2
Medium: 7,406	2,900	4,640,000	up to 24.6

Table 4.2: The estimated areas of tree planting required for both the Medium and High Ambition pathways. The area of Woking borough is approximately 6,400 ha in total. Costs based on data from the Woodland Creation & Maintenance Grant and excludes land values.

Even if residual emissions are in the low hundreds of tonnes, the council will be required to plant hundreds of hectares of trees - all within the next 3-5 years - to offset its residual emissions using this method. This is necessary to allow for the trees to grow, reach maturity, and sequester enough carbon in the process for the hundreds of tonnes of residual emissions to be legitimately offset. It is highly unlikely that all of this planting could occur within Woking, which introduces some concerns akin to those associated with market-based offsets (see Appendix 6).

Completing large-scale tree planting projects at scale would ultimately lead to the council having more "claimable" carbon savings than it would need, however, as the trees reach full maturity in the 2040s. Tree planting may therefore be a potential longer-term solution for treating residual emissions.

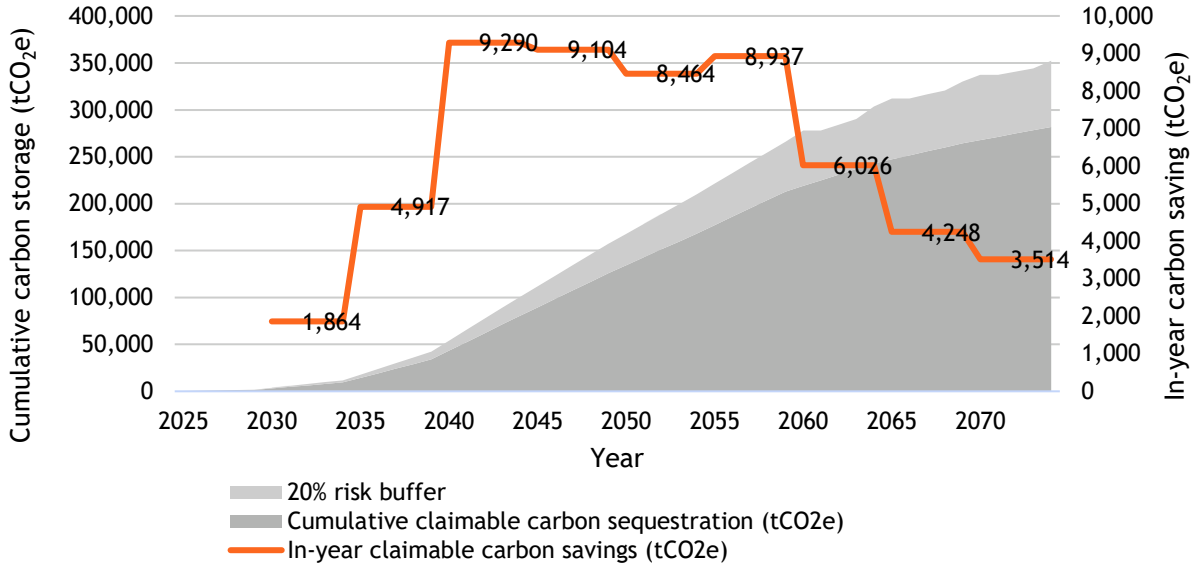


Figure 4.4: Cumulative carbon storage over time for 730ha of trees planted in 2026. The claimable carbon per year is shown by the scale on the left-hand axis and indicated by the values against the line on the chart.

3. RESIDUAL EMISSIONS
CARBON INSETTING

Using council resources, capacity and funding to facilitate local low-carbon projects outside of the council's operations and claim carbon savings.

In a corporate context, carbon insetting refers to offsetting investments targeted within a business' value chain, as opposed to outside it. In a local authority context, the investment boundary is shifted from within the value chain to the local authority boundary.

Anthesis is currently developing an Authority Based Insetting mechanism through which local authorities can identify "insetting" projects, attract finance for projects and effectively measure and report project impacts. Insetting provides an alternative local solution to offsetting, should the council face challenges in delivering in-house projects. Tables 4.4 and 4.5 opposite outline the differences between insetting and offsetting, as well as potential benefits and risks associated with their usage.

This methodology broadens the range of projects to include novel and unique solutions e.g., reducing agricultural methane emissions or increasing active travel. In-progress examples of insetting projects are varied across renewable energy projects, retrofit pilots in domestic and commercial buildings, and nature-based projects.

Insetting is a means through which the council can address its residual emissions whilst minimising some of the challenges described on page 39. The council could deliver insetting projects within the county, or work with other local stakeholders (community groups, local businesses and NGOs) to identify and fully or partially fund projects in return for a claim on the achieved carbon savings. These savings would be reported alongside the council's emissions profile and net off residual emissions.

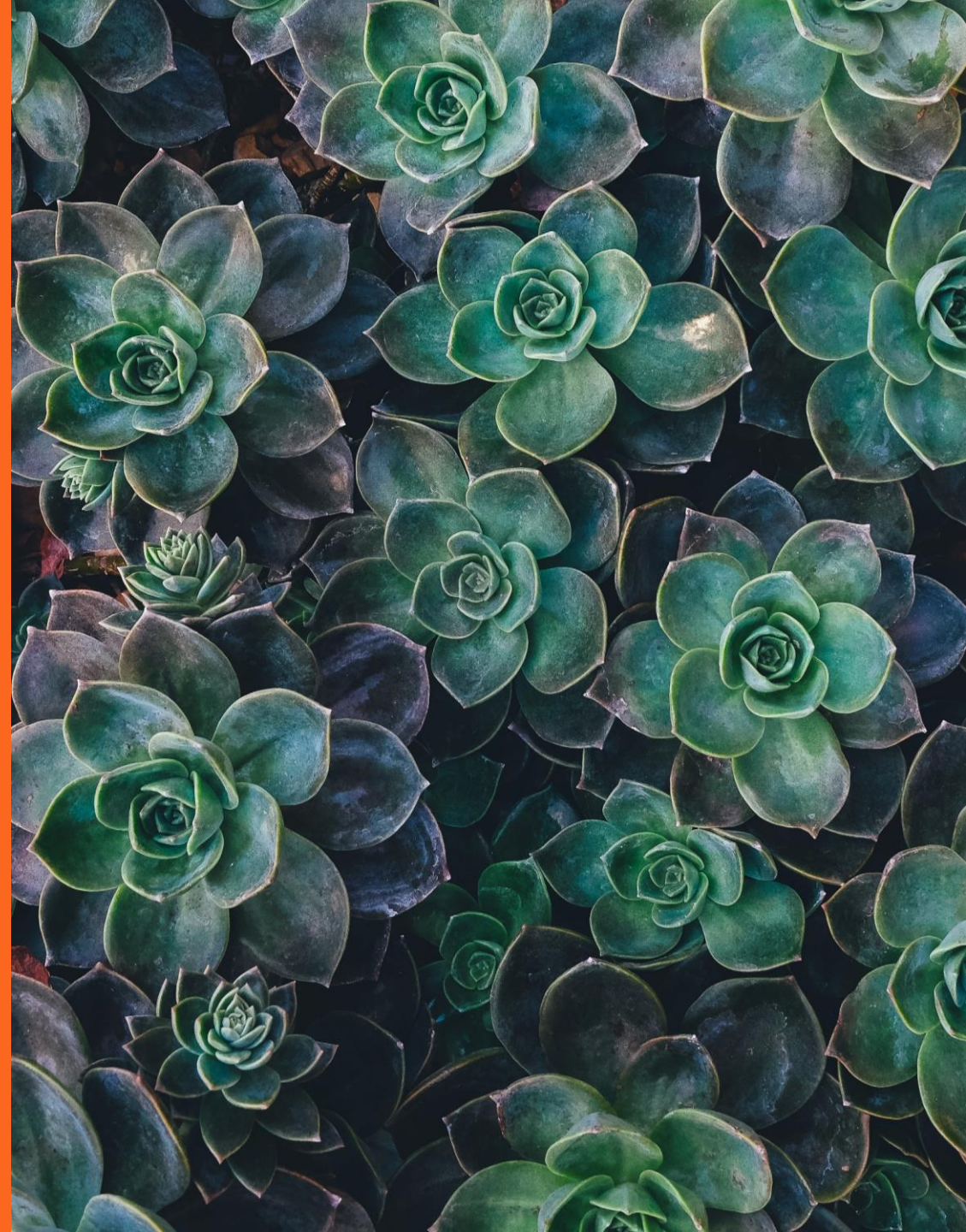
Offsetting	Insetting
• Projects commonly 'detached' from organisation & supply chain • Tradable on the global market • 3rd party broker required for purchase • High dependence on certification schemes • No payback or return on investment (ROI) • Projects readily available	• Projects embedded within an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

Table 4.4: A summary of the differences between offsetting and insetting.

Benefits of insetting	Challenges of insetting
• Social and biodiversity benefits retained locally • Protection against greenwashing • Closer relationship with local stakeholders who collaborate on projects • No formal verification requirements can save money spent on costly certification procedures, provided the council can robustly internally verify savings	• No formal verification requirements can increase risk of double-counting savings and inaccurate reporting • Costs are uncertain from project to project in terms of the capital investment required to claim a defined unit of carbon savings i.e., the £/tCO_2 value may vary between ABI projects • Lack of measurement tools to quantify emissions savings • Council involvement in local projects may require ownership of additional financial and delivery risks compared to market-based offsetting

Table 4.5: A summary of common benefits and challenges associated with insetting, including Authority Based Insetting (ABI).

05 Reaching Implementation



5. REACHING IMPLEMENTATION
CLIMATE EMERGENCY ACTION PLAN (CEAP)

The council's Climate Emergency Action Plan (CEAP) identifies a broad range of activities designed to reduce emissions from the organisation's assets and operations. The ultimate objective of the CEAP is to set out how the council will achieve carbon neutrality.

This section offers some commentary on the completeness and suitability of the CEAP:

- Discussion of the scope and ambition of different actions within the plan
- Exploring how actions should be strengthened to meet ambitions
- Identifying any gaps where additional actions should be considered
- Case studies across different UK local authorities for low-carbon project implementation

The CEAP currently includes 32 distinct actions, across the following thematic areas:

1. Council assets (corporate and leased) – focused mainly on built environment assets.
2. Transport – focused on council fleet and staff commutes.
3. Policy, leadership and behaviour change – focused on building collaborative efforts within the council and with other local authorities.
4. Sustainable development – focused on planning arrangements and future asset transfers.
5. Adaptation, ecology and habitats – focused on biodiversity and nature-based offsetting.

Actions within the plan are described in terms of a specific activity, timeframe for delivery, predicted emissions and financial implications, responsible owners, and links to broader borough-wide themes in the Woking 2050 strategy.

Scope of actions included

Actions within the plan are focused on reducing energy demand, electrifying fossil fuel heating and vehicles and increasing on-site renewable energy sources along with other related infrastructure developments. The plan also includes a series of behavioural changes and policy measures.

There is a strong degree of overlap between CEAP actions and the projects discussed in Chapter 3 as part of the emissions reduction pathways.

The following emissions sources are covered:

- Some actions relate specifically to Scope 1 and 2 emissions sources (e.g. decarbonisation of the Thameswey heat networks) though the majority relate to a combination of sources or Scope 3 emissions (e.g. improving Display Energy Certificates in owned & leased buildings and implementing sustainable practices across procurement procedures).
- All emissions sources within the council's footprint have at least one action defined to treat them, including smaller sources of emissions e.g. staff commutes and waste processing. The largest number of actions relate to owned and leased assets, which are also the largest sources of emissions.
- Actions are not currently organised according to the council's carbon footprint in terms of emissions scopes, which could now be done in conjunction with the guidance given in this study.
- The CEAP also includes actions for future asset acquisitions and sustainable development, acknowledging that the council's portfolio is likely to change in the future and that planning has an important role to play.

5. REACHING IMPLEMENTATION
CLIMATE EMERGENCY ACTION PLAN (CEAP)

Strengthening existing actions

Whilst the CEAP considers a broad range of actions and emissions sources, there is also a wide variation in the ambition and impact of each action theme. The council may consider developing its actions in the following ways:

- **Actions relating to council assets could include more specific details for high-impact sites:** Demand reduction projects are focused on energy auditing and improving the council's understanding of current energy usage, to design more specific projects in the future. Ultimately, the focus should be prioritised on the largest sites as well as the decarbonisation of the energy networks, since these have the highest impact potential.
- **Sustainable procurement policy actions can be made more specific:** Further details on assessing supplier emissions can form part of a more ambitious action. Guidance can be found in Local Government Association research on best practice in this area.
- **More formal staff training is likely to deliver better outcomes for behavioural change actions than communications campaigns:** An improved means of embedding sustainability at the colleague level may come from a more well-tailored training, such as Carbon Literacy training. Ensuring a baseline level of understanding among key officers has supported the rollout of carbon-neutral strategies in other local authorities.

Gaps for specific additional actions

The council should consider adding the following new actions to the CEAP to strengthen both its impact and deliverability:

- **An explicit commitment to EV charge point infrastructure should be included:** Council assets are strategically placed and central to the borough's economy. More visible EV infrastructure at council sites (owned and leased) will encourage uptake among both staff and members of the public. EV charge points also serve as a means of storing excess renewable energy.
- **Commitment to the development of a monitoring and reporting framework for different performance indicators:** The council should identify progress indicators for each action that can be used to track and monitor progress alongside emissions data. These will vary from action to action but will allow the council to demonstrate its successes and better define the areas where it needs delivery support.
- **Additional research which links together engagement with suppliers and tenants to borough-wide initiatives where possible:** There is currently very limited consideration of external stakeholders who have a significant role to play in the successful delivery of the CEAP, such as council and energy network tenants. Engagement with tenants at leased sites to better understand their energy habits, as well as with council suppliers for other services, will not only serve to reduce the organisational emissions of the council but also build momentum at the borough level.

Summary recommendations

- Design specific project plans which target specific, high-impact sites in the council's asset portfolio to improve visibility on the emissions and cost implications
- Allocate council resources and define actions that lead to the decarbonisation of the energy networks, given their significance to the footprint
- Identify performance indicators for each action to improve monitoring and reporting beyond annual emissions calculations

5. REACHING IMPLEMENTATION
LOW-CARBON CASE STUDIES – DEMAND REDUCTION

The rest of this chapter features a number of case studies for different projects, some of which are discussed in the CEAP and/or have been mentioned in relation to Chapters 3 & 4 of this study.

DEMAND REDUCTION
WEST MIDLANDS COMBINED AUTHORITY CONSORTIUM

Project summary

WMCA consortium partners Sandwell Metropolitan Borough Council, Solihull Community Housing, City of Wolverhampton Council, Community Housing Group, Midland Heart, Orbit Housing and Wrekin Housing Group.

The consortium, led by the combined authority, has been awarded funding to retrofit social housing, with the aim to retrofit 622 of the worst energy-performing properties across the region by March 2023.

Funding

Led by the Energy Capital team at the WMCA, seven partners made a successful bid for a share of the Government's Social Housing Decarbonisation Fund and were awarded £7.5m. The total cost of the retrofitting project is £14.7m, therefore the remaining balance of £7.2m is funded from housing association and local authority budgets.

DEMAND REDUCTION
NORTH-EAST DERBYSHIRE DISTRICT COUNCIL

Project summary

North-East Derbyshire District Council is working with a council-owned social housing provider, Rykneld Homes Ltd. and Sustainable Buildings Services, to install external wall insulation at 324 council-owned homes. The council expects residents to save an average of £286 per household through lower energy bills.

Funding

The project was funded by the Government's Green Homes Grant Local Authority Delivery Scheme as well as the council's own resources. In phase 1a of the council project, the authority spent £2.5 million of its own money, supplemented by £0.6m of LADS 1a funding, to carry out work on 115 homes. For phase 1b, the council is using £1.04m of LADS 1b funding, supplemented by £7.2m of council investment, to work on 209 homes.

5. REACHING IMPLEMENTATION
LOW-CARBON CASE STUDIES – DEMAND REDUCTION

DEMAND REDUCTION
NORTHUMBERLAND COUNCIL

Project summary

Northumberland Council replaced approximately 20,000 streetlights with new LED lights. Following completion, 2,700tCO_2e were saved between April 2015 and March 2021. The project was delivered by Galliford Try working in partnership with the Council.

Funding

The Council invested £25 million of its capital 'Invest to Save' budget. Invest to Save is a funding mechanism that councils can use where the initial funding is repaid within 25 years from anticipated budget savings. Energy bills reduced by £1.1 million a year, with approximately 75% of these savings used to repay the 'Invest to Save' loan.

COMMERCIAL DEMAND REDUCTION
LONDON BOROUGH OF SUTTON

Project summary

The London Borough of Sutton has made energy efficiency improvements across its estate, including libraries, offices, depots and a public hall.

Nine buildings in total were targeted, of varying age, condition and usage. Through the scheme, Sutton has reduced its carbon footprint by 484tCO_2e.

Energy conservation measures included:

- Lighting upgrades
- Voltage optimisation
- Boiler control upgrade
- Heating system insulation

Funding

The London Borough of Sutton used funding from the Retrofit Accelerator - Workplaces programme, which is jointly funded by the Greater London Authority (GLA) and the European Regional Development Fund (ERDF).

5. REACHING IMPLEMENTATION
LOW-CARBON CASE STUDIES – HEAT NETWORKS

HEAT NETWORKS
BRISTOL CITY COUNCIL

Project summary

Bristol Redcliffe Heat network was developed by expanding an existing network and installing a second energy centre to supply heat to new commercial developments in the area. The scheme, which uses biomass boilers, was completed in 2016 and supplies 700 social housing properties.

The scheme also includes future-proofing works to enable the network to be connected to additional existing loads and proposed new developments around Bristol Temple Meads station. The council has plans to expand in new areas of the city which will be served by renewable sources including water source heat pumps and geothermal technology.

Funding

£3.6m was awarded from Triple Point Heat Networks Investment Management.

HEAT NETWORKS
WORTHING BOROUGH COUNCIL

Project summary

Worthing Borough Council will develop a heat network powering 20 public buildings including the town hall, hospital, leisure centre, schools and law courts. A centralized water-based heat pump will use to extract heat and power from sewer water.

The council is currently looking for a partner to design, build, own, operate and maintain the network, who will be chosen by February 2023.

Funding

Worthing Borough Council secured a grant of more than £5m from the government's Heat Networks Investment Programme (HNIP) towards project costs. £1.275 million of the £5m is a fixed-rate loan and the council will be expected to pay back £51,000 per year from June 2025.

HEAT NETWORKS
HARINGEY LONDON BOROUGH COUNCIL

Project summary

Haringey London Borough Council has two heat network projects - Wood Green District Heating Network and the Tottenham Hale and Broadwater Farm District Heating Network – which will collectively supply 10,000 homes with heat. Both networks will be supplied primarily by heat generated by the Energy Recovery Facility at Edmonton Eco Park.

Funding

The two heat networks have been awarded £10.6 million and £17.2 million respectively from the UK Government under the Heat Networks Investment Project.

5. REACHING IMPLEMENTATION
LOW-CARBON CASE STUDIES – FLEET & ENERGY

ELECTRIC VEHICLES
LEEDS CITY COUNCIL

Project summary

Since 2017, Leeds City Council has transitioned its fleet to electric vehicles through several phases and now has the largest electric vehicle fleet of any UK local authority. The council has a goal to procure only Ultra Low Emissions Vehicles by 2030. Between 2018 and 2025, the council's switch to electric vehicles is expected to save at least 1,274tCO_2e.

Funding

Between 2018 and 2020 Leeds City Council invested over £5m into fleet electrification, with a further £2.5m planned up to 2023. The electrification project has been largely funded through council resources and budgeting, with the support of external funding:

- Involvement in West Yorkshire Combined Authority's successful 2019 bid for £1.9m of Office for Low Emissions Vehicles Funding; Leeds used their portion of the funding to establish 36 charging points.
- £0.34m of Clean Air Zones Early Measures government funding paid for further charging sites
- £2m from Highways England towards the electric vehicle trial service, with input from DEFRA
- Funding from the government's On-Street Residential Chargepoint Scheme to deliver multiple charging units at 18 locations (6 in 2021 and 12 in 2022)

ENERGY
CAMBRIDGESHIRE COUNTY COUNCIL

Project summary

Cambridgeshire Council has developed a 70-acre Triangle Solar Farm in Soham. The site produces 12MW to power 3,000 homes and has an initial lifespan of 25 years. Cambridgeshire Council aim to gain income from the site and are developing new solar projects following the Triangle Solar Farm's success.

Funding

The Triangle Solar Farm was funded via:

- A loan from the Public Works Loan Board
- Funding from the Contracts for Difference renewable auction and the European Regional Development Fund

ENERGY
CORNWALL COUNCIL

Project summary

Cornwall Council worked with the South West Net Zero Energy Hub to develop its Social Housing Retrofit Accelerator. The Accelerator aims to retrofit 600 Council-owns social homes with solar PV. The installations are expected to generate approximately 1,500MWh each year, with solar electricity provided to tenants at no cost.

Funding

The scheme is funded through a blend of 67% UK Government funding (Getting Building Fund) and 33% Cornwall Council match funding. The solar PV systems will be owned by Cornwall Council and operated and maintained by Cornwall Housing Limited, which is the management organisation responsible for the council's housing stock.

5. REACHING IMPLEMENTATION
LOW-CARBON CASE STUDIES – NATURAL ENVIRONMENT

TREE PLANTING
WIRRAL BOROUGH COUNCIL

Project summary

Wirral Borough Council has a 10-year vision to plant 210,000 trees at a rate of at least 21,000 a year to double tree canopy coverage and improve the resilience of its tree population.

Collaboration

The council has a working partnership with private, community and charitable owners of land, businesses and local developers in the management of trees, hedgerows and woodlands, contributing to an increased canopy across the Wirral and the establishment of new coppices and hedgerows.

Community support and voluntary engagement are vital to the success, to help with identifying any signs of tree disease, vandalism or any other local woodland issues in their local areas. Community involvement in tree planting is hoped to create a sense of ownership and aid in the protection of the project.

Funding

The council have funded the project through charity-based funding and the Urban Tree Challenge Fund.

BIODIVERSITY
KENT COUNTY COUNCIL

Project summary

The Kent Biodiversity Strategy 2020 – 2040 aims to protect and recover threatened species through habitat maintenance, restoration and creation. The project's aims include:

- 75% of Sites of Special Scientific Interest to be restored to a favourable condition
- 730 hectares of Kent water (lakes, rivers, canals and groundwater) to be improved
- 49 hectares of Lowland Beech and Yew woodlands to be created; 92 hectares to be restored by 2025
- Existing population of approximately 1,500 male nightingales to be maintained

Funding

A range of sources were involved in the funding of this project:

- Department for Environment, Food and Rural Affairs' Green Recovery Fund
- Public Health
- Kent Country Council's Members' Grants
- RSPB
- Natural England
- Roger de Haan Charitable Trust
- National Lottery Heritage Fund

06 Conclusions & Recommendations

6. CONCLUSIONS & RECOMMENDATIONS

This report sets out a roadmap to carbon neutrality by 2030 for Woking Borough Council, outlining the measures that need to be achieved, and when they should be implemented, for the council to achieve its target.

Our analysis is based on the cumulative impact of a range of emissions reduction projects and initiatives across its Scope 1 & 2 activities.

We also provide recommendations to improve future data management and suggested strategies for treating residual emissions in 2030.

Reaching carbon neutral

Our analysis highlights the importance of the application of carbon reduction measures currently set out by the council in the CEAP. However, these measures alone are not enough to achieve carbon neutrality, and the council must now explore what is needed to go further. The council will need to:

✓ **Implement the measures outlined in the "High Ambition" Pathway:**

- **Buildings:** after 2023/24, the council should upgrade building fabric and install building management controls, with all small appliances and lighting upgraded by 2025. Measures within the High Ambition pathway have been estimated to cost a minimum of £1.4m in total capital expenditure.
- **Transport:** By 2026, all leased vehicles should be electric. The additional cost of procuring electric vehicles and installing EV charge point infrastructure has been estimated between £1.6m and £2.1m.
- **Energy centres:** the council should explore the potential for different renewable fuel sources to supercede the gas-fired CHP currently used.

✓ **Work towards the decarbonisation and demand reduction of energy centres and buildings**

- Identify projects at large emitting sites through energy audits – sites with very large energy demands (>100,00kWh of heating) were prioritised for fabric and heat pump retrofits in our analysis.
- Develop the business case for implementing demand reduction projects.
- Consider implications of installing biogas or pilot hydrogen infrastructure on networks.

✓ **Address any residual emissions through carbon offsets or insets**

A range of options has been explored to manage residual emissions, including the purchase of UK-based carbon credits, running in-house tree planting projects and/or engaging in insetting projects.

Our analysis highlights the importance of reducing current emissions to limit the amount of residual carbon remaining in 2030 and the accompanying operational and financial risk their management will entail. This can be shown in the difference in predicted offsetting costs for 2030. Using cost estimates for the area of planted trees to offset, treating residual emissions may cost between £6.2m (High Ambition) and £24.6m (Medium Ambition). Annual costs for market-based offsetting solutions may incur costs in excess of £195,000-£780,000 and brings a number of challenges and concerns.

Mitigating residual emissions with tree planting will require projects to begin by 2026, to enable the trees to reach maturity to sequester carbon. Our estimates indicate a planting area between 730ha (High Ambition) and 2,900ha (Medium Ambition) will be required depending on the Pathway. It is recommended that an offsetting plan is developed, considering a mixture of these solutions to balance their benefits and risks.

5. CONCLUSIONS & RECOMMENDATIONS

To achieve the council's target of carbon neutrality by 2030, we recommend the council now leverage the insights provided by this report by:

Continuing to strengthen reporting and monitoring

- **Implement data recommendations:** Continue the valuable monitoring and reporting of emissions and implement the guidance provided in this report to improve the value and insights of the data. These actions will enable the council to measure progress towards the target of carbon neutrality and track the impact of all carbon reduction measures. The guidance provided on managing the council's emissions data is intended to support the council in reporting emissions in the future that are aligned to best practice guidelines and enable the delivery of high-impact emissions reductions.

- **Complete calculation of Scope 3 emissions:** Undertake a full assessment of the council's Scope 3 emissions, including an assessment of the impacts of the council's value chain. A Scope 3 baseline is an important step that can inform future decisions on potential service/ contract insourcing and asset transfers.

Translating plans into discrete actions

- **Centre climate in council operations:** Coordination across the council will be required to ensure sustained implementation of these measures, and to drive behaviour change-focused measures. There is a requirement for strong policies and processes which are likely to cut across existing measures. In designing new projects, the council should consider specific working groups under different delivery themes and assign responsibility for actions across departments. It may also be beneficial to review the council's governance processes to ensure carbon reduction is suitably prioritised.

- **Remain open and flexible to existing and innovative funding:** Applications for funding should be prioritised and alternative funding mechanisms, such as through procurement policy or alternative grants, explored to support financing carbon reduction initiatives in the council.

Communicating clearly on residual emissions

- **Create an offsetting/insetting strategy:** It is highly likely that the council will have to treat residual emissions in 2030. The council should consider the different forms of offsetting discussed in this report and identify which methods it wishes to pursue as part of an offsetting strategy well in advance of that date. If using local tree planting as an offsetting measure, the earlier trees are planted the more carbon they will be able to offset from 2030 due to their delayed carbon sequestration potential. This report suggests a planting date no later than 2026 to ensure that trees reach maturity to sequester significant carbon.

Appendices

APPENDIX 1
EMISSIONS SCOPES AND BOUNDARY SETTING

The Greenhouse Gas (GHG) Protocol provides internationally recognised standards and guidance on emissions reporting for companies, cities and other types of organisations. Following this standardised approach increases accuracy and consistency in reporting.

The GHG Protocol provides the definitions of GHG Scope which underpin this reporting – these are shown in the table opposite. Emissions are grouped according to their source into either Scope 1, Scope 2, or Scope 3 categories. This separates emissions in a way that enables organisations to shape policies and targets based on their organisational structures.

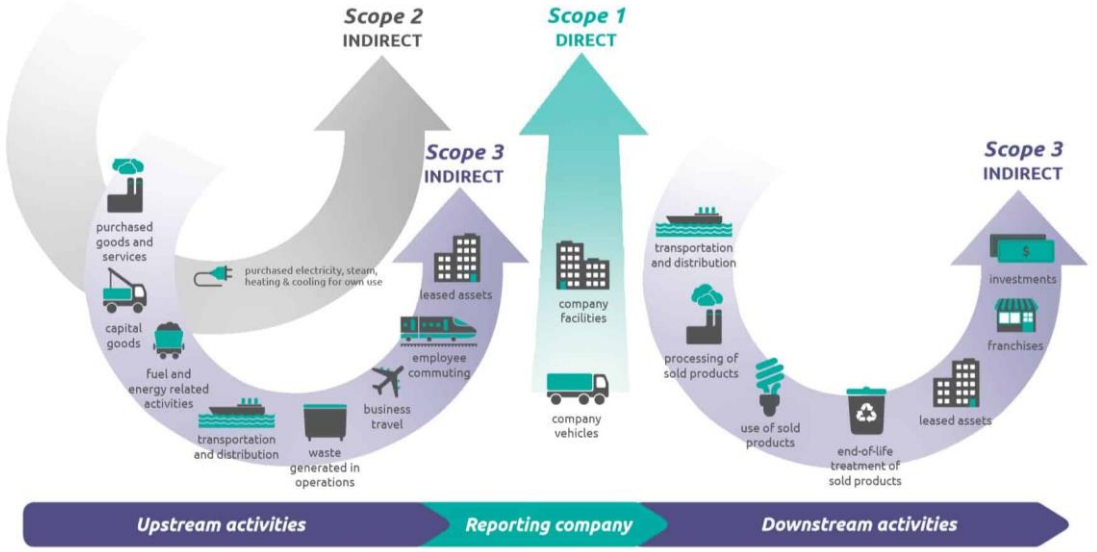
Organisations may also further subdivide emissions within scopes to assist in targeting their emissions reduction activities.

Reporting Scope 2 emissions

The Greenhouse Gas Protocol Corporate Standard recommends that emissions are reported using both a *location-based* and *market-based* assessment:

- *Market-based* emissions account for any low carbon energy products such as green electricity tariffs or power purchase agreements.
- *Location-based* emissions calculate emissions according to the UK's national grid factor based on a typical energy mix.

It is important that the council continues to measure its electricity consumption and report on both values each year.



GHG Protocol Definitions	
Scope 1	Direct GHG emissions occur from sources that are owned or controlled by the organisation, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.
Scope 2	Accounts for GHG emissions from the generation of purchased electricity consumed by the organisation. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.
Scope 3	All other indirect emissions. Scope 3 emissions are a consequence of the activities of the organisation, but occur from sources not owned or controlled by the organisation. Some examples of Scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

Figure 2.2: Diagram showing different emissions scopes and the activities covered by each, taken from the GHG Protocol, alongside a table of Scope definitions.

APPENDIX 1
EMISSIONS SCOPES AND BOUNDARY SETTING

Carbon footprints should be calculated according to a well-defined organisational boundary. An organisational boundary is established by deciding which operations, subsidiaries and partners are defined as "under control" of the council according to certain criteria.

Setting a boundary

There are two approaches to defining the council's organisational boundary. The suitability of each approach is usually dependent on legal and organisational structures as well as the council's relationship with other parties. The approaches can be defined as follows:

- **Equity** – the council accounts for GHG emissions from operations according to its share of equity in those operations. An equity boundary reflects economic interest.

- **Control** – the council accounts for all the GHG emissions from operations over which it has control. "Control" can be defined as either operational or financial. The differences between the two control approaches are explored in Table 2.1 opposite.

    - *Operational control* – activities under the full authority of the council. This is the defined boundary used by the council to define its carbon footprint.

    - *Financial control* – an activity is under financial control if the council can direct the financial and operating policies of said activity, to gain economic benefits or if it retains the majority of risks and rewards of ownership.

It is entirely feasible that influence over certain activities changes from year to year and their emissions are reclassified as Scope 1 from Scope 3 (and vice versa) when the council reports its updated emissions. The emissions covered by commitments to carbon neutrality/net zero vary from council to council. Scope 1 & 2 emissions are universally included within carbon-neutral targets since they relate to activities directly within the operational control of the council. Scope 3 emissions categories are often excluded from consideration within targets, for the following reasons:

- Data quality is often lower than other activities, meaning it is harder to measure and mitigate the impact.
- The degree of influence over Scope 3 is often far lower than Scope 1 & 2, with an increased reliance on stakeholders outside of the council itself.

Exploring influence to define "control"

Some activities require more detailed investigation to determine whether they constitute Scope 1 or Scope 3. Listed below are some common "stress tests" used to help reach a decision:

- How does the council physically "use" the asset? *E.g. does the council physically turn the lights on and off? Do council operations take place on site?*
- If the asset requires maintenance or replacement, is the council responsible? *E.g. will the council pay out of its own budgets for building repairs when required?*
- Who retains the risk associated with the asset? *E.g. do tenants hold a finance lease or an operating lease?*
- Does the value of the lease exceed the value of the asset?

If the council is implicated in the responses to these questions, there is a strong case to include the activity within Scope 1 as opposed to Scope 3.

APPENDIX 2
SCOPE 1, 2 & 3 EMISSIONS DATA

The tables on this page shows a full list of emissions data assessed as part of this report. These data were sourced from a combination of council sources.

Emissions Source	Emissions (tCO_2e)
Scope 1	14,464
Natural Gas	14,345.6
Fleet	118.5
Scope 2	4,939
Electricity - building use	4,938.8
Electricity - streetlighting	0.2
Electricity - Electric vehicles	0.01
Scope 1 & 2 total	19,403
Scope 3 (selected sources)	657.07
Waste	15.77
Electricity T&D	199.29
Gas WTT	210.07
Staff travel	8.62
Contracts	223.32

Fleet Scope 1	tCO_2e
Diesel van Class II	13.11
Diesel van Class III	12.88
Small Petrol Car	2.62
Medium Petrol Car	11.82
Small Diesel Car	0.04
Medium Diesel Car	1.20

Contracts and services emissions	
Industry sector - top 10	Emissions (tCO_2e)
Buildings and building construction works	76.37
Services to buildings and landscape	62.40
Waste collection, treatment and disposal; materials recovery	29.09
Other professional, scientific and technical services	21.00
Computer programming, consultancy and related services	8.49
Sports services and amusement and recreation services	7.39
Employment services	2.76
Insurance and reinsurance services	2.34
Food and beverage serving services	2.24
Other manufactured goods	1.81

WTT and T&D emissions

Well-to-tank (WTT) emissions occur upstream within the council supply chain and are associated with the extraction, refining and transportation of raw fuel sources to the council prior to use. Similarly, Transmission & Distribution (T&D) emissions are associated with grid losses; the energy loss that occurs in getting the electricity from the power plant to council sites.

Staff commuting assumptions

Using the employee travel survey, we have:

- Assumed all respondents commute every working day (equivalent 260 days)
- Assumed respondents with less than a 7-mile commute use active travel measures (including walk, run, cycle responses)
- Used an emissions factor for an average car that runs on petrol/diesel

APPENDIX 3A
PATHWAYS METHODOLOGY NOTES

All pathways carry a common starting point, which varies slightly from the overall total given in the council's current footprint on account of a variation between the electricity emissions factor. In the pathways, UK Treasury Green Book totals were applied, whereas for the footprint the BEIS reporting statistics were used.

The pathways were also designed according to a location-based methodology for Scope 2 emissions accounting. This is in recognition of the fact that REGO arrangements are not guaranteed up to 2030 (though they are heavily recommended). Given the best practice guidance on reporting both location- and market-based emissions, a judgment was made to include Scope 2 emissions on a location basis, whilst signposting the benefits of procuring energy through REGOs.

How were projects assessed for carbon reduction potential?

An estimate for the carbon reduction potential of pipeline projects was made according to the type of project and the building where it was carried out. These estimates were taken from the Building for Energy Efficiency Survey (BEES) 2014-15, which is the same body of research used by the Committee on Climate Change to assess carbon abatement potential in the Sixth Carbon Budget report. The BEES survey records the potential energy demand reduction that can be achieved by completing different projects. The survey is also sensitive to different building types i.e., LED upgrades in an office vs. a retail space garner different results on account of their differing energy consumption profiles.*

**For example, an LED replacement project in an office building was projected to deliver a 6% reduction in overall energy demand; a BMS upgrade in a leisure centre was projected to deliver a 7% reduction in demand.*
The BEES research, alongside its full methodology report, can be found at:
https://www.gov.uk/government/publications/building-energy-efficiency-survey-bees

What if multiple projects of the same type are completed at the same site?

Projects within BEES are grouped under common types or sub-categories. These sub-categories group together similar activities e.g., the sub-category "building fabric" includes a range of different insulation projects.

BEES statistics reflect the maximum *potential* abatement as a result of a given project type being completed; real-life energy demand reductions cannot be properly verified until after the project has been completed.
The order in which a series of projects are completed can also materially change the recorded reduction in demand e.g., a building fabric upgrade completed before a building instrumentation/control project may garner different results than if it had been completed afterwards.

Carbon savings shown on the waterfall graph (Figure 3.8) have been estimated by measuring the anticipated change in energy consumption (taken from BEES) based on the completion of each project in sequence. A different sequence of projects is likely to garner a different profile of attributable carbon savings and the council is advised to more rigorously assess the carbon savings potential of projects in their design stage.

More details on the costings methodology can be found in Appendix 5.

APPENDIX 3B
PATHWAYS METHODOLOGY NOTES

Woking's Annual Reduction Rate

In Figure 3.2b, the annual reduction rate for Woking (area-wide) from the Tyndall Centre is applied to the council's footprint. The percentage and tonnage reductions per year are provided below.

Including energy centres

	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29-	2029-30
Percentage reduction	BASELINE 18,218	13%	13%	13%	13%	13%	13%	13%	13%	13%
Tonnage reduction (tCO_2e)		-2,277.24	-1,992.59	-1,743.51	-1,525.57	-1,334.88	-1,168.02	1,022.01	-894.26	-782.48

Excluding energy centres

	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Percentage reduction	BASELINE 3,041	13%	13%	13%	13%	13%	13%	13%	13%	13%
Tonnage reduction (tCO_2e)		-380.18	-332.66	-291.08	-254.69	-222.85	-195.00	-170.62	-149.30	-130.63

APPENDIX 4
LOW-CARBON CHP

As the electricity grid decarbonises, the emissions savings associated with gas CHP are expected to decline and its role within district heat networks is expected to change. This is because the grid power and heat displaced by using gas CHP is expected to transition from the current gas-dominant power plants to low-carbon sources, such as renewables. The future of gas CHP may include more specific and specialist use cases to balance peaks in demand.

The CCC considers district heating and CHP plants as part of the Sixth Carbon Budget but offers limited detail on how existing networks will transition to low-carbon fuels. Existing research generally considers three main options for this transition, which have been discussed in more detail below.

Biomass

The government are expected to publish a biomass strategy which will review what amount of sustainable biomass could be available to the UK and how this resource can be best utilized. However, in existing models used by the CCC, the majority of available biomass is currently projected to be allocated to industrial clusters and decarbonisation of industrial processes as opposed to district heating. We have modelled biogas as part of our scenario analysis.

Hydrogen

Hydrogen is expected to play a significant role in the future energy mix, particularly for industrial applications and the government has committed to installing 5GW of hydrogen production capacity by 2030. How hydrogen fuel is created, stored and transported has a significant impact on the associated emissions created in its production. We have modelled the future emissions from data in the government's Low Carbon Hydrogen Standard and considered an average of various production pathways. Creating hydrogen fuels using renewable energy sources significantly lowers the associated carbon emissions.

Heat pumps

Heat pumps can also be used to power district heating through electricity through various primary fuel sources e.g., energy from waste facilities or solar thermal arrays.

Technology	Key advantage	Key disadvantage
Biomass	• Current incumbent technology for much renewable CHP	• Likely competition for supply with industrial centres
Heat pump	• Range of potential fuel sources	• May require significant investment in renewables to meet network demand
Hydrogen	• Can be applied to existing CHP plants with minimal modification in most cases	• Supply technology and infrastructure require further development to deliver low-carbon fuel

Table: Showing the key advantages and disadvantages associated with the renewable CHP fuels.

Research sources

- CHP pathway to decarbonisation call for evidence
- Combined Heat & Power: route to 2050 call for evidence responses

APPENDIX 5
COSTINGS METHODOLOGY NOTES

Measure	Capital cost (£m)	Typical payback (years)	Method notes
Small appliances and lighting	0.54	8-10	Capital cost of measures taken from BEES and scaled down to approximate demand reduction in Woking
Building management controls	0.09	6	Capital cost of measures taken from BEES and scaled down to approximate demand reduction in Woking
Behaviour change programmes	0.07	2	Capital cost of measures taken from BEES and scaled down to approximate demand reduction in Woking
Air conditioning and hot water system upgrades	0.13	10	Capital cost of measures taken from BEES and scaled down to approximate demand reduction in Woking
Building fabric upgrades	0.25	20-22	Capital cost of measures taken from BEES and scaled down to approximate demand reduction in Woking
Heat pump replacement	0.31	8-10	Estimate made for size of heating system required to meet baseline demand, before cost factor of £/kW applied from Committee on Climate Change Sixth Carbon Budget costings
Heat network decarbonisation	Scale of millions of pounds		Hydrogen estimates based on government estimates for the levelized cost of energy for hydrogen production in 2030 (central case, produced via electrolysis) Biomass CHP plant estimates taken from government estimates for energy infrastructure costs
Total	**>1.4**		

Table 4.1: The additional capital cost of measures within the High Ambition pathway. Please note that **all** costings and carbon savings are indicative only and not representative of a full business case or due diligence process.

The BEES report assesses for capital costs required to deliver the defined kWh of energy abated. These two statistics have been cross-referenced to achieve a £/kWh factor for each measure. The kWh abated as a result of installation is estimated from the baseline statistics for energy consumption. The estimate provided is thus the cost of each measure in isolation as opposed to accounting for the compound benefit of multiple measures. The BEES report also provides a £ estimate for the annual energy bill savings for each measure. This statistic was cross-referenced with the capital cost requirement to give an estimate for the number of years of bill savings required to pay back the upfront capital cost.

Offsetting costs were estimated from point costs described in the Woodland Creation & Maintenance Grant.

APPENDIX 5 (CONT.)
COSTINGS METHODOLOGY NOTES

EV fleet replacement options

This page summarises the options available to Woking Borough Council in terms of capital costs, alongside options for EV charging infrastructure.

Differing styles of fleet replacement and additional capital costs

Replacement with like-for-like electric vans and cars would occur an additional cost of £0.9m. Alternative electric models have also been provided in Table 4.3. As shown in Table 4.3, the price for electric cars and vans can vary. Opting for cheaper models would downsize the average van and, assuming all vehicles are replaced by cheaper/smaller equivalents, this would lower the cost by £0.3m.

Vehicle replacement scenario	Cost (£m)	Additional cost (£m)
Replace petrol/diesel for petrol/diesel, using same vehicle models	1.3	-
Replace petrol/diesel for electric, using same or similar vehicle models	2.2	+0.9
Replace petrol/diesel for electric, with cheaper vehicle models, scaling down average van size	1.6	+0.6
EV charge point installation	0.01	+0.01

Table 4.2: The additional capital cost of fleet electrification in various scenarios.

EV charging infrastructure options

Depending on the number of Vivero 3.5kW or 22kW chargepoints installed, the cost of EV charging infrastructure varies between £18,000 and £45,000, assuming an approximate 50:50 split.

Vehicle type	Point cost per vehicle	
Van	**Electric**	**Diesel**
Nissan e-NV200	£26,305	£20,157
Vauxhall Vivaro	£34,645	£28,105
Ford Custom	£39,145	£25,000
Car	**Electric**	**Petrol/Diesel**
Ford Fiesta	£41,625	£18,655
Renault (Clio)	£29,995	£18,795
Vauxhall Corsa	£36,195	£17,440
Volkswagen Polo	£36,195	£18,855
Toyota Prius	£23,969	£17,115

Number of charge points	Total cost of installation (£)
20 (10 x 3.5kW; 10 x 22kW)	18,000
50 (25 x 3.5kW; 25 x 22kW)	45,000

Table 4.3: Comparing the point costs of different vans and their electric equivalents. Sources: Ford, Renault, Vauxhall, Toyota, Nissan based on average dealership costs, LEVC, Volkswagen
Table 4.4: Comparing costs of installation for varying numbers of electric vehicle charge points.

APPENDIX 6
CHALLENGES OF MARKET-BASED OFFSETTING

Outside of the significant cost implications, there are other common challenges that public sector organisations face when using market-based offsets. These include:

- **Increasing public scrutiny:** Climate-literate members of the public are increasing the amount of attention on government decisions, in particular around offsetting.
- **Difficulty in retaining co-benefits locally:** Local authorities need to demonstrate a social return on financial investments e.g., an increase in jobs and improved health, within the area that they serve. This is difficult to achieve using existing certified offsetting schemes as they most commonly relate to out-of-region areas.
- **Lack of taxpayer choice:** Unlike corporate customers, residents cannot choose to not pay council tax based on the council's sustainability credentials.
- **Limited options available in the UK:** Existing carbon neutrality standards such as PAS2060 require 'certified' offsets. However, the range of UK options is currently limited (i.e., the Peatland Code and Woodland Carbon Code). As demand rapidly grows, these schemes are becoming increasingly inaccessible and prohibitively expensive.
- **Current certified offsets do not offer a financial return on investment:** Most conventional offsetting schemes require an annual investment with no direct financial payback. This contrasts with more 'direct' emissions reduction measures applied within an organisation that can offer a financial return through reduced energy or fuel costs.
- **Limited supply and impact of UK certified options:** Current options for certified UK schemes are 'nature-based', i.e. tree planting and peatland restoration. While these are tremendously positive activities that offer a raft of co-benefits in addition to carbon removal, it is important to recognise the scale of the challenge to decarbonise transport, energy, and buildings. Even with radical investment in nature-based solutions, there may simply not be enough projects and savings on offer within Woking to reliably offset emissions.

As a result, many local authorities are now seeking to focus their investments inwardly on more local offsetting initiatives.

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