CITY OF MANCHESTER

Manchester Climate Change Framework 2

Evidence Base: Sub-Objectives and Implementation Plan

August 2022

Version 5.3

MANCHESTER CITY COUNCIL

MANCHESTER CLIMATE CHANGE AGENCY

Zero Carbon Cities

URBACT Driving change for better cities

European Union

European Regional Development Fund

Anthesis

CONTENTS

Anthesis

1. About this report

An important note on this report's findings

Original analysis used the Anthesis SCATTER tool, unmodified, which illustrates a 36% reduction by 2025. The use of SCATTER offers some consistency with GMCA modelling utilised within the 5-year Environment Plan and enabled MCCA to use their limited resources more efficiently (compared to commissioning a bespoke model to be built). However, in order to better align to Manchester's target of a 50% reduction by 2025, some additional tailoring of the SCATTER results has been applied within the Framework. This tailoring overlays new assumptions and modifies the original timelines presented in this report, into a revised, shorter timeframe. This more tailored pathway is loosely consistent with the original pathway's interventions in the year 2030.

This enables users of this analysis to have a better understanding of the scale of change required for Manchester. However, we recognise that in certain areas, it may mean that less reliance can be placed on assumptions and the evidence base upon which the original SCATTER scenarios and the underlying timelines were based upon. As with any future scenario analysis, the higher ambition scenario is just one judgemental illustration of what needs to happen. It will now be up to the city to consider how it delivers this change, including the speed with which it can mobilise all relevant actors.

The reader is directed to Appendix 10 for more details on the interventions required to meet the 50% reduction by 2025 target.

1. ABOUT THIS REPORT
OVERVIEW & SCOPE

This report has been commissioned by the Manchester Climate Change Agency and Manchester City Council to support the development of Manchester's second Climate Change Framework ("Framework 2"). The content will be used to provide a technical evidence base for the sub-objectives and an implementation plan that form part of Framework 2. It aims to support Manchester to play its full part in limiting the impacts of climate change and to create a healthy, green, socially just city, where everyone can thrive.

The report is structured as follows:

- **Chapter 1** outlines the structure and principles guiding this report.
- **Chapter 2** explains what Manchester has committed to.
- **Chapter 3** provides an overview of Manchester's baseline emissions and presents future emissions pathways alongside the Tyndall Centre's science-based carbon budget.
- **Chapter 4** explores what needs to happen in Manchester and provides detailed sub-objectives and targets for 2025 based on SCATTER pathways modelling
- **Chapter 5** explores the roles that different stakeholders in Manchester can play to help the city achieve net zero.
- **Chapter 6** identifies a series of actions Manchester can take over next 3 years to achieve interim carbon targets.
- **Chapter 7** provides recommendations on how Manchester can proceed and the next steps.
- **Chapter 8** provides further details on the methodology and data sources.

1. ABOUT THIS REPORT
FRAMEWORK 1

Manchester Climate Change Framework 2020-25

Framework 1 set out Manchester's latest science-based targets and the high-level strategy for achieving them.

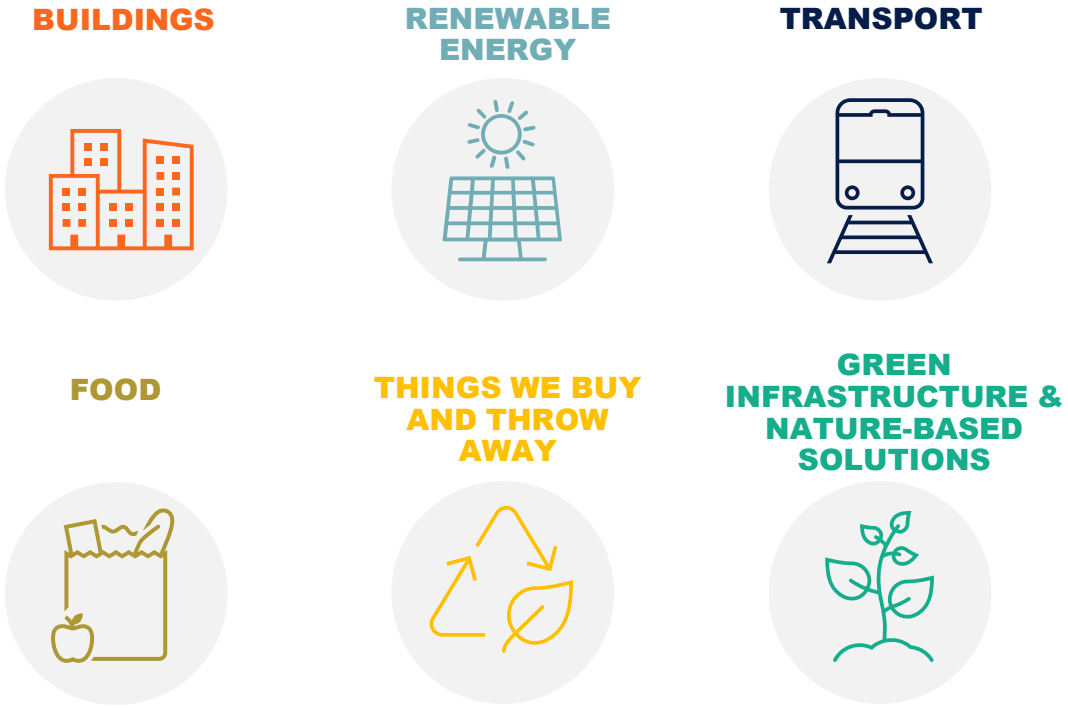
4 headline objectives:

1. Staying within our carbon budgets
2. Climate adaptation and resilience
3. Health and wellbeing
4. Inclusive, zero carbon and climate resilient economy

Vision and target for 2025

By 2025, Manchester will be on track to stay within its 15 million tonne carbon budget for 2018-2100, for the emissions from our homes, workplaces and ground transport. During 2020-25, Manchester aims to reduce its direct CO_2 emissions by at least 50%.

The framework sets out **6 thematic areas** for action in order to meet the objectives. These areas of action are explored in further detail in this report.



1. ABOUT THIS REPORT
PLACE WITHIN FRAMEWORK 2

Version 2.0 of the Framework for 2020-25 seeks to provide more detail on what and how zero carbon can be achieved.

Framework 2 aims to answer:

1. Where does Manchester need to get to?
2. What needs to happen to get there?
3. Who needs to be involved?
4. How can this be achieved?

Elements of Framework 2 included in this report:

- Targets and analysis for each thematic sub-objectives
- A new Implementation Plan which sets out the actions necessary for the city to meet its headline and thematic objectives and targets.
- Consideration of a 7th thematic area of action: "Supporting and enabling residents and organisations to act".

Elements of Framework 2 not included in this report:

The analysis in this report is focused mainly on the headline objective of staying within Manchester's carbon budget. The other headline objectives have been considered in detail elsewhere and analysed as part of different strands of work. For example, Manchester's Adaptation and Resilience Advisory Group have led the analysis on how to make Manchester more resilient to climate change and future climate shocks. Where possible, areas of overlap have been highlighted in the co-benefits sections of this report.

This report has also considered or acknowledged other separate pieces of analysis being performed by the Manchester Zero Carbon Advisory Group and other sub-groups. These groups are producing separate reports on:

- Aviation – Exploring the sub-objectives for the city and Manchester Airports Group for reducing emissions from the airport and resident/business flights.
- Consumption – Consumption-based emissions are not covered in this report but addressed by a separate strand of analysis focused specifically on reducing the emissions driven by consumption of goods and services.

These will also form part of Framework 2, which is being co-ordinated by the Manchester Climate Change Agency.

1. ABOUT THIS REPORT
PRINCIPLES GUIDING THIS REPORT

This report has been guided and informed by the following principles, which have been integrated throughout the analysis.

Evidence-based

This report will provide the technical analysis to support Framework 2 and ensure the sub-objectives and actions will be grounded in science, data and local context. The evidence base has been built using a combination of approaches, including emissions modelling specific to Manchester, best practice toolkits and stakeholder engagement.

Working together

Collaboration will be a key principle of this report. A 50% reduction in emissions by 2025 cannot be achieved without working together and without each group playing their part. With this in mind, the implementation plan has been informed by consultations with residents and businesses. Actions for other stakeholders have also been identified.

Aligning with the best

The targets set for Manchester are ambitious and this analysis does not shy away from the scale of the challenge. Manchester wants to lead the way and realises the opportunities presented by shifting to a low carbon economy. The report will therefore draw from best practice from across the world and align with internationally recognised initiatives.

Maximising co-benefits

The analysis carried out also seeks to identify the opportunities for the sub-objectives and actions to deliver wider benefits beyond carbon reduction. Where carbon reductions can contribute to improving the resilience, health and economy of Manchester it will be highlighted to demonstrate the potential to achieve multiple priorities for the city.

1. ABOUT THIS REPORT
THE CHALLENGE AHEAD

Manchester's carbon budget

As part of Framework 1, Manchester committed to a carbon budget that positions it to make a fair contribution to meeting the goals of the Paris Agreement. In alignment with the Tyndall Centre for Climate Change Research, the city previously set a commitment to limit carbon emissions from energy from 2018 onwards to 15 $MtCO_2$.

Analysis from Manchester's Direct Emissions Report[1] indicates that 86% of the 2018 to 2022 interim 5 year budget has already been used, despite a provisional estimate of an 11% drop in emissions due to COVID-19 restrictions. This means that Manchester will certainly exceed the first interim carbon budget and this must be compensated for by faster reduction rates in the future to keep within budget.

Key statistics for Manchester

To keep Manchester aligned with the Paris Agreement, an average reduction rate of 16% per year is now required based on an evenly distributed budget

If Manchester continues along a business-as-usual pathway, the carbon budget (2020 – 2100) will be exceeded in just 7 years

Between 2005 and 2018, the average annual emissions reduction rate in Manchester was 0.9%, highlighting the ambitious action required to meet the Paris Agreement targets

By 2043, 5% of the budget remains, provided that Manchester achieves the recommended annual reduction rate.

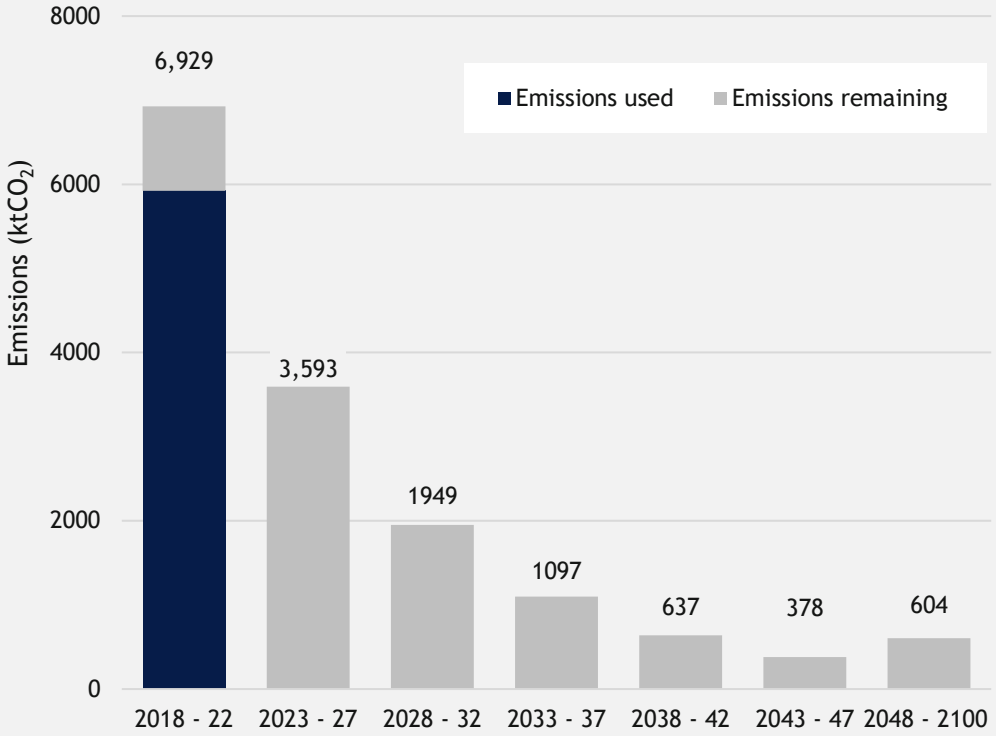


Figure 1.1 Manchester's adopted Paris Agreement aligned carbon budgets presented by 5 year budget periods identified in the UK Climate Change Act. Detailed analysis can be found in Manchester's Direct Emissions Report 2021.

[1] Manchester Direct Emissions Report 2021 (not published, prepared by Dr Chris Jones, University of Manchester)

2. City Context

2. WHY DO WE NEED TO ACT
RESPONDING TO THE CLIMATE EMERGENCY

A growing consensus

Climate change is the greatest threat to humanity and urgent action is required across all aspects of society. The recognition of urgency is no longer just a message from environmental groups, but is now being reiterated at every scale:

- **UK Local Authorities:** The majority of local authorities in the UK have now declared a climate emergency, including all local authorities within Greater Manchester. Climate Emergency Declarations were first issued following the IPCC's 1.5ºC special report, published in October 2018.
- **UK Climate Strike Action:** Several climate strikes have occurred across Manchester in recent years, and these have been driven by the Manchester Strike 4 Climate group.
- **Global Businesses:** Nearly 800 companies globally are setting Science Based Targets. As part of the lead up to COP26, the campaign 'Race to Zero'and 'Race to Resilience' was launched across businesses, cities and nations.

Dangerous Impacts

The UK Climate Projections Report is the latest generation of national climate projections in the UK which helps to predict the changes that will occur with future climate change. The main trends from the projections are increasing warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extreme weather events.

Since 1950, there has been a 10-fold increase of flooding and heatwaves incidents in Greater Manchester, with flooding most recently affecting Manchester City Centre in January 2021. In 2018, smoke, ash, particle pollution and reduced visibility were reported in the city following wildfires on Saddleworth Moor.

The Sixth Assessment Report published by the Intergovernmental Panel on Climate Change in August 2021 stated that human influence has unequivocally warmed the world's atmosphere, oceans and land, with the past five years being the hottest on record globally since 1850. The report stresses that unless urgent action is taken in the next few years to drastically reduce carbon emissions, 1.5ºC of warming will be reached before 2040.

2. CITY CONTEXT
GREEN RECOVERY

COVID-19 & Climate Change

The global disruption and impacts of the COVID-19 pandemic have forced governments, businesses and citizens to radically reassess their policy decisions, operations and lifestyles.

The ongoing restrictions offer the chance to reflect on what is important to local communities. This time also presents the opportunity to shift our collective values and review the demands of "emergency action" in a climate context. Local and national commitments to emissions reductions have not changed as a result of the COVID-19 crisis and the cost of delaying action has been felt in many countries during the pandemic. Decisiveness will be required in the wake of this crisis, to lead a recovery which revolves around the resilience, health and sustainability of local communities.

The next few years will be pivotal for climate change mitigation as we enter the decisive decade for action. The urgency of the situation is growing as we approach planetary tipping points and are held to account as a nation against international climate targets.

A Green Recovery

To maintain the prospect of meeting the commitments set out in the Paris Agreement, it is essential that government policies in response to the economic crisis avoid locking nations into carbon intensive pathways, and instead steer economies towards a resilient *Green Recovery*. In May 2020, the Committee on Climate Change called for government to use the economic recovery as an opportunity to accelerate the shift towards a low carbon economy. This would stimulate jobs, stabilise future economic resilience, and mitigate climate related risks. Business and health professionals are also making similar calls.

There is an opportunity during a just transition for not only a reduction in carbon, but also other wider social benefits. For example, there are opportunities to improve public health, both mental and physical, and opportunities to tackle employment issues with green jobs. A climate strategy can reduce our carbon but also work alongside the council's other ambitions to deliver a fairer future for all.

The C40 Cities group has published an overview of principles which it recommends should inform this Green Recovery. Decisiveness will be required as we recover from this crisis, responding with policy that is centred around the resilience, health and wellbeing of local communities.

In November 2020, Manchester City Council published its Economic Recovery and Investment Plan. The Plan reaffirmed the city's climate commitments and outlined zero-carbon and housing retrofit and city centre transport and mobility as strategic investment propositions.

2. CITY CONTEXT
CLIMATE COMMITMENTS

Local background

In 2016, Manchester committed to 'playing it's full part in limiting the impacts of climate change'. This commitment is set out in the Our Manchester Strategy for 2016-25. In 2020, Manchester published its Climate Change Framework 2020-25, as the city's high-level strategy for tackling climate change.

In 2018, Manchester set an ambitious target, in line with Greater Manchester, to be zero carbon by 2038 at the latest and deliver its full part in relation to the Paris Agreement 1.5°C goal. This was based on recommendations from the University of Manchester's Tyndall Centre for Climate Change Research. Manchester committed to emitting 15 tonnes of CO_2 between 2018 and 2100 and adopting a carbon budget to track progress. This target calls for a 13% annual carbon emissions reduction.

What does zero carbon mean?

Manchester has adopted a zero-carbon target meaning that no carbon emissions will be produced in the city i.e. no fossil fuels will be burned within the city boundary or be burned to provide electricity, heating or cooling. This differs from Net Zero which would allow for residual emissions to be 'offset' via carbon removal activities occurring outside of the city boundary.

National, Regional and Local Commitments

Commitments have been made and targets have been set at all levels of government in response to the growing consensus and evidence around climate change.

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

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. In April 2021, the government committed to reducing emissions by 78% by 2035 compared to 1990 levels.

In 2018, Greater Manchester's Mayor, Andy Burnham, announced that Greater Manchester would aim to be a carbon-neutral city region by 2038 through the implementation of the 5-year Environment Plan for Greater Manchester. All 10 of the metropolitan cities in Greater Manchester have made commitments in line with the GMCA target date.

In 2018, Manchester adopted a target to be zero-carbon by 2038 at the latest based on the recommendations from the University of Manchester's Tyndall Centre for Climate Change Research.

3. High level visioning
Where does Manchester need to get to?

3. HIGH LEVEL VISIONING
GREENHOUSE GAS INVENTORY

In 2018, Manchester was responsible for net emissions totalling 2,461 $ktCO_2e$. The majority resulted from buildings & facilities (63.8%) and transport (24%).

The current emissions profile for the area administered by Manchester City Council is shown opposite, based on the SCATTER tool calculations. This covers three greenhouse gases: carbon dioxide, nitrous oxide and methane, and relates to the 2018 reporting year. While the embodied carbon associated with creating products used in Manchester is an important consideration, this emissions profile only accounts for emissions generated within the city boundary (Scopes 1 & 2). Scope 3 emissions are excluded from this profile to align with the scope of Manchester's 50% emissions reduction target.

Not all subsectors can be neatly summarised as a "slice" of this chart. Emissions from land use act as a carbon sink for the region, sequestering 2.6 $ktCO_2e$ carbon from the atmosphere.

All aviation emissions relating to air travel at Manchester Airport have been excluded from this emissions profile and are considered within a separate piece of analysis produced by the aviation sub-group.

What is SCATTER?

SCATTER stands for Setting City Area Targets and Trajectories for Emissions Reduction. It is a tool designed specifically for Local Authorities to help measure and model area-wide emissions. The first part of SCATTER is a GHG inventory which has been developed in line with the Global Protocol for City-wide GHG Emissions.

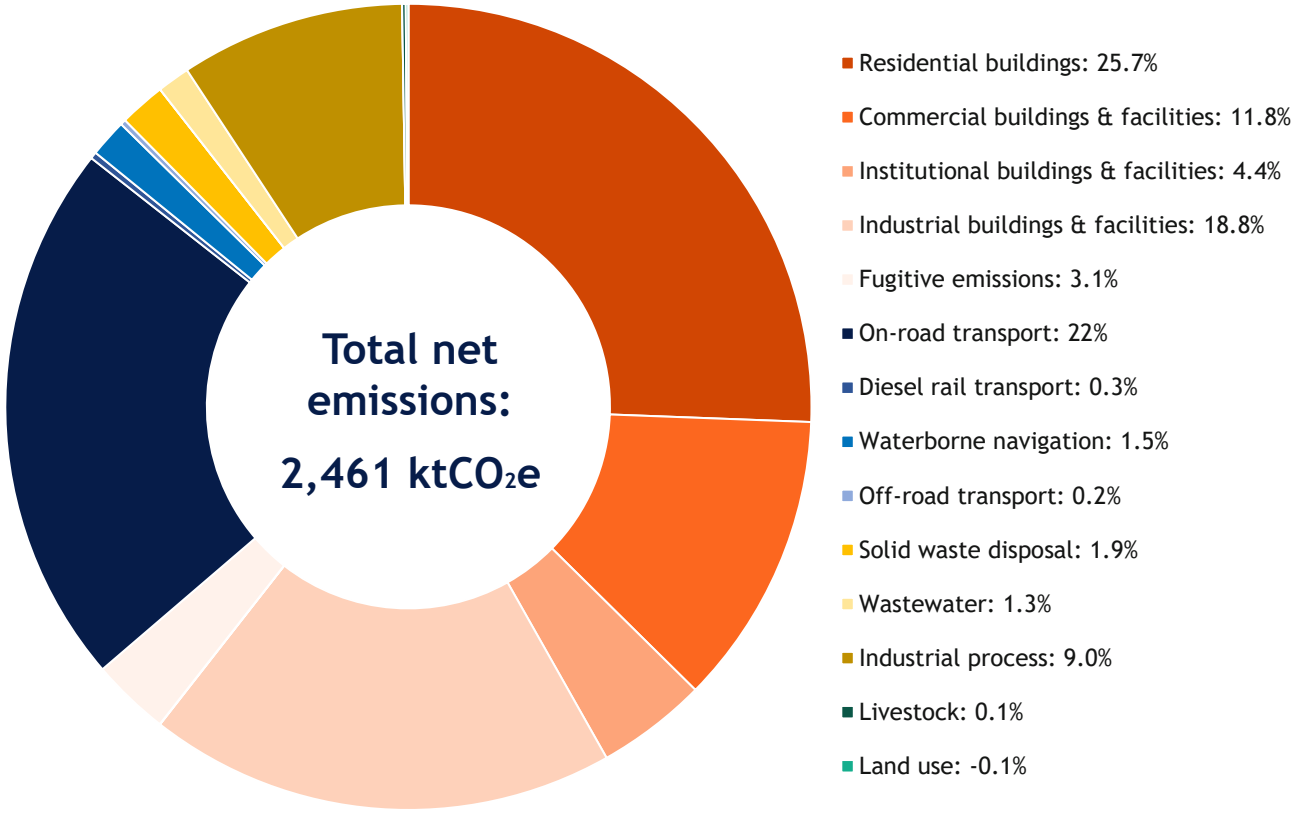


Figure 3.1 Manchester's 2018 emissions profile as calculated by the SCATTER Tool (Scopes 1 & 2). The inventory data presented here relates to the 2018 reporting year as emissions are reported two yeas in arrears. Institutional buildings refers to emissions from energy used in public buildings such as schools, hospitals, government offices, highway street lighting, and other public facilities.

3. HIGH LEVEL VISIONING
SCATTER METHODOLOGY

Introduction

Whilst the Tyndall Centre's Paris-aligned carbon budget (page 8) covers what the science says must be achieved, it is also useful to look at other tangible pathways. Reviewing these pathways helps us to understand the impact of differing levels of action, or inaction, in relation to goals set, and in the context of macro-factors such as grid-decarbonisation and policy.

As well as the inventory presented on page 14, SCATTER also includes a Pathways model designed to help local authorities inform priorities for emissions reduction. The pathways are based on a combination of 30+ sub-objectives or carbon reduction measures which can be implemented to various extents. This serves to provide an idea of the scale of change necessary to deliver decarbonisation targets.

Comparing SCATTER and the Tyndall Budget

Differences in scope between the Tyndall Budget and SCATTER tool means that direct comparisons of the Tyndall Budget with the cumulative emissions from SCATTER Pathways trajectories (detailed in the following pages) should be taken as an estimate only. Manchester's target is based on BEIS $LACO_2$ data which accounts for CO_2 emissions only, whereas SCATTER utilises a CO_2 equivalent value (CO_2e). A full comparison is detailed further in Appendix 5.

SCATTER

What informs SCATTER?

Sir David MacKay's "Sustainable Energy - Without Hot Air (2009)" underpins the basis for the pathways modelling. As a scientific advisor to the Department for Energy & Climate Change (DECC), now BEIS, MacKay's work led to the development of the 2050 Pathways calculator. An open source, Microsoft Excel version of this tool was published by DECC which we used as the foundation for SCATTER.

Two key modifications were made by Anthesis:

1) **We scaled it down for sub-national regions:** Scaling assumptions and localised data sets were built into the tool so that results were representative of cities and local authority regions, rather than the UK as a whole.
2) **We pushed ambition further:** Technology specification changes were reviewed and updated where judged to be out of date and constraining ambition. Given that almost a decade had passed since MacKay's publication and the release of the 2050 Pathways tool, we sought the counsel of a technical panel to make these updates. The technical panel comprised subject matter experts from Arup, BEIS, Electricity North West, GMCA, The Business Growth Hub, The Energy Systems Catapult, The Tyndall Centre and Siemens. We also referenced the 2050 Wiki page during the course of the update.

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

3. HIGH LEVEL VISIONING
MANCHESTER'S HIGHER AMBITION PATHWAY

Changes across the thematic areas

It is fundamental to recognise that the pace of change will inevitably vary over time across each of the key themes and sub-objectives; transport for example is likely to decarbonise much more quickly than buildings.

By 2025, the SCATTER Higher Ambition Pathway estimates a 36% reduction in Manchester's total emissions, with the greatest reductions seen in transport and the things we buy and throw away. Emissions from buildings are modelled to have fallen the least by 30% and this is not surprising given the challenges associated with quickly decarbonising the sector and the scale at which action is needed. There is a 41% increase in carbon sequestration through uptake of green infrastructure and nature-based solutions.

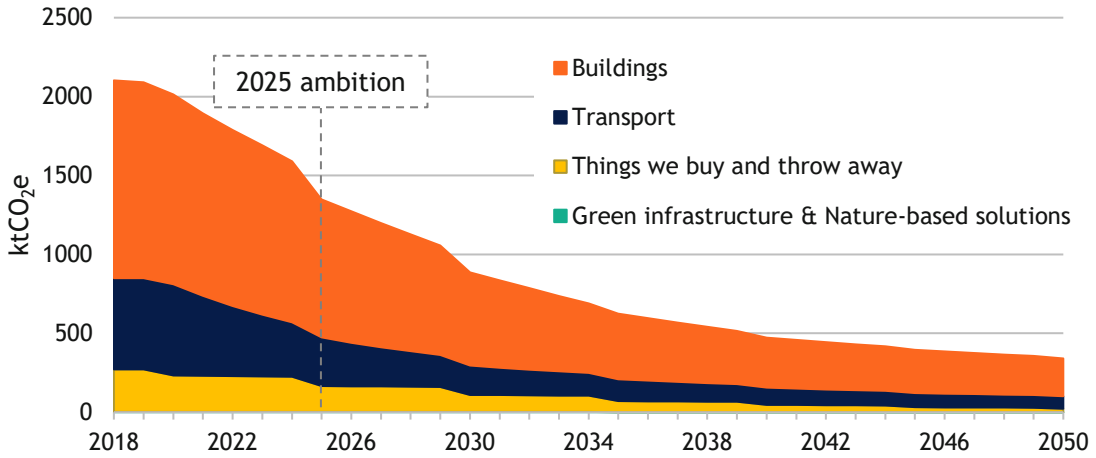


Figure 3.2: Manchester's SCATTER Higher Ambition pathway broken down by thematic area. Emissions from the natural environment are comparatively too small to identify, further modelling is detailed on page 72.

2025 Focus

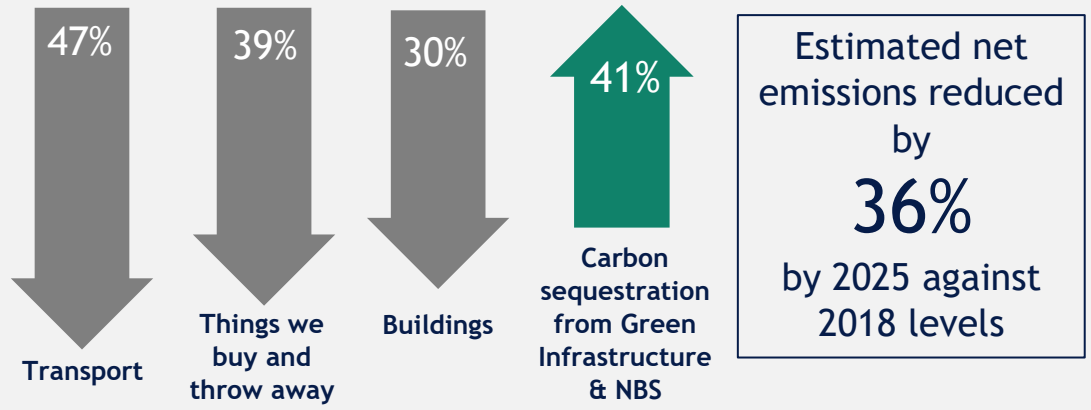


Figure 3.3: Emissions reductions by 2025 across the key themes under the SCATTER Higher Ambition Pathway

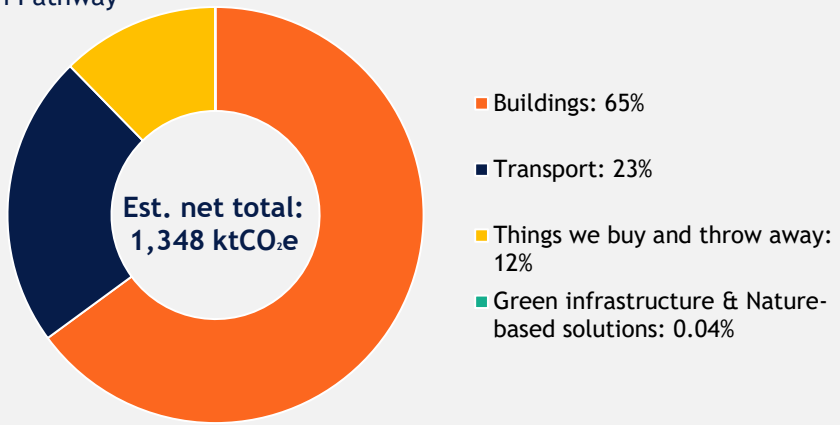


Figure 3.4: Estimated 2025 emissions profile for Manchester when following the Higher Ambition pathway.

3. HIGH LEVEL VISIONING
PATHWAYS RESULT

Please see Appendix 10 for a summary of interventions, carbon savings and financial costings that will deliver a 50% reduction in emissions.

Key

Historic Emissions: Manchester's historic energy related CO_2 emissions (excluding LULUCF) taken from the 2021 BEIS Local and Regional Data Release.

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

SCATTER Higher Ambition Pathway: Assumes Manchester goes significantly beyond national policy and National Grid assumptions. It is the result of all sub-objectives modelled by SCATTER at maximum ambition levels.

Tyndall Centre Recommended Pathway: The Tyndall Centre's Recommended Pathway evenly distributes Manchester's remaining carbon budget over time, as detailed in Manchester's 2021 Direct Emissions Report. Differences in scope mean that direct comparisons between the Tyndall Budget and SCATTER Pathways should be taken as estimate only. See Appendix 5.

The graph below shows two possible future emissions pathways for Manchester as modelled by the SCATTER tool compared against the Tyndall Centre's recommended pathway as detailed in Manchester's 2021 Direct Emissions Report.

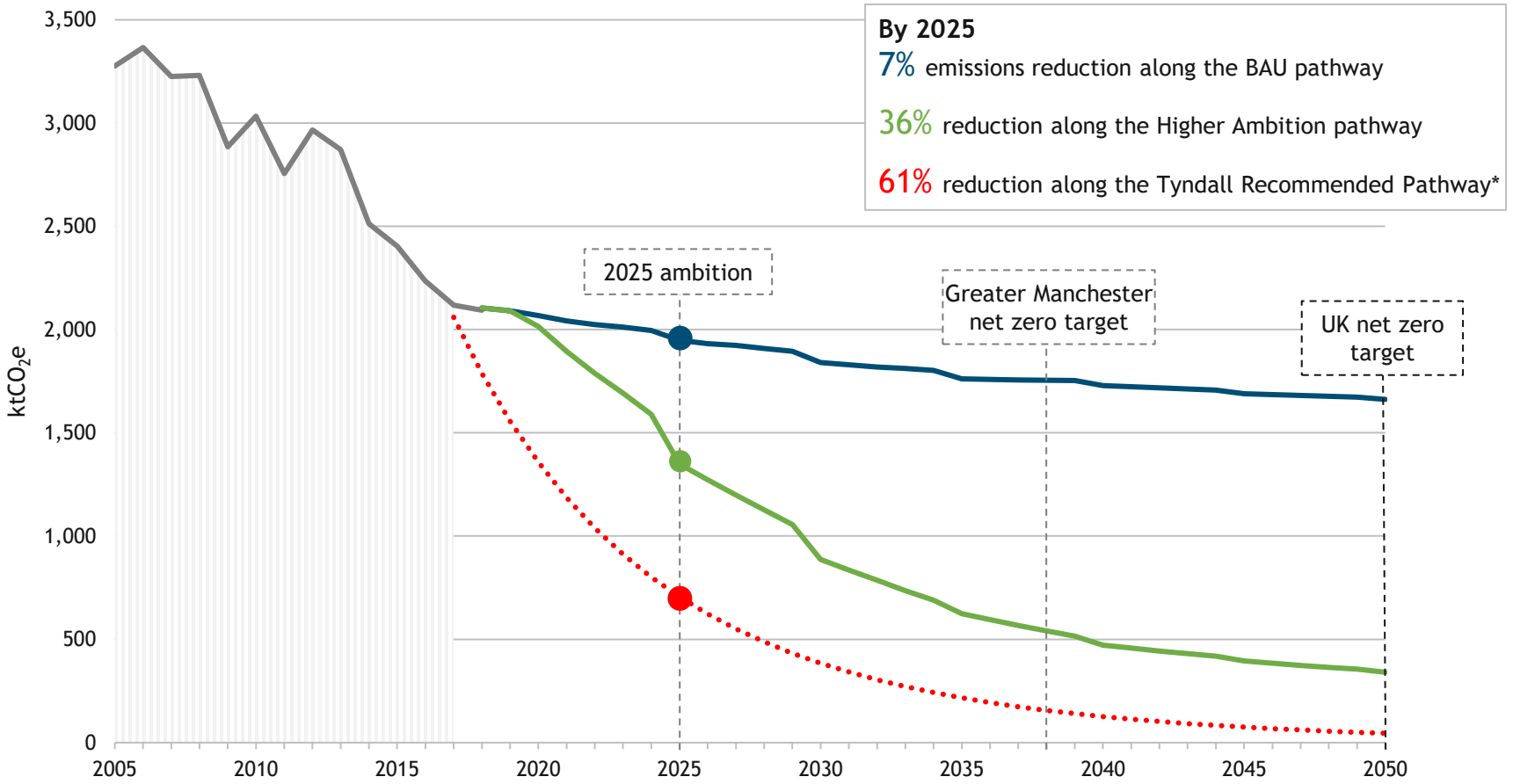


Figure 3.5: Two possible future emissions pathways for Manchester modelled by SCATTER Pathways, compared to the Tyndall Centre's Recommended Pathway.

*A 61% reduction has been calculated between 2018 & 2025 based on the data provided by the Tyndall Centre as part of Manchester's 2021 Direct Emissions Report (not yet published).

3. HIGH LEVEL VISIONING
CLOSING THE GAP

There is currently a gap between the SCATTER modelled 'Higher Ambition' pathway and the science based carbon budget. The constraints of the SCATTER model are not intended to constrain ambition. On the contrary, the associated sub-objectives should still serve as targets that are to be *exceeded* rather than just met, despite already being incredibly radical and transformative. Manchester will need to significantly increase the pace and scale of change implemented to date, to achieve a 50% reduction by 2025. Detailed below are some of the ways it may be possible to "close the gap" between the Higher Ambition pathway and the science based carbon budget:

1. Accelerated and increased deployment

Manchester may consider action 'above and beyond' the interventions outlined in this report by increasing the scale and speed of the interventions defined. For example, rather than a deep retrofit of 80% of homes as per SCATTER, stakeholders may aim for a deep retrofit of 90% of homes. Manchester may also seek to deliver the 2025 KPIs by 2024 in order to accelerate emissions reductions. It is important to approach this with an understanding of the challenge associated with reaching the maximum ambition level presented in SCATTER, and the dependency on such developments.

2. Technological innovation and marginal improvements

Improvements to technology, such as solar PV, has moved forward at an unpredictably rapid rate in the past twenty years. Technological efficiency improvements in different areas may dramatically improve the feasibility for emissions reduction in different sectors. The development of a thriving low carbon hydrogen sector in the UK also presents opportunities, as highlighted in the recently published UK Hydrogen Strategy. The modelling of hydrogen is currently discounted from SCATTER pathways due to the limited availability of large-scale datasets. However, no "silver bullet" transformational technology should be relied upon or anticipated.

3. Insetting

This is an alternative to current forms of offsetting where instead of purchasing an instrument that relates to an emissions reduction activity outside of the city's direct boundary, an investment is made in a project within city boundary. Historically for organisations, insetting would relate to investments in activities within their own their own value chain. For a local authority, the focus would be on emissions within its city boundary. Authority Based Insetting is a mechanism intended to stimulate greater investment in carbon-saving projects locally. Ultimately, it is a method of accelerating and increasing the scale of deployment (point 1. above); rather than allowing any emissions to be 'netted off'.

3. HIGH LEVEL VISIONING
CLOSING THE GAP

Early adoption of SCATTER's interventions is a potential means for Manchester to not only take steps closer to its net zero target, but also drastically reduce the city's cumulative emissions.

The graph below shows a "*Higher Ambition: Accelerated*" pathway which illustrates quicker implementation of Higher Ambition measures, where Manchester achieves SCATTER's Higher Ambition interventions "ahead of schedule" – with all interventions applied to their full extent by 2038 as opposed to 2050.

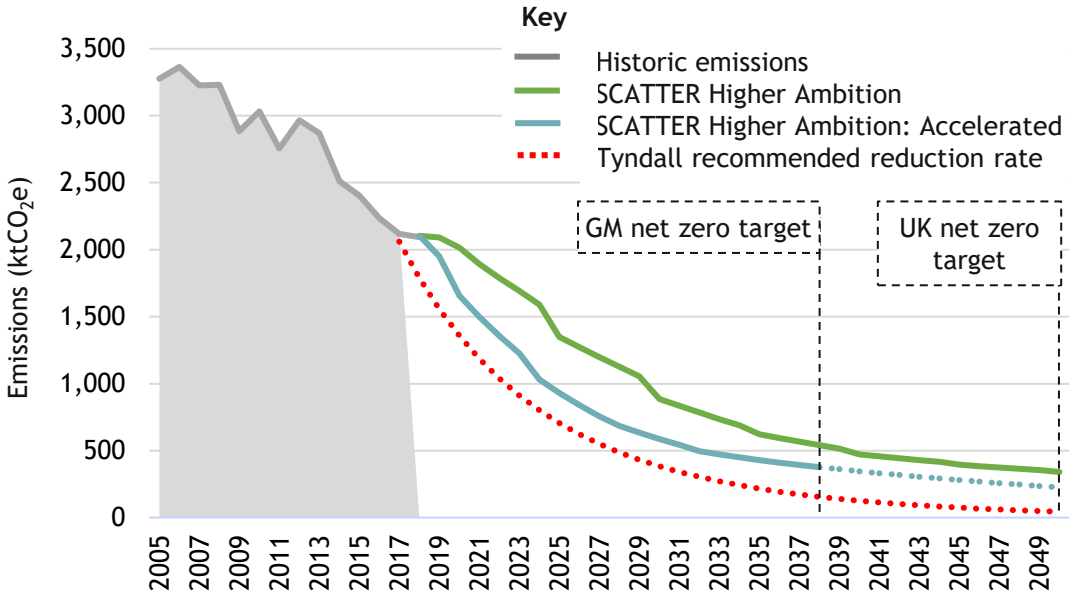


Figure 3.6: Comparing the *Higher Ambition: Accelerated* pathway (blue), delivering Higher Ambition changes no later than 2038. Historic emissions (grey), Higher Ambition (green) and Tyndall's recommended pathway (red) have also been shown for comparison.

The impact of accelerated action

Keeping Manchester's cumulative emissions within the Tyndall Centre's recommended carbon budget (15 $MtCO_2$) must ultimately shape the city's approach to tackling the climate emergency.

By achieving early adoption of SCATTER's Higher Ambition measures, cumulative emissions along the Accelerated Higher Ambition pathway are just under 19 $MtCO_2e$ by 2038, as opposed to 30 $MtCO_2e$ that the Higher Ambition pathway represents.

Further adjusting this for non-CO_2 gases that are included in SCATTER but not in the Tyndall Budget (13% of the 2018 Inventory); the *Higher Ambition: Accelerated* line would more *broadly align* with the Tyndall budget of 15$MtCO_2e$*.

Thematic breakdown of Manchester's gap to target

By 2025, Manchester will need to retrofit 5,500 homes to a medium standard and 44,300 households to a deep retrofit standard. In order to meet the 50% reduction, closer to 8,500 households will need to be medium retrofit and 68,500 will need to have received deep retrofit measures.

Within the transport sector, by 2025 Manchester will need to obtain a 3% reduction in road transport use but in order to meet the 50% reduction ambition, this must be closer to 5%.

By 2025, the total volume of waste produced in Manchester must be reduced by 17%. To meet Manchester 50% ambition, this needs to be closer to 23%.

To meet the Higher Ambition pathway targets, 920 hectares of tree coverage must be planted across the city, however, to meet the 50% reduction target, it's estimated that more than 1000 hectares must be planted.

*within 5-10%. Further details on assumptions and methodology provided within Appendix 5.

4. Targets and Sub-Objectives
What needs to happen by 2025?

4. TARGETS AND SUB-OBJECTIVES
INTRODUCTION

This chapter provides the basis for the strategic response to Manchester's commitment to reduce emissions by 50% by 2025. It is intended to underpin the delivery of projects and actions within Manchester by offering in-depth analysis and recommendations. These are based upon outputs from the SCATTER tool in conjunction with a data request and research by Anthesis to understand opportunities for action in the city.

In this chapter you will find information on:

- **Sector overview:** Introductory contexts within each sector. This includes a breakdown of key emissions sources based on SCATTER modelling, along with additional local context related to the key emissions hotspots.
- **Key plans and policies:** A summary of current plans and policies at the national, regional and city level to provide an idea of current ambition.
- **Targets and thematic sub-objectives:** An overview of the targets and sub-objectives Manchester needs to take per thematic area. These outline what needs to happen to achieve the Higher Ambition Pathway. These SMART objectives will enable Manchester to measure progress to ensure the city is on track and/or corrected action can be taken, where needed.
- **Sub-objective milestones:** For each sub-objective, we explain *what* needs to be achieved in order to reach the Higher Ambition Pathway by 2025. We also provide "current context" relating to Manchester's performance with the most recent data in line with these targets.
- **Case studies:** Global, national and local examples of action in the sector are provided. The global case studies are taken from C40 cities as Manchester aims to aligns with national and international best practiceD. Some of these cities may differ in governance and structure so may not be directly replicable but they aim to demonstrate the level of action and ambition elsewhere.

Each thematic area, defined in Framework 1.0, has sub-objectives and targets to help measure progress. In Chapter 6 details of the priority areas and actions for each sub-objective are outlined. The sub-objectives outline "*the what*" needs to happen and the actions provide "*the how*" it could be achieved.

Setting Targets

Manchester's Framework 2.0 targets were developed utilising the SCATTER Higher Ambition Pathway outputs as well as additional research conducted by Anthesis. In this chapter, targets for 2025 are detailed based on the SCATTER Higher Ambition Pathway. SCATTER modelling considers all of the thematic areas outlined in Framework 1.0, except for food and these targets have been developed separately.

Framework 2.0 identifies 30 individual targets across 21 sub-objectives, within Manchester's 6 key thematic areas.

4. TARGETS AND SUB-OBJECTIVES USING SCATTER

Interpreting the SCATTER analysis

The analysis in this chapter is based on energy systems modelling performed by the SCATTER pathways tool. It is intended to focus on '*what is required*' rather than '*how to get there*'.

The modelled pathways aim to act as 'lines in the sand' for Manchester. They serve as an indication of whether the adoption of certain sub-objectives can drive the transition to a low carbon economy and help to guide target-setting and key performance indicators. SCATTER pathways run up to 2050 and "checkpoint" targets are given for 2025, 2030, 2038 and 2050 to guide progress towards Manchester's ambition to be a zero-carbon city by 2038. A summary of these sub-objective targets are detailed in Appendix 7.

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

The feasibility of implementation is also not considered as this is dependent on action from national government and all stakeholders. Is it intended to serve as an evidence base to help Manchester understand their current influence and offer challenge as to whether this influence can be applied in new, innovative and more ambitious ways. The SCATTER model does consider additional metrics such as population growth and the increase of skilled labour required to achieve, for example, deep retrofit or the mass installation of renewable technologies.

Considerations in SCATTER

Considered in SCATTER

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

Not considered in SCATTER

- New and emerging technologies e.g. hydrogen
- Feasibility or policy limitations of implementation
- Availability of skills or funding

The milestones presented are informed by a rigorous evidence base, but it is acknowledged that there may be multiple ways of meeting these milestones which Manchester may wish to consider.

Manchester will require further consultation with stakeholders in the region to agree targets and SCATTER presents **one way** of achieving these targets. If alternative technologies or routes are opted for, this does not invalidate the SCATTER analysis as the scale of change required can help to inform these discussions. **Manchester are encouraged to set targets that go beyond the SCATTER milestones.**

4. TARGETS AND SUB-OBJECTIVES
OVERARCHING POLICIES

National UK Policy

UK National Energy and Climate Plan sets out integrated climate and energy objectives, targets, policies and measures for the period 2021-2030.

The Ten Point Plan for a Green Industrial Revolution specifies how the UK Government will provide £12 billion of funding to create green jobs in initiatives including renewable energy, transport, natural environment and green finance.

The 25 Year Environment Plan sets out the UK's goals for improving the natural environment.

The Clean Growth Strategy sets out the UK's path to decarbonising all sectors of the UK economy.

The Climate Change Committee is an independent, statutory body which advises the UK government on its emissions targets and reports progress on the UK's Sixth Carbon Budget.

Several policy documents are due to be published in the lead up to COP26. This includes the UK's Net Zero Strategy and the Heat and Buildings Strategy.

Greater Manchester Combined Authority

The Five-Year Environment Plan for Greater Manchester 2019-2024 outlines the five key aims for the region which include reaching zero carbon by 2038, protecting, maintaining and enhancing the natural environment, and preparing for the impacts of climate change.

Places for Everyone is a joint long-term plan for nine Greater Manchester boroughs. The Plan details the kind of development in the boroughs up to 2038 and how it should interact with transport and utilities systems and the natural environment.

Greater Manchester Local Industrial Strategy identifies clean growth as a future opportunity, including supporting energy and material efficiency measures.

Manchester City Council

Manchester Climate Change Framework 2020-25 is the city's high-level climate strategy to achieve zero carbon by 2038. It outlines four objectives Manchester needs to meet by 2025.

Our Manchester Strategy commits Manchester to "playing its full part in limiting the impacts of climate change". It sets out the long-term version for Manchester and a framework for how they will achieve it.

Manchester City Council has set out a Climate Change Action Plan 2020-25 which translates their target into clear and measurable actions to help the council reduce emissions by 50% by 2025. It also covers the Council's plans for adapting to the expected impacts of climate change.

The Manchester Core Strategy determines planning policy until 2027 which specifies the need for sustainable development which contributes to halting climate change.

The Manchester Local Plan, which also guides development, is currently being updated.

4. TARGETS AND SUB-OBJECTIVES
UNDERSTANDING CARBON IMPACT POTENTIAL

Figure 4.1 provides a visual overview of the estimated carbon savings that would result if the sub-objectives detailed in this chapter were achieved. Savings provided are cumulative, for the period 2020-2025. Supplementary carbon savings for the period 2020-2038 are detailed in Appendix 9.

- The diagram illustrates the high variance between the impact potential of the action areas
- Mirroring the trend observed in the emissions inventory, the largest savings potential is found within the buildings and transportation sectors
- Specifically, actions associated with on-road transportation and building energy efficiency under Sub-Objectives 1.1 and 3.1, 3.2, 3.3 and 3.4 offer the biggest potential carbon savings

Indicative carbon savings are given throughout the implementation plan at the start of each theme chapter. A calculation methodology is outlined in Appendix 8 and full detail of the cumulative carbon savings can be found in Appendix 9.

Emissions from the food system are not considered as a subsector within SCATTER. This, as well as the fact that food sub-objectives and actions most closely relate to the city's consumption emissions, means that any potential carbon savings are not directly comparable with the analysis provided opposite.

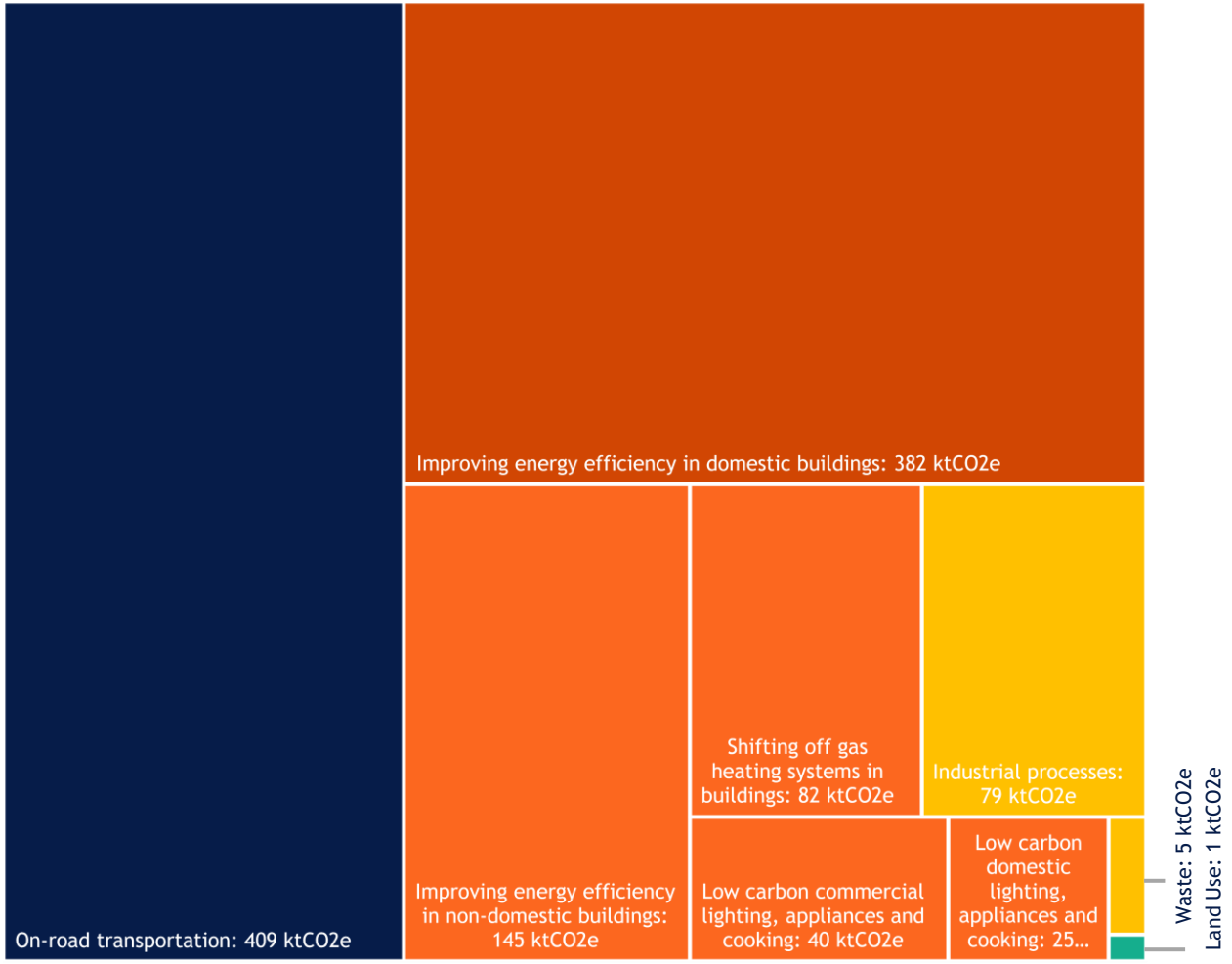


Figure 4.1: Cumulative carbon savings for Manchester (2020-2025), in line each sub-objective

4.1 Buildings

Sub-Objectives

Anthesis

4.1 SUB-OBJECTIVES: BUILDINGS
CURRENT CONTEXT

Scope of Section

The built environment sector represents the majority of Manchester's emissions, totalling 63.9% of baseline emissions. This is then further split into emissions from domestic buildings which represents 25.7% of total emissions and non-domestic buildings, which accounts for 38.1% of emissions. This sub-objective section of Framework 2 outlines the current policies and plans in place relating to Manchester's buildings, provides an overview of C40, national, and GMCA targets relating to buildings, and details the 2025 targets needed to achieve Manchester's Higher Ambition pathway. Suggested implementation actions to accelerate progress in reducing carbon impact are outlined in Chapter 6.1.

Key Emissions Sources

The challenge of reducing emissions from buildings requires looking at not only improving new-build developments, but also retrofitting and improving the energy efficiency in existing building, especially given the UK Green Building Council's estimate that 80% of the homes we will use in 2050 already exist[1]. Population growth across Greater Manchester, particularly in the city centre and its surrounding wards has accelerated emissions within residential buildings as the demand for housing has increased. Additionally, the high number of new employers to the city in recent years requiring office space and industrial units has also led to an increase in emissions from commercial and industrial buildings & facilities.

Buildings Sub-Objectives

1.1. Improve energy efficiency in buildings

1.2. Shift off gas heating systems

1.3. Low carbon and energy efficient cooking, lighting and appliances

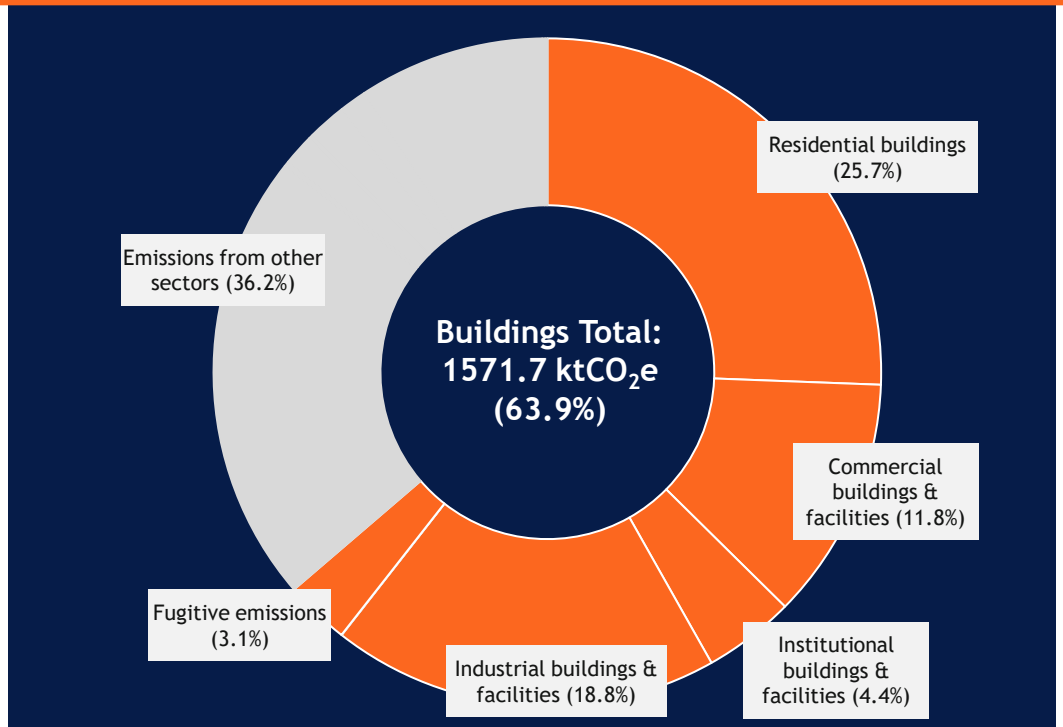


Figure 4.1.1: Emissions from different building types in Manchester

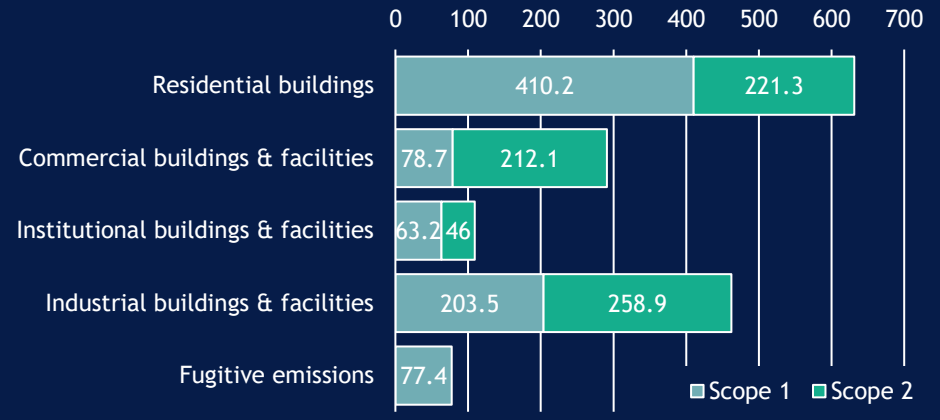


Figure 4.1.2: Building emission sources broken down by scope

[1] UK Green Building Council

4.1 SUB-OBJECTIVES: BUILDINGS
POLICY AND PLANS

National UK Policy

- The Clean Growth Strategy set targets to upgrade as many houses to EPC band C by 2035 (2030 for all fuel-poor households). The Government's preferred target is that non-domestic property owners in the private sector achieve EPC band B ratings by 2030.
- The Future Homes Standard provides an update to Part L of the building regulations and will include the future ban on gas boilers by 2025 (which may be brought forward to 2023 under the recent 10-Point Plan).
- The third phase of the Energy Company Obligation (ECO3) will conclude in 2022.
- The UK Green Building Council was set up in 2013 to investigate and recommend new ways forward to reach zero-carbon buildings.
- Salix Finance offers 100% interest-free capital to deliver energy-saving measures across public sector organisations.

Greater Manchester Combined Authority

- The Greater Manchester Spatial Energy Plan provides an informed evidence base of the current energy system in Greater Manchester. The plan collates existing information on domestic and non-domestic building stock and outlines future energy system scenarios.
- The Places for Everyone Strategy outlines that promoting the retrofit of existing buildings, reducing heat demand in homes and commercial buildings and moving away from carbon intensive gas heating systems will be imperative to meet GMCA carbon commitments by 2028.
- The Decarbonising Greater Manchester's Existing Buildings Report sets out the current context, where GM's existing domestic, commercial and public buildings need to get to, and a set of recommendations for action.

Manchester City Council

- Manchester's Housing Strategy 2016 – 2021 is part of the Manchester Strategy. It highlights the need for green homes and neighbourhoods and sets targets to reduce fuel poverty, reduce domestic property emissions, improve energy efficiency of new and existing homes and ensure Housing Providers become Carbon Literate Organisations. A new strategy is currently being developed.
- The Manchester Residential Growth Strategy sets out the key priorities for delivering residential growth and achieving a minimum target of 25,000 new homes within the city by 2025. Key priority areas progressed from the initial action plan include supporting the delivery of sustainable neighbourhoods and the use of low carbon construction methods and technologies.
- The Manchester Climate Change Partnership's Net Zero Carbon New Build policy document aims for all new builds to be zero carbon by 2023.
- The Manchester Core Strategy specifies the need for sustainable, lifetime homes and Policy EN4 aims to enable Low and Zero Carbon development.

4.1 SUB-OBJECTIVES: BUILDINGS
SUMMARY TARGETS

The following interventions relate to domestic households, commercial properties, institutional buildings, and industrial property. The analysis demonstrates the need for both decreasing demand for energy, as well as the electrifying heating systems and appliances. SCATTER achieves this based on a range of assumptions regarding the technologies available for efficiency and heating. Manchester may wish to prioritise other low carbon technologies to reach the same point and the mixes here are one way this could be achieved.[1]

Sub-Objective	2025 Indicator (Higher Ambition)
1.1. Improve energy efficiency: This measure considers changes in the energy demand for heating and cooling our buildings. Retrofit options, energy use practices and the performance of new builds are considered.	More than 5,500 households have received medium retrofit & 44,300 households have received deep retrofit At least, 15% reduction in domestic energy demand and a 12% reduction in non-domestic energy demand
1.2. Shift off gas heating systems: Considers the uptake of non-fossil fuel sources for heating, including heat pumps, district heating and combined heat and power networks (CHP). The impact of the fuel mix will be heavily influenced by the increased availability of renewable energy. Hydrogen technology is not modelled in the tool.	12% of non-domestic heating systems are district heating 20% of domestic heating systems are heat pumps
1.3. Low carbon and energy efficient cooking, lighting and appliances: Considers the reduction in energy demand from more efficient domestic and commercial cooking, lighting and appliances, including electrical devices. Additionally, considers the increased uptake in electrical cooking systems.	Lighting and appliance energy demand decreases for domestic buildings by at least 21% and commercial buildings by at least 7% At least, a 15% increase in electric fuel usage for domestic cooking and 5% increase in commercial cooking

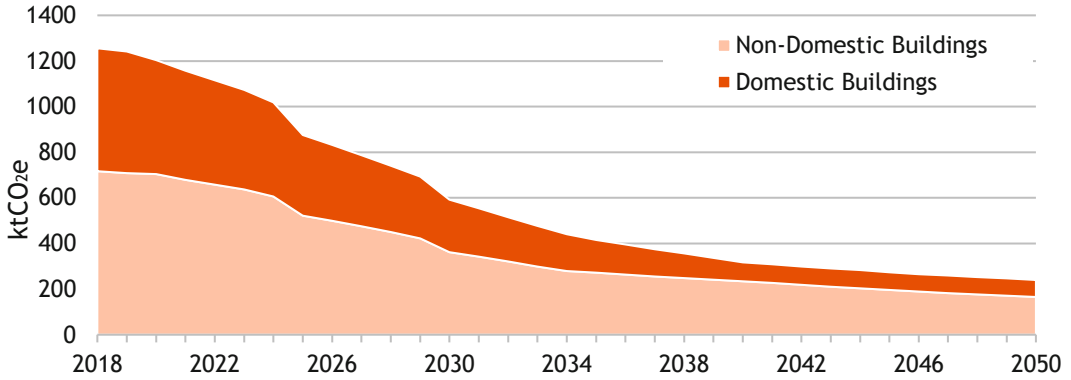


Figure 4.1.3: SCATTER Higher Ambition Pathway for domestic and non-domestic building types.

C40 Guidance & Example

Several C40 cities have signed the Net Zero Carbon Buildings Declaration which pledges to ensure **new buildings operate at net zero carbon by 2030** and **all buildings by 2050**. Tokyo has set a number of targets for the building sector for **2030** including reducing its **GHG emissions by 30%** and **energy consumption by 38%**

National Targets

- From **2021**, buildings are expected to produce 31% lower carbon emissions
- By **2025**, homes should produce 75-80% less CO_2 compared to current levels under the Future Homes Standard
- There will be a ban on gas boilers by **2025** in new homes.

GMCA Targets

- Retrofit 61,000 of existing homes each year from now until **2040**
- GMCA aims to add at least 10TWh of low carbon heating by **2024**
- Reduce heat demand from existing non-domestic buildings by 10% by **2025**

[1] See page 22 for more information on how to interpret the SCATTER analysis

4.1 SUB-OBJECTIVES: BUILDINGS
CURRENT CONTEXT & TARGETS FOR 2025

The table below provides a summary of current context and minimum targets for 2025 across each of the buildings sub-objectives. The following targets are expected to be achieved by 2025 in order to meet the SCATTER Higher Ambition pathway.

Sub-Objective	Current Context	2025 Indicator (Higher Ambition)
1.1 Improve energy efficiency	• By March 2021, 33,296 households in Manchester had received ECO measures.[1] • In 2018, 33,216 households (15.5%) in Manchester were classed as fuel poor.[2] • In 2020, 39% of EPC-rated domestic properties were rated D or below.[3] • In 2020, 45% of EPC-rated non-domestic properties were rated D or below.[4]	• 5,500 households have been retrofit to a "medium" standard, reducing annual average energy demand by 66% • 44,300 households have additionally received "deep" retrofit measures, reducing annual average energy demand by 83% • All of the 11,000 new houses projected in SCATTER have an average annual energy consumption of 1,020kWh • 15% reduction in domestic energy demand • 12% reduction in non-domestic energy demand
1.2 Shift off gas heating systems	• It is estimated that in 2019, 19.6% of properties in Manchester were not connected to the gas network.[5] • Since 2013, gas consumption across Manchester has fallen by 1.8%.[6]	• 12% of non-domestic heating systems are district heating • 20% of domestic heating systems are heat pumps
1.3 Low carbon and energy efficient cooking, lighting and appliances	• In the UK, consumption by domestic lighting decreased 25% between 2010 and 2019.[7] • In Manchester, total consumption (GWh) of electricity has fallen by 6.6% since 2010.[8] • Nationally in 2016, it was estimated that around 45-50% of domestic cooking was electrified.[7]	• 21% reduction in domestic energy demand for appliances, lighting and cooking • 7% reduction in non-domestic energy demand for appliances, lighting and cooking • 5% increase in electric fuel usage for non-domestic cooking • 15% increase in electric fuel usage for domestic cooking

[1] Household Energy Statistics
[2] Fuel Poverty Data
[3] Energy Performance Building Certificates in England and Wales
[4] Non-Domestic EPCs, Ministry of Housing, Communities and Local Government
[5] MSOA estimates of properties not connected to the gas network
[6] National Gas Consumption Statistics
[7] Per BEIS analysis
[8] Energy Consumption in the UK: Final Energy Consumption Tables

4.1 SUB-OBJECTIVES: BUILDINGS
INTERVENTION MILESTONES

1.1 Improve energy efficiency

a) Domestic buildings

This sub-objective considers changes to the energy demand for heating homes, in both existing properties and newly built homes. Different retrofit options are considered for existing households, as well as the performance of new builds.

The aim of retrofit is to drive down the energy demand for heating and hot water in buildings; typical measures include insulation for floors, windows and ceilings, as well as improved ventilation. Currently household retrofit is led largely by government-supported schemes, such as ECO3 retrofit measures and the Domestic Renewable Heat Incentive (RHI). Greater Manchester's Spatial Energy Plan highlights the need for a robust retrofitting policy and suggests that spatial mapping from the study, as well as further analysis, could support identifying priority retrofit zones within Greater Manchester. SCATTER models future energy demand based on the uptake of two "modes" of retrofit:

- Medium – a 66% reduction in annual average energy demand through inner wall insulation.
- Deep – an 83% reduction in annual average energy demand, through inner & external wall insulation.

New builds must also be constructed to extremely high energy performance standards, and this is of great significance to the city given the minimum target of 25,000 new homes to be delivered within the city between 2017-2025.[1] The Association for Environmentally Conscious Builders (AECB) deems a "high performance" building as requiring 25% of the current average energy demand for heating, Passivhaus standards are typically 10% of current average demand with an average energy consumption per year of 1,020 kWh.

[1] Manchester's Residential Growth Strategy

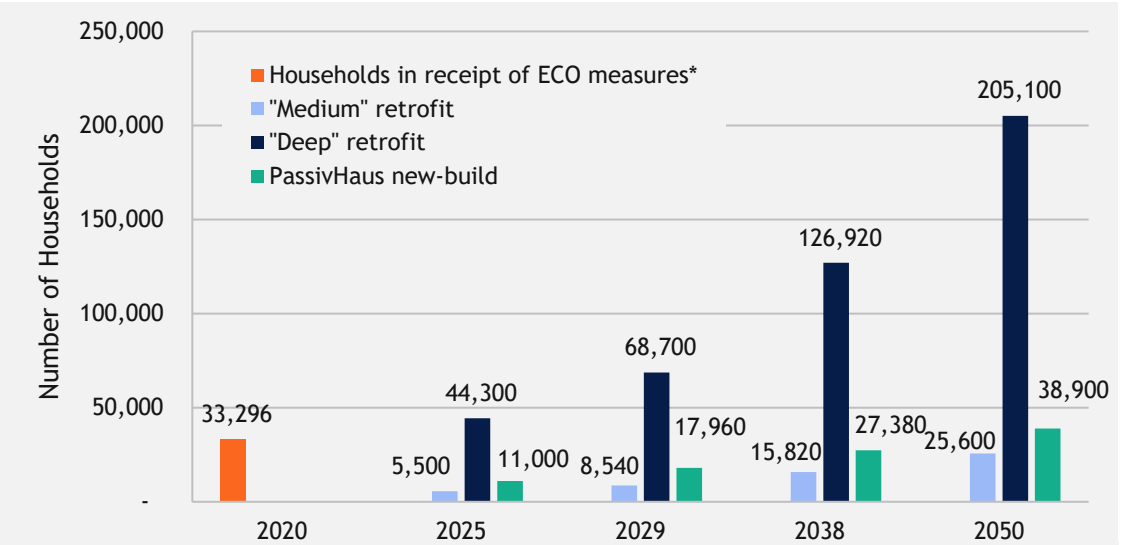


Figure 4.1.4: Retrofit rates and new build standards for Manchester. *ECO measures are included as a proxy for comparison, though the average improvements to energy demand fall well short of medium retrofit in practice.

Current Context	Target achieved by 2025
By March 2021, 33,296 households across Manchester were in receipt of ECO measures and 39% of EPC-rated domestic properties were rated D or below. In 2018, the number of households in fuel poverty was estimated at 33,216, equating to approximately 15.5% of households.	• All of the 11,000 new houses projected in SCATTER to be built to have 1,020 kWh/year energy consumption • 5,500 households have received medium retrofit, 44,300 households have received deep retrofit • 15% reduction in domestic energy demand

Table 4.1.1: Current context and targets to be achieved by 2025 for energy efficiency in domestic buildings in Manchester.

4.1 SUB-OBJECTIVES: BUILDINGS
INTERVENTION MILESTONES

b) Non-domestic buildings

This sub-objective describes energy demand reduction for space heating and hot water heating as a result of improvements to building fabric and positive behaviour changes. "Retrofit" in this context refers to insulation, draughtproofing, double glazing etc., as opposed to the installation of renewable energy technologies. The demand-side reductions are focused on changes to the building fabric, which are considered separately to any changes to electrified systems.

The reductions in emissions modelled by SCATTER:

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

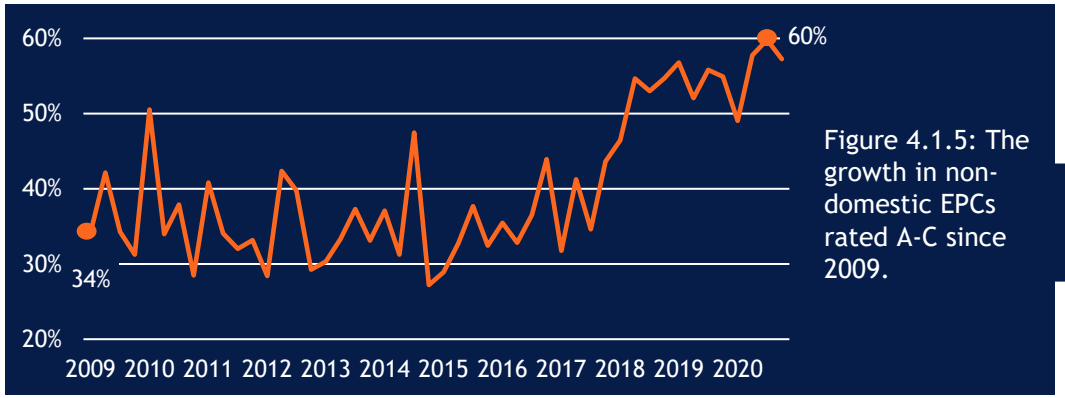


Figure 4.1.5: The growth in non-domestic EPCs rated A-C since 2009.

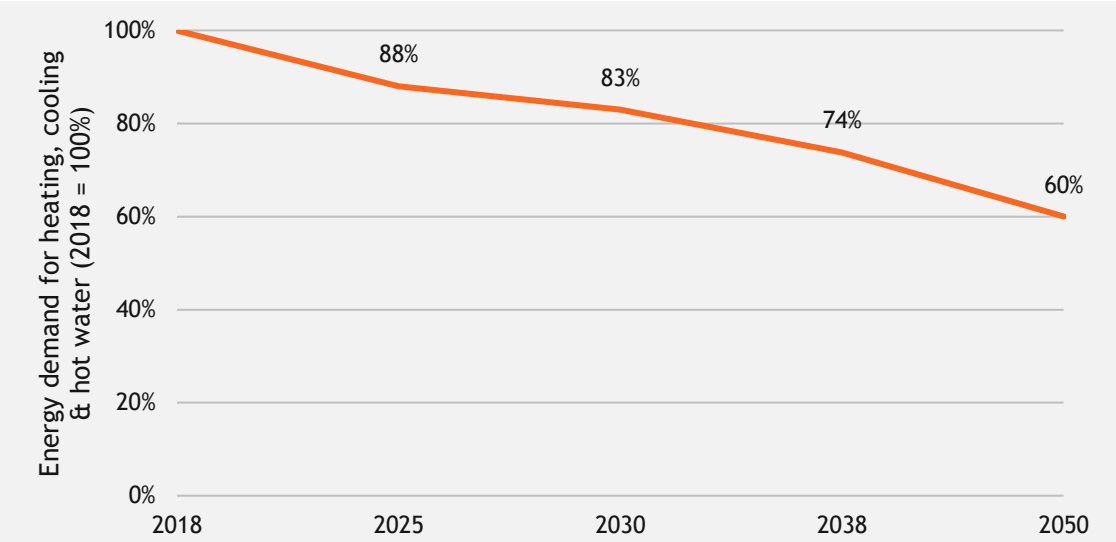


Figure 4.1.6: Modelled changes in energy demand for space heating and hot water relative to a 2018 baseline of 100%.

Current Context	Target achieved by 2025
By the end of 2020, 45% of non-domestic EPCs registered were rated D or below and 61% of Display Energy Certificate (DEC) rated non-domestic properties (public authority buildings) were rated D or below. Since 2009, the percentage of EPC ratings A-C in Manchester's non-domestic buildings has increased from 34% to 60%.	• Commercial heating, cooling and hot water demand has decreased by 12%

Table 4.1.2: Current context and targets to be achieved by 2025 for energy efficiency in non-domestic buildings in Manchester.

4.1 SUB-OBJECTIVES: BUILDINGS
INTERVENTION MILESTONES

1.2 Shift off gas heating systems

This sub-objective represents a transition from fossil fuel-source heating technologies to less carbon-intensive systems. The technology mix under the Higher Ambition Pathway includes heat pumps for domestic buildings, and a mix of community-scale district heating and heat pumps for non-domestic buildings. Hydrogen technology is not modelled within SCATTER due to the limited availability of large-scale data.

Transitioning to district heating technologies for non-domestic buildings, which includes community scale CHP, is modelled in SCATTER to deliver the greatest emissions reductions. Community scale CHP systems are a low carbon alternative to individual gas/grid systems since they more efficiently convert fuel into electricity and heat. CHP systems can also be fed by renewable technologies (e.g., solar thermal), meaning that they offer a long-term zero-carbon option for heating systems.

Heat pumps are modelled in SCATTER to deliver the greatest emissions reduction for domestic buildings. Heat pumps are an effective and energy efficient way to produce hot water to heat homes and they work by absorbing heat from the environment and transferring it to a fluid, which is then compressed to further increase its temperature. The difference between a ground source heat pump and an air source heat pump is simply where the heat is absorbed from.

The impact of this sub-objective on emissions is heavily influenced by the availability of green electricity supplied by renewable energy sources. The transition toward electrified heating brings an added demand for electricity, which will have associated carbon emissions until the national grid is fully "greened". The more rapidly the grid greens, the greater the impact on emissions reduction as a result of transitioning to electrified heating systems.

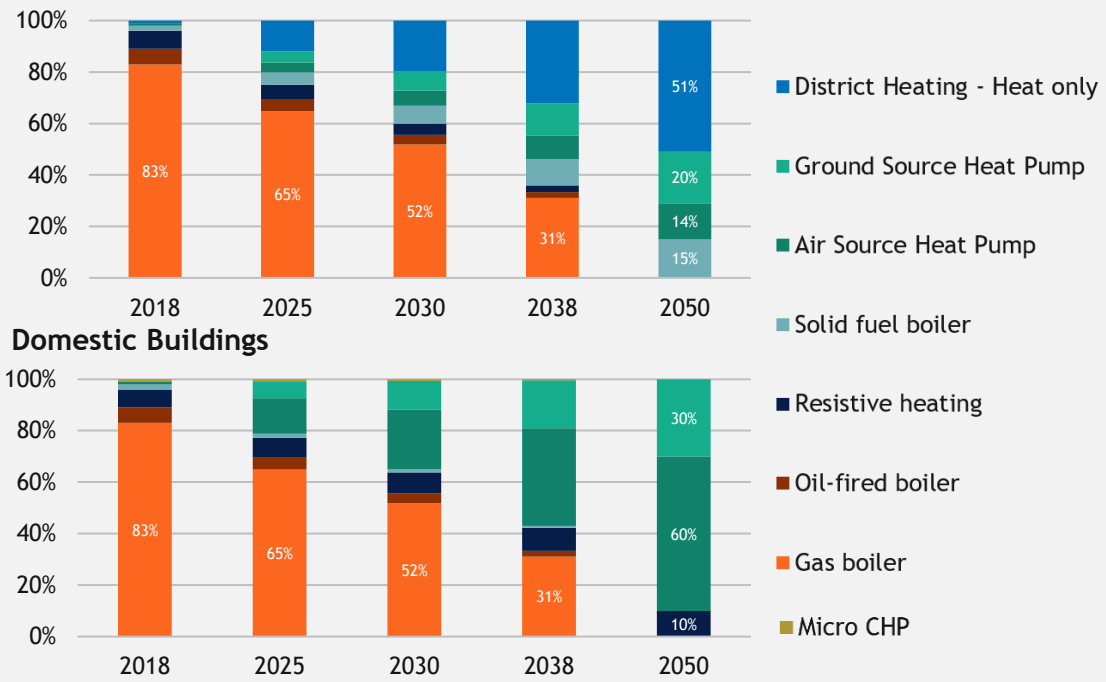


Figure 4.1.7: Modelled changes in the technology mix used for heating domestic and non-domestic buildings.

Current Context	Target achieved by 2025
According to BEIS estimates, 19.6% of properties in Manchester are currently not connected to the gas grid. Since 2013, gas consumption across Manchester has fallen by 1.8%.	• 12% of non-domestic heating systems are district heating • 20% of domestic heating systems are heat pumps

Table 4.1.3: Current context and targets to be achieved by 2025 for shifting off gas heating systems in Manchester.

Further information on the SCATTER methodology for heating mixes is available on: https://scattercities.com/

4.1 SUB-OBJECTIVES: BUILDINGS
INTERVENTION MILESTONES

1.3 Low carbon and energy efficient cooking, lighting and appliances

a) Appliance and lighting efficiency

This intervention considers the reduction in energy demand due to the installation of more efficient lighting and appliances, including electrical devices. It also considers all types of cookers and catering equipment, regardless of their source fuel.

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

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

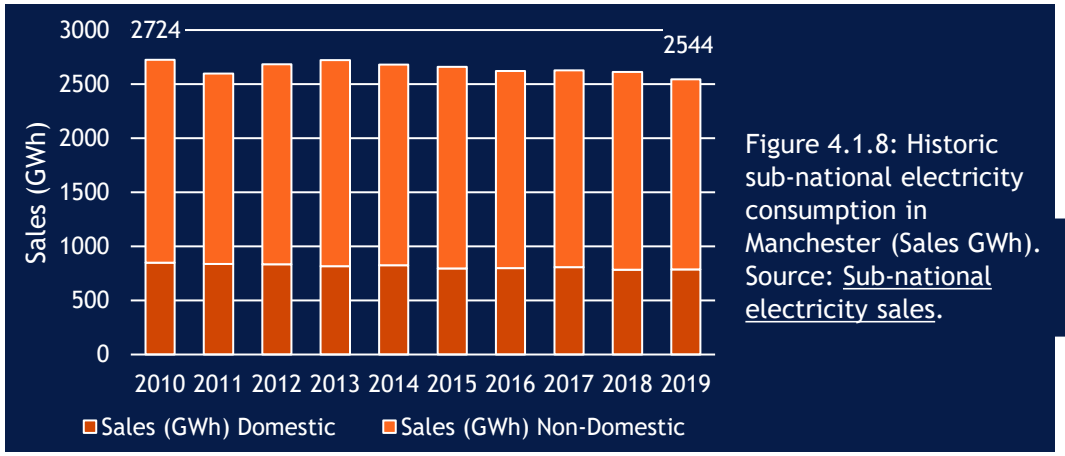


Figure 4.1.8: Historic sub-national electricity consumption in Manchester (Sales GWh). Source: Sub-national electricity sales.

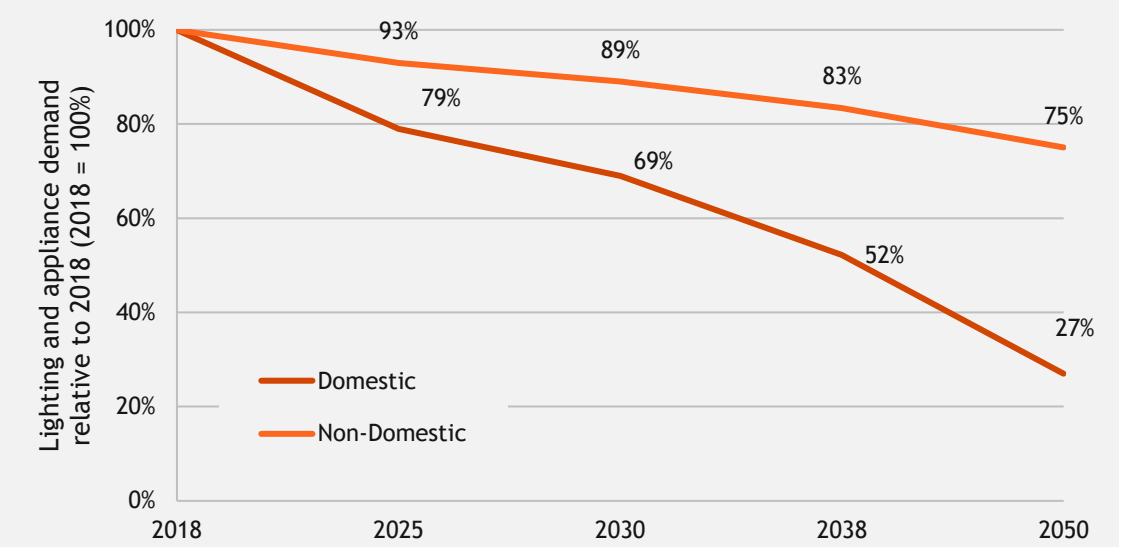


Figure 4.1.9: Modelled energy demand reduction for changes in appliances, lighting and cooking defined against a 2018 baseline.

Current Context	Target achieved by 2025
In the UK, consumption by domestic lighting decreased 25% between 2010 and 2019. In Manchester, total consumption (GWh) of electricity has fallen by 6.6% since 2010.	• Domestic lighting and appliance energy demand decreases 21% • Commercial lighting and appliance energy demand decreases by 7%

Table 4.1.4: Current context and targets to be achieved by 2025 for shifting off gas heating systems in Manchester.

4.1 SUB-OBJECTIVES: BUILDINGS
INTERVENTION MILESTONES

b) Increase uptake of electric cooking systems

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

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

Current Context	Target achieved by 2025
Nationally in 2016, it was estimated that around 45-50% of domestic cooking was electrified.	• 15% increase in electric fuel usage for domestic cooking • 5% increase in electric fuel usage for commercial cooking

Table 4.1.5: Current context and targets to be achieved by 2025 for uptake of electric cooking systems in Manchester.

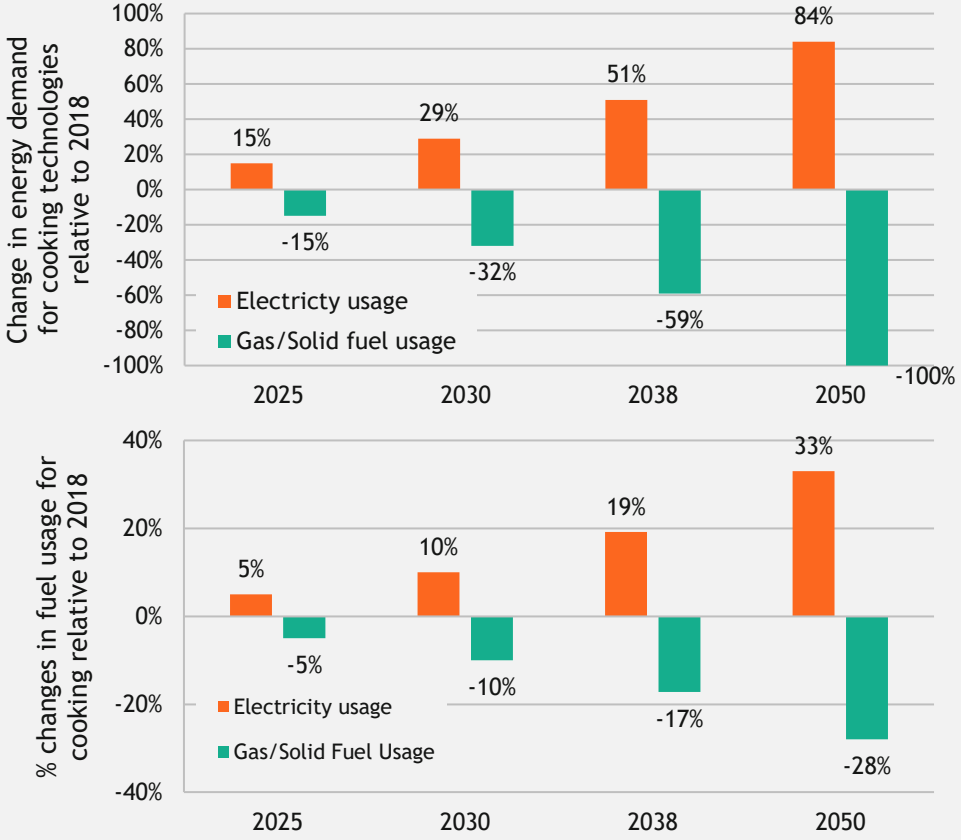


Figure 4.1.10: Modelled changes in domestic (top) and non-domestic (bottom) cooking energy demand relative to a 2018 baseline of 100%.

4.1 SUB-OBJECTIVES: BUILDINGS
CASE STUDIES

C40 Case Studies

Copenhagen: In 90% of Copenhagen's municipal buildings, data from smart electricity, heat, and water meters is recorded hourly to track usage and identify and improve inefficient buildings. The scheme has a payback period of 6 years and is expected to achieve economic co-benefits of $6 million savings annually.

New York: The City Council mandate building energy performance and have established legislation that will require all large buildings to achieve a 20% reduction in their energy use by 2030.

Stockholm: The integration of retrofitting into renovation works of 323 public housing apartments surpassed the project's target of reducing total energy consumption by 60%. The buildings with a geothermal heat pump achieved a 76% reduction in energy consumption and those without achieved a reduction of 61%.

National Case Studies

London: In July 2018, a £500m Energy Efficiency Fund was launched which has provided long term, low interest loans to public bodies and small to medium enterprises for low carbon, sustainable projects and infrastructure. The projects that have been funded have so far reduced London's CO_2 emissions by more than 15,000 tonnes per year.

Manchester Case Studies

The Manchester Civic Quarter Heat Network (CQHN) is an innovative centre that aims to provide a sustainable heat and power system to some of Manchester's most iconic buildings. The first buildings to be connected are: the Town Hall, the Town Hall Extension and Central Library, Manchester Central Convention Centre, The Bridgewater Hall and Heron House. It is estimated that the upgrades will result in a reduction of 2,000 tonnes of carbon emissions per year.

Two residential buildings in a conservation area in Didsbury Park in Manchester are being built, with high priority to low emissions, minimised waste and energy efficiency. Solar panels, careful choice of insulation and materials, energy efficient heating and ventilation with heat recovery are some of the measures that will result in a final carbon reduction of 44.7%.

Greater Manchester has set a target for being carbon neutral city-region no later than 2038. In order to accomplish the target, a Retrofit Accelerator has been established to identify mechanisms to increase the energy efficiency of the existing building stock.

4.2 Renewable Energy

Sub-Objectives

4.2 SUB-OBJECTIVES: RENEWABLE ENERGY

CURRENT CONTEXT

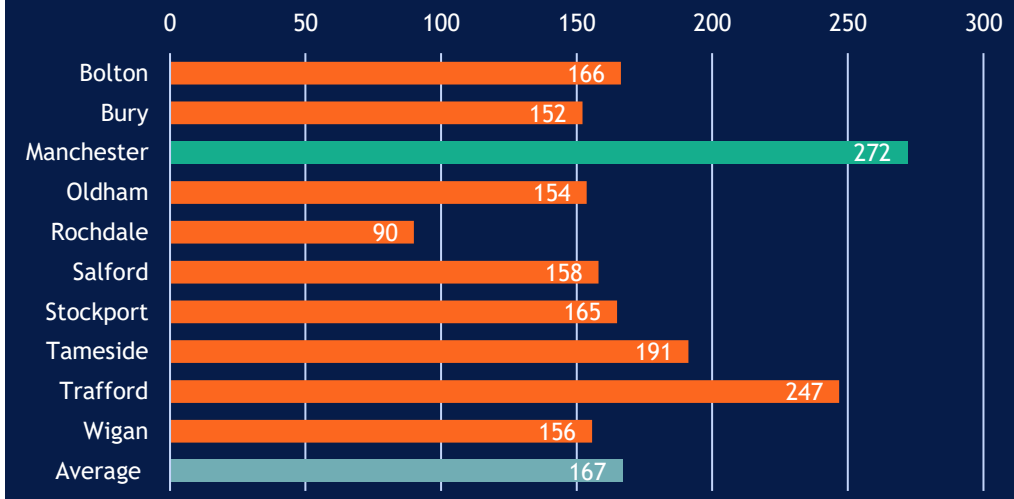
Scope of Section

Throughout this report reference has been made to the importance of providing decarbonised electricity for Manchester. Electricity will remain an integral part of the energy system across Manchester as it is increasingly used for both heat and power. The following analysis provides details for the scale and ambition required to meet Manchester's energy consumption with renewable sources. The method by which SCATTER apportions local renewable capacity is based upon the scaling up of installed capacity in a given local authority. These are based on the National Grid's Two Degree Scenario and weighted according to current installed capacity. Suggested implementation actions to accelerate progress in reducing carbon impact are outlined in Chapter 6.2.

Key emission sources

In recent years, Greater Manchester has seen a growth in local installed renewable capacity through national policy initiatives. Compared to other Greater Manchester Local Authorities, Manchester has the greatest renewable capacity per unit land area at 272 kW/km^2. This is attributed to Manchester's high installed capacity of solar PV in the city centre and the 9,673 kW of installed capacity from anaerobic digestion and plant biomass. Manchester's local energy system will need to adapt in order to accommodate shifting patterns of supply and demand. The increased use of smart technologies and local storage must also be prioritised given the limited space for local renewable installation.

Renewable Energy Sub-Objectives
2.1 Increase solar photovoltaic capacity
2.2 Increase wind capacity
2.3 Explore other renewable technologies



Greater Manchester Local Authorities	Installed Renewable Capacity (kW)				Total	Renewable capacity per unit land area (kW/km^2)
	Solar PV	Local Wind	Hydro	Organic fuels*		
Bolton	20,587	11	0	2,649	23,247	166
Bury	6,003	297	100	8,738	15,138	152
Manchester	21,773	3	0	9,673	31,449	272
Oldham	9,527	150	51	12,146	21,874	154
Rochdale	12,757	1,247	75	150	14,229	90
Salford	10,580	500	678	3,611	15,369	158
Stockport	15,843	5	149	4,795	20,792	165
Tameside	18,181	0	0	1,550	19,731	191
Trafford	8,748	0	4	17,424	26,176	247
Wigan	20,772	37	0	8,482	29,291	156
Average	14,129	341	45	6,671	21,187	167

Figure 4.2.1: Comparison of renewable energy capacity within Manchester compared to other Greater Manchester Local Authorities (Source: BEIS Regional Renewable Statistics).

*encompasses anaerobic digestors, sewage & landfill gas, municipal solid waste generation and plant biomass

4.2 SUB-OBJECTIVES: RENEWABLE ENERGY
POLICY AND PLANS

National UK Policy

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

Greater Manchester Combined Authority

- The Greater Manchester Spatial Energy Plan provides strategic analysis and an informed evidence base of existing energy demand and supply systems in Greater Manchester. The plan outlines the current contribution of low carbon and renewable energy and examines Greater Manchester's future energy scenarios.
- GMCA's SMART Energy Plan describes a roadmap of projects and activities that will enable Greater Manchester to respond to the challenge of decarbonising the wider energy system. The plan focuses on innovation, smart systems and integration across four key areas; generation and storage, decarbonisation of heat, low carbon transport and diversity & flexibility.
- Greater Manchester's Places for Everyone Plan identifies the need to increase renewable energy generation across the region through community initiatives as these provide local benefits to wider society.

Manchester City Council

- The Manchester Strategy 2016 highlights that smart investments in new energy infrastructure will create new review streams that can be reinvested and retained locally. The Strategy highlights the ambition for Manchester to be a 100% clean energy city by 2050.
- Policy EN5 of the Manchester City Council Core Strategy (2012 – 2027) identifies strategic areas within the city for the deployment of decentralized energy
- Policy EN7 of Manchester City Council's Core Strategy identifies the priority considerations for energy infrastructure in Manchester.
- The forthcoming Manchester Local Area Energy Plan will provide plans to decarbonise energy systems and improve their efficiency. The Plans are being developed in partnership with Greater Manchester Combined Authority for the 10 local authorities within Greater Manchester.

4.2 SUB-OBJECTIVES: RENEWABLE ENERGY

SUMMARY TARGETS

The sub-objectives described will be heavily influenced by the provision of renewable electricity from zero-carbon sources. SCATTER considers a wide range of renewable technologies based on projections of future national energy scenarios scaled to Manchester. The analysis shows that a significant increase in renewable energy to ~950 MW is required through a mix of technologies. The sub-objectives and targets below are one suggested way of achieving this target but Manchester may wish to focus on other technologies or ways of delivering this generation if some are deemed less feasible.[1]

Sub-Objective	2025 Indicator (Higher Ambition)
2.1 Increase solar photovoltaic capacity: As with wind, installed capacity from both Major Power Producers and local, more small-scale sites are considered.	More than, 344.7 MW local PV installed & 346.5 MW of large-scale PV installed
2.2 Increase wind capacity: Both onshore and "local" wind are considered for Manchester. Local capacity is defined as power generated from sources that are not Major Power Producers.	More than, 12.3 MW local wind installed, 7.4 MW of large-scale onshore wind installed & 231.8 MW of large-scale offshore wind installed
2.3 Explore other renewable technologies: This covers other potential renewable technologies, beyond solar and wind, that could be explored within Manchester. Some key technologies to consider are: solar thermal, anaerobic digestion, sewage and landfill gas, municipal soil waste generation and plant biomass.	Over 0.2 MW of local hydro installed Solid fuel biomass generation is modelled to increase fourfold

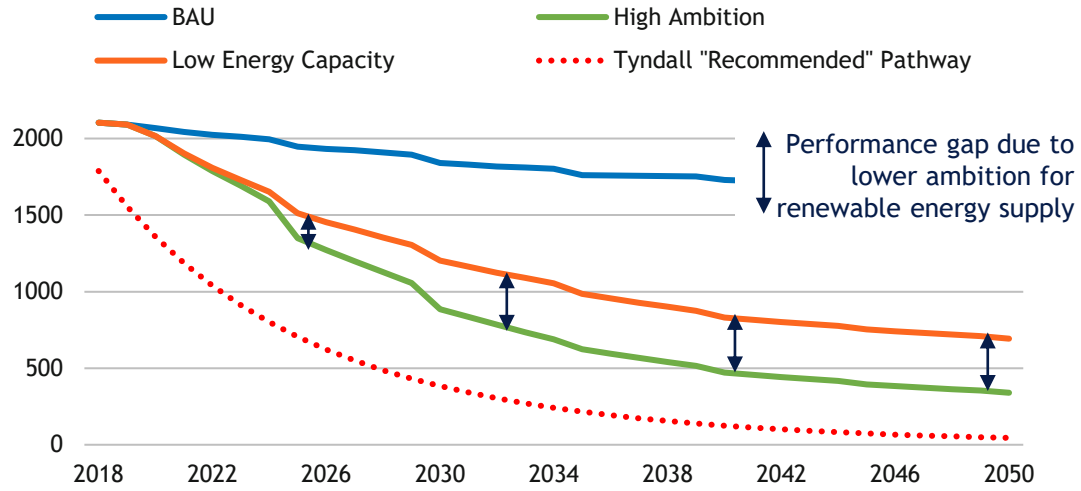


Figure 4.2.2: The energy supply sector has been presented differently to other sectors to avoid double counting. It is not possible to separate out the savings specifically from renewable energy supply as it is independent with demand-side measures.

C40 Guidance & Example

One of the C40 Strategic Recommendations is to achieve **100% clean electricity by 2030**, in the transition to **100% clean energy by 2050.**

- Fossil-free Stockholm by 2040 aims at a **carbon neutral Stockholm by 2040**. By then, residual emissions are predicted to be 0,4 tonnes CO_2/person
- The City of Sydney aims to achieve **50% renewable electricity** for the City **by 2030**

National Targets

- In 2020, the UK Government committed to producing enough electricity from offshore wind to power every home in the country by **2030.**
- **The UK announced that it is aiming for 100% renewable electricity by 2035**

GMCA Targets

- By **2024**, GMCA aims to increase local renewable energy generation by 45MW.

[1] See page 22 for more information on how to interpret the SCATTER analysis

4.2 SUB-OBJECTIVES: RENEWABLE ENERGY
CURRENT CONTEXT & TARGETS FOR 2025

The table below provides a summary of current context and minimum targets for 2025 across each of the renewable energy sub-objectives. The following targets are expected to be achieved by 2025 in order to meet the SCATTER Higher Ambition pathway.

Sub-Objective	Current Context	2025 Indicator (Higher Ambition)
2.1 Increase solar photovoltaic capacity	• In 2019, Manchester had 6,685 installations with a capacity of 21.8 MW and 21,215 MWh generation[1]	• Local PV: 344.7 MW installed capacity • Large-scale PV: 346.5 MW installed capacity
2.2 Increase wind capacity	• In 2019, Manchester had 1 onshore wind site with 5 MWh generation[1]	• Local wind: 12.3 MW installed capacity • Large-scale onshore wind: 7.4 MW installed capacity • Large-scale offshore wind: 231.8 MW installed capacity
2.3 Explore other renewable technologies	• In 2019, Manchester had two anaerobic digestion sites and three plant biomass sites with a capacity of 9.6 MW and 48,271 MWh generation[1] • In 2019, Manchester had 0 hydro sites[1]	• 0.2 MW local hydro • Solid fuel biomass generation is modelled to increase fourfold

[1] BEIS Regional Renewable Statistics

4.2 SUB-OBJECTIVES: RENEWABLE ENERGY
INTERVENTION MILESTONES

2.1 Increase solar photovoltaic capacity

Solar photovoltaic (PV) technologies can be split out into local installations, and larger sites for ground- or roof-mounted arrays. According to the Energy Saving Trust, the typical household array capacity is between 2-4 kW. The current average square meter of solar PV panel provides a capacity in the region of 0.15-0.20 kW of energy.

The Greater Manchester 5-year Plan highlights that solar PV installation should be prioritised where technically feasible across the region due to the general lack of suitable land and space, especially within the city centre and surrounding wards.

SCATTER considers a wide range of renewable technologies, some can be implemented locally, whilst others require an out-of-boundary delivery (e.g. offshore wind). SCATTER also considers the installation of large-scale renewable energy projects, they are theoretically based on out-of-boundary installations delivered, managed or directly owned by Manchester-based stakeholders or Major Power Producers.

SCATTER does not account for the geographies and local contexts unique to a given local authority, which we acknowledge play a very important role in the viability of a given technology. Where capacities are not met, energy supply from these sources may need to compensated by other local authorities elsewhere in the UK, (in addition to their own ambitious targets. Offshore capacity is flexible across the different renewable technologies (i.e. increased solar PV or onshore wind) or via a partnership with a Major Power Producer. A recent study in Manchester suggested that the city explore purchasing a solar farm out of the city for large scale renewable generation.

The overall installed capacity target for 2025 remains the same and a variety of factors should be considered when deciding the amount of local and large-scale installations.

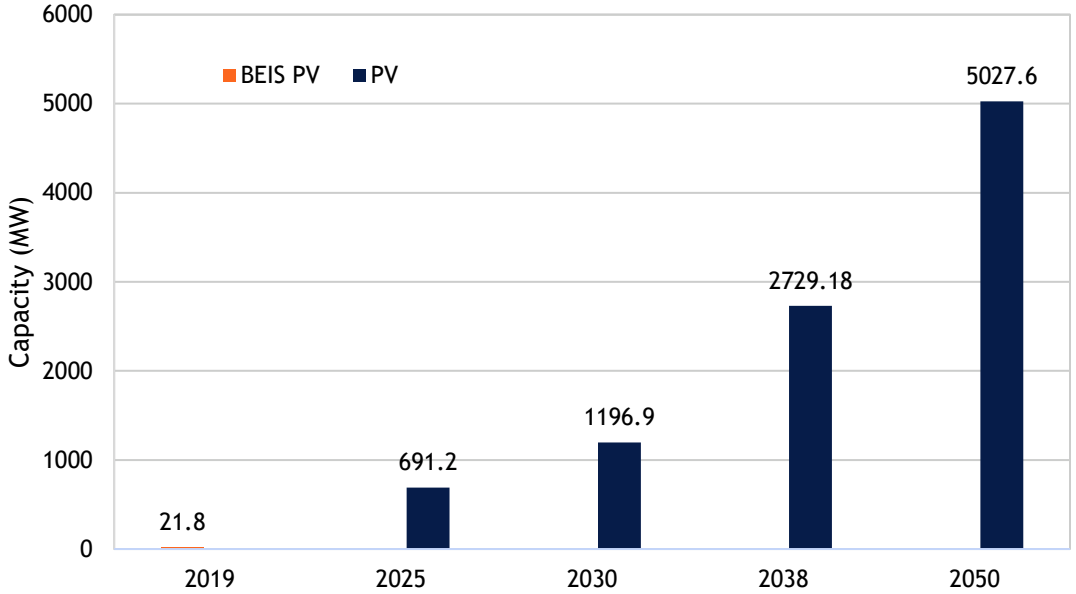


Figure 4.2.3: Comparing the SCATTER outputs against the current installed capacity from BEIS renewable energy statistics for energy generated from solar PV in Manchester.

Current Context	Target achieved by 2025
In 2019, Manchester had 6,685 installations with a capacity of 21.8 MW and 21,215 MWh generation	PV: 691.2 MW installed capacity

Table 4.2.1: Current context and target to be achieved by 2025 for solar PV capacity in Manchester.

4.2 SUB-OBJECTIVES: RENEWABLE ENERGY
INTERVENTION MILESTONES

2.2 Increase wind capacity

The capacity of wind power technologies vary between on- or off-shore installations. A typical on-shore wind turbine has a capacity of 2.5 MW, with off-shore turbines typically of much higher capacity. In contrast, small-scale wind turbines which contribute to domestic household power typically have small capacities in the region of 15 kW.

This modelling estimates values for the installed capacity of each supply technology, by taking a nationally assumed capacity figure and scaling down to region based on a local authority's size proxy (e.g. population, number of households, land area, fuel consumption). This serves as an indicator for the nature and extent of renewable supply required for future demand. As previously mentioned, we acknowledge that the extent of increase in certain technologies may not be feasible due to geographical and/or physical constraints of the city and offshore sources or alternative technologies may be required to meet targets.

Given the national commitments to offshore wind and the lobbying influence of increased numbers of offshore wind turbines, figures for offshore capacity have been included to give an indication of the potential contribution of that technology to the future energy mix within the city.

Greater Manchester's wind power generation currently delivers 2.2 GWh/year and has the technical potential to increase installed capacity across the region. Greater Manchester's Spatial Energy Plan highlights the need for GMCA collaboration across this intervention, especially from GM authorities that lack space for large wind installations, such as Manchester.

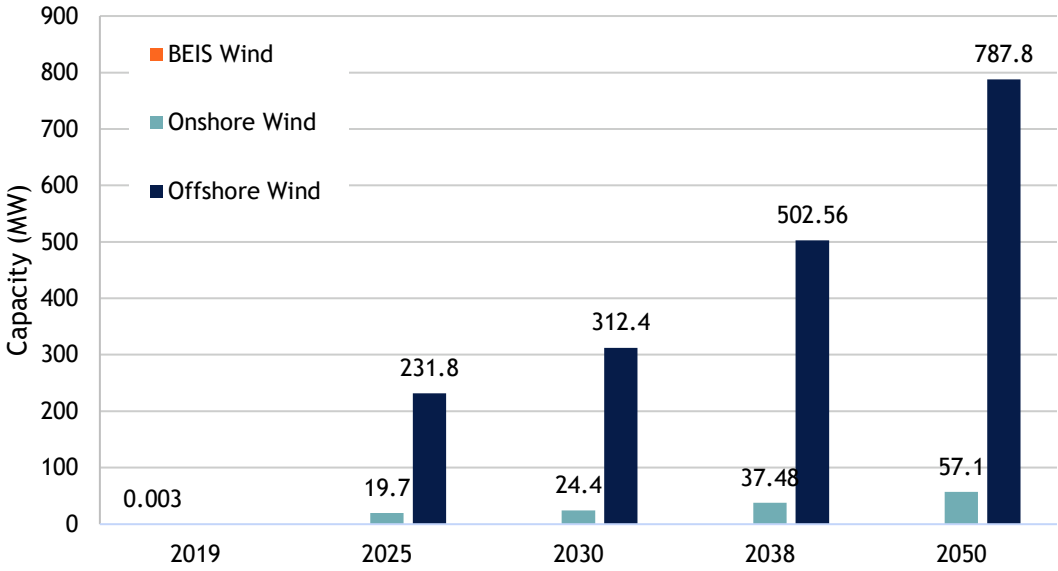


Figure 4.2.4: Comparing the SCATTER outputs against the current installed capacity from BEIS renewable energy statistics for energy generated from wind in Manchester.

Current Context	Target achieved by 2025
In 2019, Manchester had 1 onshore wind sites with 5 MWh generation	• Onshore wind: 19.7 MW installed capacity • Offshore wind: 231.8 MW installed capacity

Table 4.2.2: Current context and targets to be achieved by 2025 for wind capacity in Manchester.

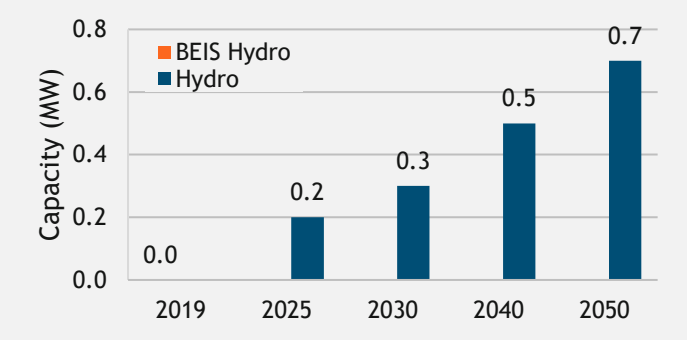
4.2 SUB-OBJECTIVES: RENEWABLE ENERGY
INTERVENTION MILESTONES

2.3 Explore other renewable technologies

Manchester has the third highest installed capacity of other renewable sources in Greater Manchester after Trafford and Oldham, with 9.6 MW of installed capacity. Two anaerobic digestion sites and three plant biomass sites exist within the city's boundary.

Biomass within SCATTER is assumed to displace fossil fuels as an energy source for generation in power stations. The combustion of solid biomass fuels (such as woodchips or chicken litter) still releases greenhouse gases into the atmosphere, albeit with a much smaller impact than that of coal or natural gas. For the Higher Ambition Pathway, generation in power stations from solid biomass fuels is modelled to increase fourfold by 2025, before dropping off to very low levels by 2050. Biomass is an extremely versatile energy source and the Greater Manchester Spatial Energy Plan highlights that around 10,000 tonnes of biomass could be available within the Greater Manchester boundary.

SCATTER also considers other renewable technologies, including hydroelectric power. To this end, very small amounts of small-scale hydroelectric projects may be suitable along the Manchester Ship Canal.



(Left) Figure 4.2.5: Small-capacity local hydro technologies modelled in SCATTER against current 2019 hydro installed capacity.

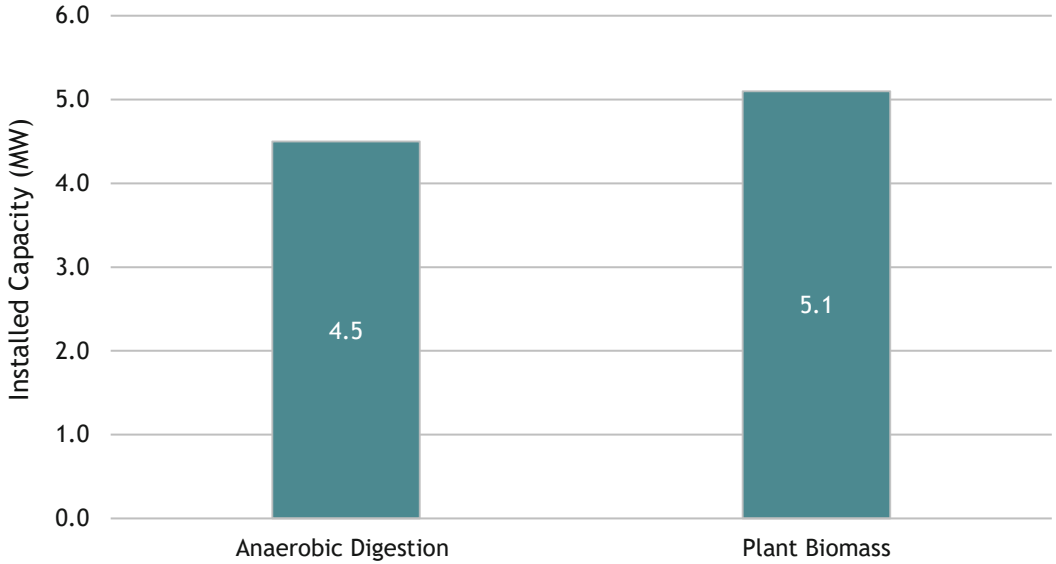


Figure 4.2.6: Current installed capacity in MW of other renewable technology types within Manchester.

Current Context	Target achieved by 2025
• No hydro sites • Two anaerobic digestion sites with 4.5 MW of installed capacity and 24,574 MWh of generation • Three plant biomass sites with 5.1 MW of installed capacity and 23,697 MWh of generation	• 0.2 MW local hydro • Solid fuel biomass generation is modelled to increase fourfold

Table 4.2.3: Current context and targets to be achieved by 2025 for other renewable technologies in Manchester.

4.1 SUB-OBJECTIVES: RENEWABLE ENERGY
CASE STUDIES

C40 Case Studies

Copenhagen: Through increasing the share of green energy from biomass used in the city's combined heat and power plants and wind energy, a 38% reduction in annual CO_2 emissions compared to 2005 levels was achieved, despite population growth of over 16% during the same period. Additionally, 20,000 streetlamps have been replaced with LED lighting, resulting in an energy saving of 57% compared to 2010 levels.

Oslo: Following statutory phasing out of fossil energy sources for heating and urban development, all district heating in Oslo is powered by renewables. For example, recovery from heat from one data centre supplies enough energy for 5,000 apartments.

Stockholm: Biochar Project - The city is investigating the opportunity to create carbon sinks and invest in bio energy carbon capture and storage (BECCS) activities within the municipal boundary. The goal of the project is to produce heat for 400 apartments and create a carbon sink which will sequestrate carbon equivalent to the CO_2 emitted by 3,500 green cars.

National Case Studies

Bristol: Bristol City LEAP is using local area energy planning to deliver investment in renewables in the city. The city will partner to deliver £875 million investment in heat networks, a smart energy system, domestic energy efficiency, renewable energy and heat pumps.

Manchester Case Studies

Unlocking Clean Energy in Greater Manchester - a pioneering project that will deliver a number of renewable schemes across the city region. The project seeks a **3,134 tCO_2** annual reduction in carbon emissions across Greater Manchester, **8,881 MWh** annual generation of clean electricity from renewable sources and will reduce energy costs for the Council.

Manchester's CIS tower was refurbished by the company Solarcentury by installing 7,244 PV cells which replaced the traditional mosaic tiles on the tower's entire surface. The tower became "the largest commercial solar façade in Europe" which resulted in saving 100 tonnes of CO_2 emissions.

Greater Manchester Community Renewables is a community benefit society run by volunteers which aims to install community-owned renewables across Greater Manchester. They have already raised funds and installed solar panels on seven schools across the city region.

4.3 Transport

Sub-Objectives

4.3 SUB-OBJECTIVES: TRANSPORT CURRENT CONTEXT

Scope of Section

This section on transport assesses current transport policy and plans, as well as SCATTER Higher Ambition targets for a range of activities including modal share, travelling shorter distances, uptake of electric vehicles (EVs) and freight transport. Suggested implementation actions to accelerate progress in reducing carbon impact are outlined in Chapter 6.3.

Key Emissions Sources

Emissions from transport represent 24% of Manchester's emissions profile, making them a fundamental source to target action. On-road transport in particular accounts for the majority of emissions at 22%. The dense road network across the city and within the city centre is likely to further encourage the uptake of on-road travel.

Within Greater Manchester, 88% of trips are shorter than five miles, and more than half of these are made by car[1]. During 2019, there were over 100,000 trips into Manchester city centre during peak morning hours, with over 20,000 by car[1]. The city's Metrolink produces 56% less grams of carbon emissions per passenger kilometre and accounted for 16% of peak morning journeys in 2019[2].

Transport Sub-Objectives

3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less

3.2 Travel shorter distances

3.3 Switch to electric vehicles

3.4 Improve freight emissions

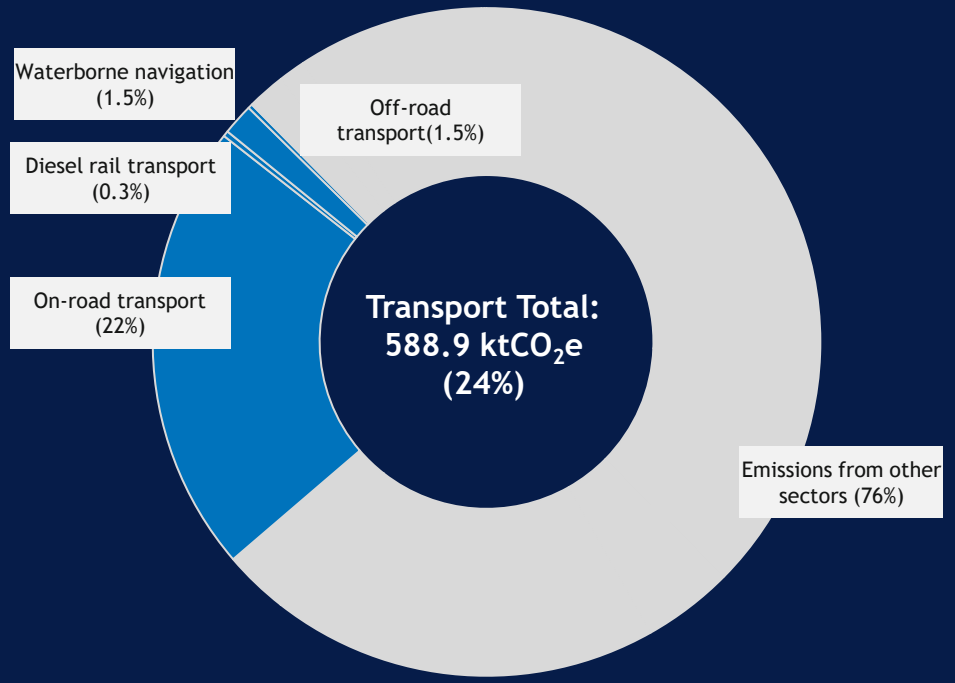


Figure 4.3.1: Emissions from transport in Manchester

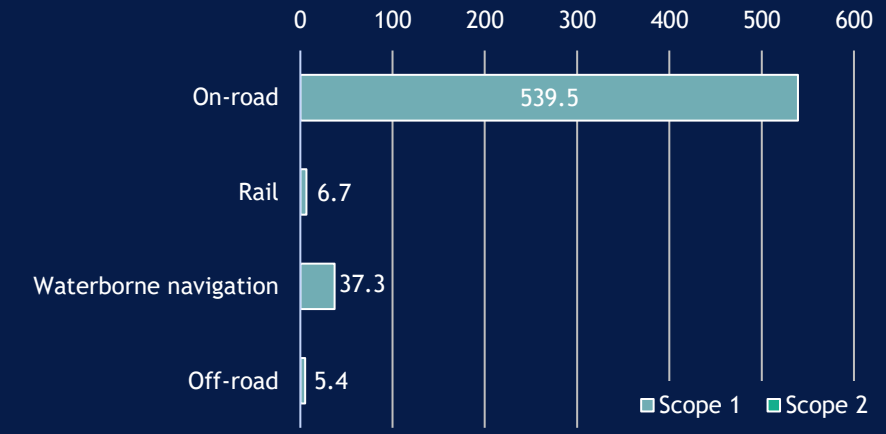


Figure 4.3.2: Transport emission sources broken down by scope

[1] Manchester City Council State of the City Report
[2] TfGM City Centre Transport Strategy to 2040

4.3 SUB-OBJECTIVES: TRANSPORT
POLICY AND PLANS

National UK Policy

- The Road to Zero Strategy 2018 sets out new measures to establish the UK as a world leader in development, manufacture and use of zero emission road vehicles.
- The Ten Point Plan for a Green Industrial Revolution includes ending the sale of new petrol and diesel cars and vans by 2030.
- The Moving Forward Together strategy commits bus operators to only purchase ultra-low or zero carbon buses from 2025.
- Well Managed Highway Infrastructure – A Code of Practice advocates sustainability through; sustainable consumption and production, climate change and energy, natural resource protection and sustainable communities.

Greater Manchester Combined Authority

- The Transport for the North Draft Decarbonisation Strategy 2021 considers embodied carbon, climate resilience and adaptation and clean growth across the North of England's transport system.
- The Greater Manchester 2040 Transport Strategy 2017 aims to tackle an ageing population and the need to reduce poverty and social inequality whilst working towards net zero carbon for the region by 2038.
- TfGM's Our Five Year Transport Delivery Plan 2021 provides interventions to tackle climate change, improve air quality, support recovery from the COVID-19 pandemic and tackle social exclusion.
- The Greater Manchester Freight and Logistics Strategy aims to minimise the social and environmental impacts of the industry and encourage sustainable distribution.

Manchester City Council

- The TfGM City Centre Strategy to 2040 is a sub-strategy to the Greater Manchester Transport Strategy 2040 which is jointly produced by TfGM and Manchester City Council and Salford City Council. The Strategy has a central aim for 90% of all trips to the city centre in the morning peak to be made on foot, by cycle, or on public transport before 2040. The Strategy also aims to improve public transport and active travel networks and reduce car-based trips.
- Chapter 6 of Manchester City Council's State of the City Report 2020 provides an assessment of the city's connectivity and outlines the goals for the city region under the Greater Manchester 2040 Transport Strategy.

4.3 SUB-OBJECTIVES: TRANSPORT
SUMMARY TARGETS

The transport measures are based on delivering a large decrease in the distances travelled by fossil fueled vehicles, approximately 1.9 bn vehicle km. This is achieved in SCATTER through a variety of approaches from reducing overall distances travelled, modal shift as well the electrification of vehicles. The extent to which these approaches are applied can be prioritised differently. SCATTER has a notable portion of savings delivered through electric vehicles however Manchester may wish to place heavier reliance on other options, such as modal shift, to deliver the change needed.[1]

Sub-Objective	2025 Indicator (Higher Ambition)
3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less: Changes to the mode by which passengers travel, defined by miles travelled. These are broken down into car (which includes petrol, diesel, hybrid and electric vehicles), active (walking and cycling) and public (train and bus).	At least a~5% reduction in road transport use and minimal increase in rail transport
3.2 Travel shorter distances: A change in the overall mileage travelled per passenger across all forms of transport. Increases in population are also considered in this measure.	Over 17% reduction in the average number of passenger miles travelled per person
3.3 Switch to electric vehicles: Considers the speed of the uptake of electric cars, trains and buses and phasing out of petrol and diesel vehicles. The impact of this measure is influenced by both the demand-side reductions and grid supply from renewable energy supply. The tool does **not** consider hydrogen-fuel vehicles.	More than 63% of vehicles are EV or HEV and 87% of buses and trains are electric
3.4 Improve freight emissions: Considers changes to both the fuel efficiency and mode of travel for freight and commercial journeys.	Over 6% reduction in road freight mileage & 47% reduction in energy used per mile travelled

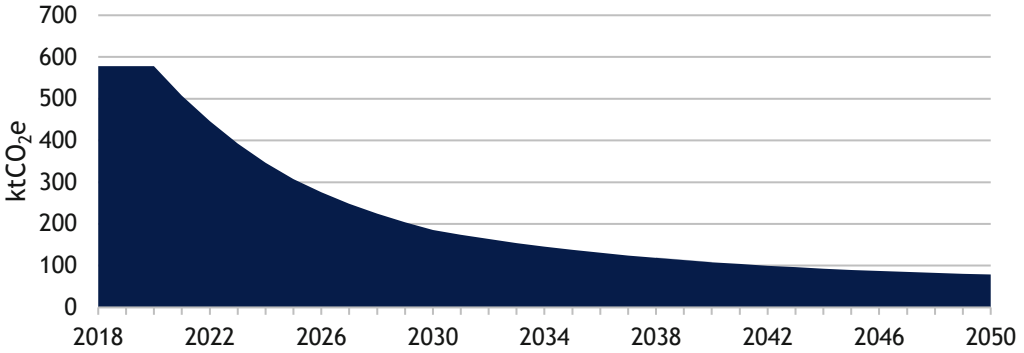


Figure 4.3.3: SCATTER Higher Ambition Pathway for transport.

C40 Guidance & Example

Several C40 cities have signed the Fossil fuel free streets declaration which pledges to procure only **zero-emission buses from 2025** and ensure a major area of the city is zero-emission by 2030. The cities commit also to a transition to **100% zero emission transport system by 2050**.
The Amsterdam Clean Air Action Plan sets two milestones: By 2025 all traffic apart from private cars and motorbikes must be emission free within the ring road, and **by 2030 all traffic** within the built-up area must be **emission free.**

National Targets

- 50% of all journeys in towns and cities to be walked or cycled by **2030.**
- No sales of cars and vans with only a petrol or diesel engine after **2030** and no sales of new fossil fuel vehicles (including hybrids) after **2040.**

GMCA Targets

- 50% of all journeys in Greater Manchester to be by public transport or active travel by **2040.**
- No net increase in motor vehicle traffic and 200,000 more EVs by **2040.**

[1] See page 22 for more information on how to interpret the SCATTER analysis

4.3 SUB-OBJECTIVES: TRANSPORT
CURRENT CONTEXT & TARGETS FOR 2025

The table below provides a summary of current context and minimum targets for 2025 across each of the transport sub-objectives. The following targets are expected to be achieved by 2025 in order to meet the SCATTER Higher Ambition pathway.

Sub-Objective	Current Context	2025 Indicator (Higher Ambition)
3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less	• According to the latest available census data, 52.8% of commutes to work were by car, van or taxi, 19.1% by active travel (walking and cycling) and 27.4% by public transport.[2]	• ~5% reduction in road transport use • Minimal increase in rail transport
3.2 Travel shorter distances	• The average distance travelled to work has increased in all regions of England and Wales. In 2011, the average distance travelled to work in Manchester was 7.7 mi.[1]	• 17% reduction in the average number of passenger miles travelled per person
3.3 Switch to electric vehicles	• Since 2014, 468 charging points have been installed in Manchester under the Electric Vehicle Homecharge Scheme (EVHS) and 93 sockets have been installed under the Workplace Charging Scheme (WCS). [3] • In Q1 of 2021, there were 1,105 ULEVs registered in Manchester.[4]	• 63% of vehicles are EV or HEV • 87% of buses and trains are electric
3.4 Improve freight emissions	• In 2020, there were approximately 16,300 LGVs and 2,800 HGVs registered in Manchester.[5] • In 2020, there were 296 million kilometers of freight emissions in Manchester from Light Commercial Vehicles and Heavy Goods Vehicles.[5]	• 6% reduction in road freight mileage • 47% reduction in energy used per mile travelled

[1] Distance travelled to work, 2011 Census.
[2] Method of travel to work, Census 2011.
[3] Department for Transport: Electric vehicle charging device statistics.
[4] Number of ULEVs licensed by Local Authority
[5] Department for Transport: Dataset on road traffic by road and vehicle type.

4.3 SUB-OBJECTIVES: TRANSPORT
INTERVENTION MILESTONES

3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less

SCATTER considers changes to the *mode* of travel i.e. the means by which the journey was completed. This is broken down into private vehicle (i.e. cars), public (which includes buses and trains) and active (i.e. walking and cycling). The 2019 modal split in figure 4.3.4 is taken from the Department for Transport (DfT) National Travel Survey data.

Since 2009, the number of cars being used to enter the city centre has been declining, whilst there has been an increase of public transport use.[1] Between 2015-2019, use of the Metrolink increased 78% and rail use increased 13%.[1] The city's Metrolink is the largest light rail network in the UK and accounts for 41 million journeys per year.[2]

Promoting and facilitating active travel is also prioritised throughout the area's strategies, with the TfGM City Centre Strategy aiming for 90% of all trips to the city centre in the morning peak to be made on foot, by cycle before 2040.[3] To achieve this, TfGM's proposals include higher frequency of Metrolink services, connectivity and capacity enhancements to the rail network and smart integrated ticketing.[2]

Manchester may choose to remove fossil fuel vehicles through an approach which focuses more on active travel, which would influence the modal shift targets and the EV targets under Intervention 4.3.3 by 2025.

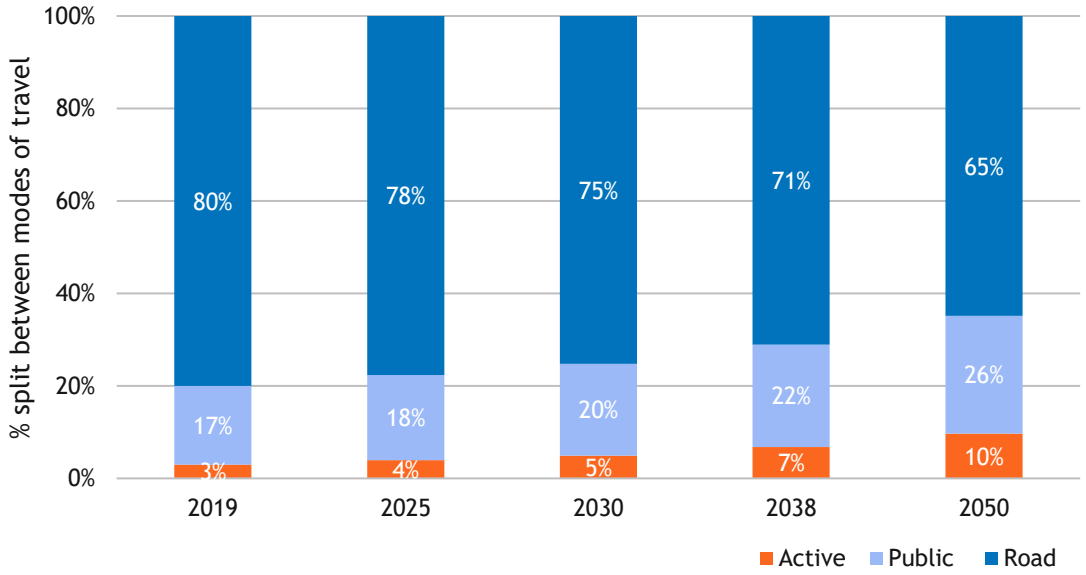


Figure 4.3.4: SCATTER-modelled changes in mileage share for different modes of transport along the Higher Ambition Pathway. The data for 2019 is the national average modal share (Source: Modal comparisons, DfT)

Current Context	Target achieved by 2025
According to the latest available census data, 52.8% of commutes to work were by car, van or taxi, 19.1% by active travel (walking and cycling) and 27.4% by public transport.	• ~5% reduction in road transport use • Minimal increase in rail transport

Table 4.3.1: Current context and targets to be achieved by 2025 for driving less in Manchester.

[1] Manchester City Council State of the City Report
[2] TfGM Metrolink Performance
[3] TfGM City Centre Transport Strategy to 2040

4.3 SUB-OBJECTIVES: TRANSPORT
INTERVENTION MILESTONES

3.2 Travel shorter distances

This measure models the reduction in total travel demand per person, across all transport modes. Travelling shorter distances can be achieved in a number of ways. The COVID-19 pandemic has certainly encouraged large numbers of people to find remote home working solutions. The future of office working remains uncertain, as many businesses become receptive to future working patterns which incorporate home-working. Following the introduction of lockdown measures in March 2020, road traffic fell to around one third of pre-pandemic levels on weekdays, however following the re-opening of office spaces and schools in September, this number recovered to approximately 90% of typical levels.[1]

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

With Manchester predominantly being a small and densely packed urban authority, distances travelled within the city are usually short. Within Greater Manchester, 88% of trips are shorter than five miles.[2] However, many journeys either begin or end outside of the city, highlighting the need to work closely with neighbouring Greater Manchester local authorities to reduce the average distance travelled per person.

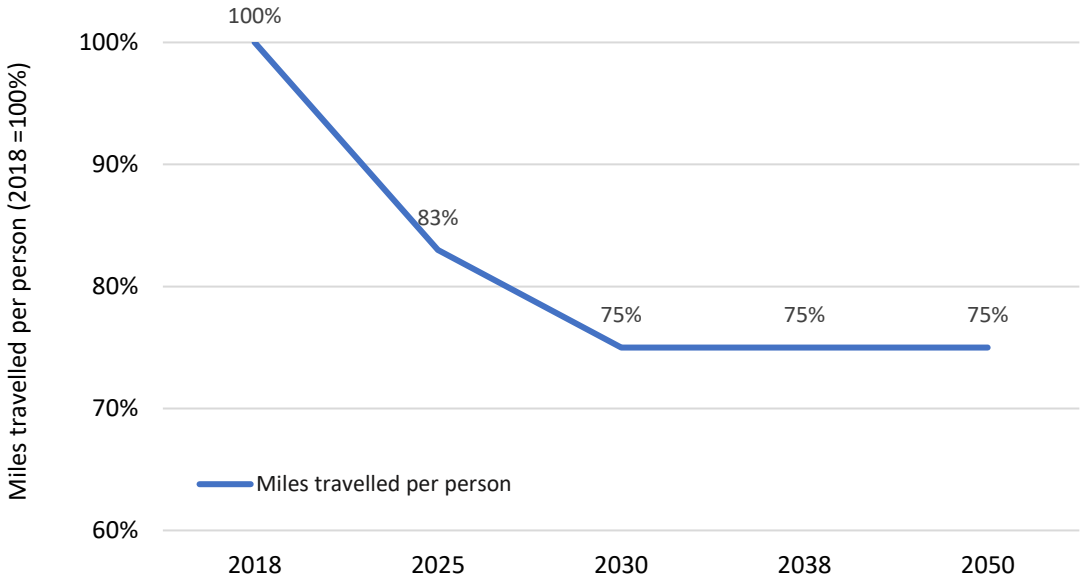


Figure 4.3.5: Modelled shortening of the average number of miles travelled per passenger across all modes within Manchester

Current Context	Target achieved by 2025
The average distance travelled to work has increased in all regions of England and Wales. In 2011, the average distance travelled to work in Manchester was 7.7mi.	17% reduction in the average number of passenger miles travelled per person

Table 4.3.2: Current context and targets to be achieved by 2025 for travelling shorter distances in Manchester.

[1] DfT Statistics on transport during the COVID-19 pandemic.
[2] Manchester City Council State of the City Report

4.3 SUB-OBJECTIVES: TRANSPORT INTERVENTION MILESTONES

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

3.3 Switch to electric vehicles (EVs)

One of the most important steps to reducing transport emissions in Manchester is the transition to electric vehicles. As with other interventions around electrification, the success of a city-wide switch to EV relies heavily on grid decarbonisation and renewable electricity supply. Data from the DfT and DVLA indicates that at the beginning of 2021, there were 1,105 licensed ULEV vehicles across the city, equating to less than 1% of total vehicles.

Greater Manchester's Clean Air Zone will launch in May 2022 to reduce nitrogen dioxide (NO2) levels to within legal limits by 2024. Most road vehicles except private cars and motorbikes will be encouraged to upgrade or retrofit to compliant, less polluting vehicles (such as LEV buses) to avoid a daily charge. Additionally, TfGM is trialing 12 electric car clubs during 2021 to allow residents to try out EVs.

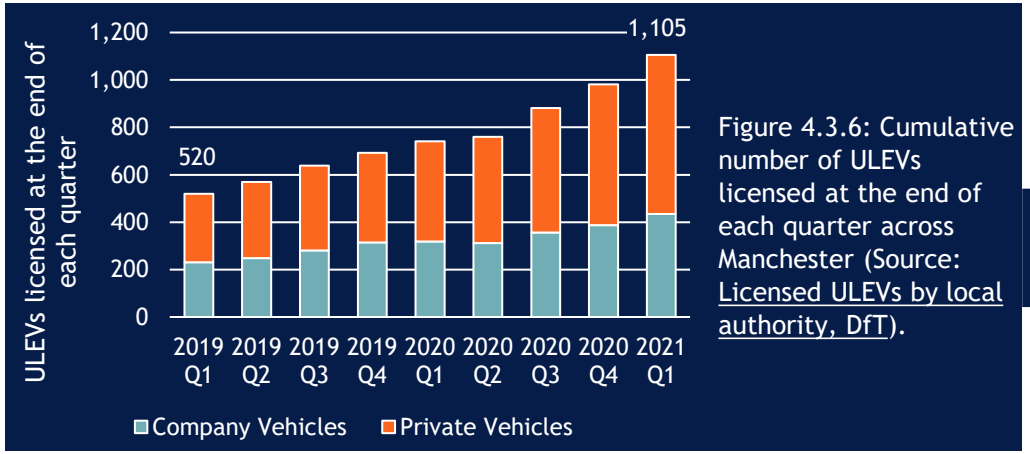


Figure 4.3.6: Cumulative number of ULEVs licensed at the end of each quarter across Manchester (Source: Licensed ULEVs by local authority, DfT).

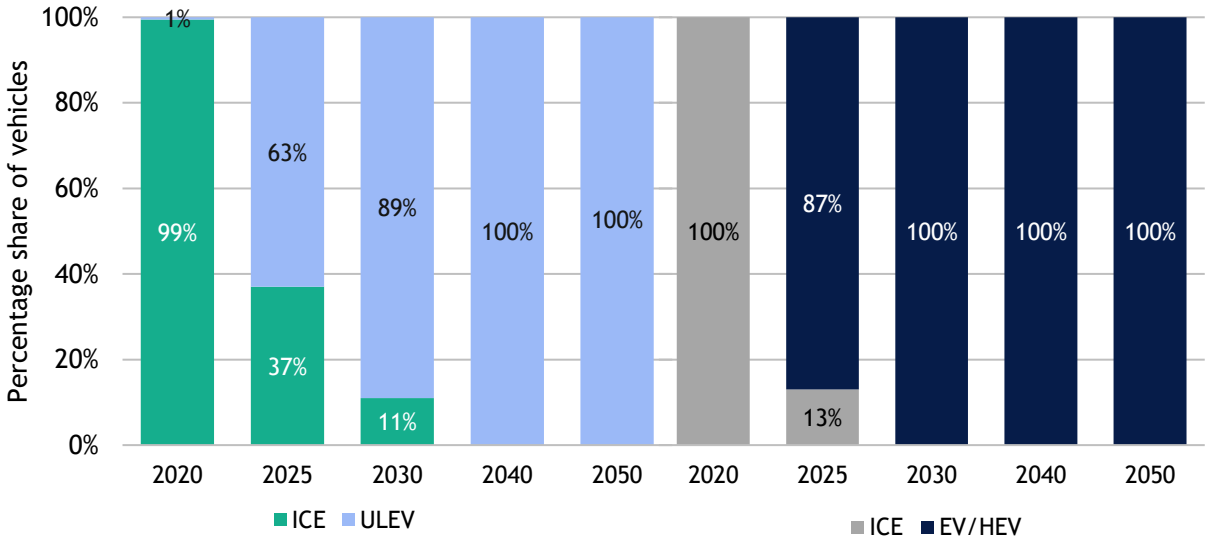


Figure 4.3.7: Transitioning away from fossil-fuel powered internal combustion engines (ICE) to ULEV or HEV. All rail networks are electrified by 2025.

Current Context	Target achieved by 2025
In Q1 of 2021, there were 1,105 ULEVs registered in Manchester. Since 2014, 468 charging points have been installed in Manchester under the Electric Vehicle Homecharge Scheme (EVHS) and 93 sockets have been installed under the Workplace Charging Scheme (WCS)	• 63% of vehicles are EV or HEV • 87% of buses and trains are electric

Table 4.3.3: Current context and targets to be achieved by 2025 for switching to electric vehicles in Manchester.

4.3 SUB-OBJECTIVES: TRANSPORT
INTERVENTION MILESTONES

3.4 Improve freight emissions

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

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

Greater Manchester's Clean Air Zone will also cover freight vehicles in the city and contribute to their improved efficiency. An increase in last mile deliveries and distribution hubs can also contribute to improving freight emissions. Hydrogen could be an alternative fuel for hard to decarbonise sectors such as freight. However, SCATTER does not model hydrogen (see page 18).

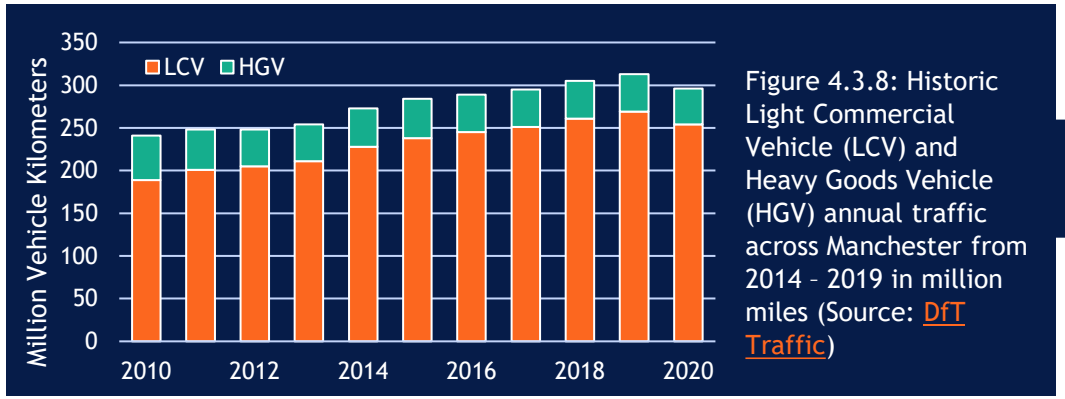


Figure 4.3.8: Historic Light Commercial Vehicle (LCV) and Heavy Goods Vehicle (HGV) annual traffic across Manchester from 2014 - 2019 in million miles (Source: DfT Traffic)

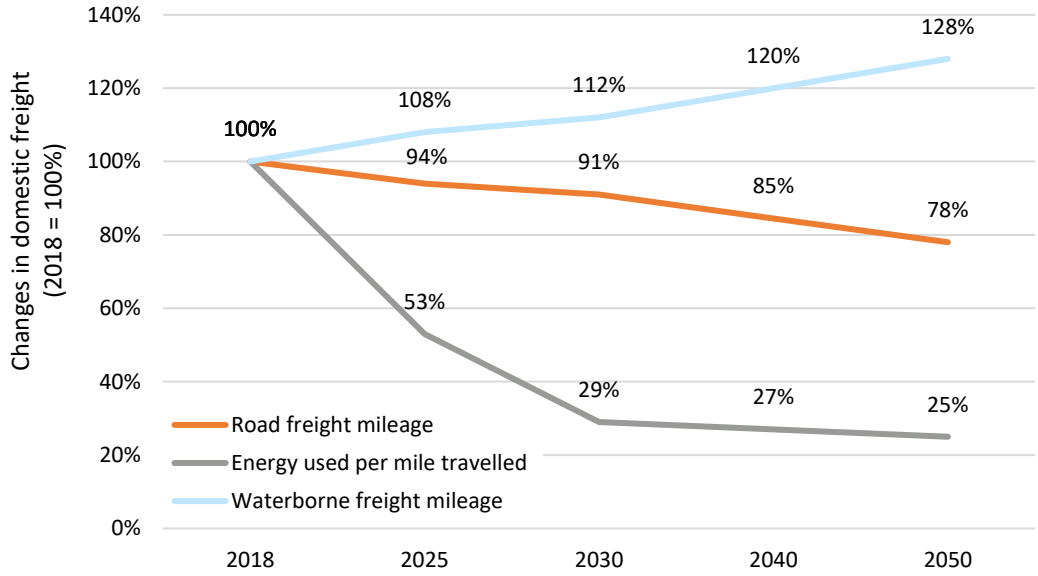


Figure 4.3.9: Improving freight emissions across three areas of activity. Percentage changes are relative to a 2018 baseline at 100%.

Current Context	Target achieved by 2025
In 2020, there were 296 million kilometers of freight emissions in Manchester from Light Commercial Vehicles and Heavy Goods Vehicles. In the same year, there were approximately 16,300 LGVs and 2,800 HGVs registered in Manchester.	• 6% reduction in road freight mileage • 47% reduction in energy used per mile travelled

Table 4.3.4: Current context and targets to be achieved by 2025 for improving freight emissions in Manchester.

4.1 SUB-OBJECTIVES: TRANSPORT
CASE STUDIES

C40 Case Studies

Rio de Janeiro: TransOeste is Rio's first of four Bus Rapid Transit (BRT) corridors. It serves approx. 100,000 passengers per day and is 62% faster than normal buses. The BRT corridor has resulted in the reduction of 107,000 tonnes of CO_2 and 6 tonnes of particulate matter per year since its opening in 2012.

Barcelona: Barcelona's Low Emissions Zone prohibits pollutant vehicles from circulating in the protected area on working days from 7am to 8pm. The restrictions are expected to result in a reduction of NO_2 emissions by 15%.

Oslo: Some of Oslo's green solutions to reduce transport emissions include:

- Selling only zero-emission cars from 2025. In 2019, 57% of the sold new cars were electric and 12% were hybrids. In 2019, 17% of Oslo's car fleet were electric.
- Introducing a toll road system which improves traffic control and finances other infrastructure. The toll system is estimated to reduce the road-transport emissions by 13% by 2021 from a 2018 baseline.
- Introducing fossil-free public transport. In 2019, 10% of the public bus fleet was electric. It is estimated a fossil-free public transport sector will save 14,700 tonnes of CO_2e.
- Better cycling facilities which are estimated to save 1,700 tonnes of CO_2e by 2021.

National Case Studies

Birmingham: The city has set out ambitious proposals in its Transport Plan to move away from being the UK's motor city to having a green and inclusive transport network. The plans include dividing the city into 6 segments where each area will only be accessible from the ring round with other movement between areas via public transport and active travel.

Manchester Case Studies

The Greater Manchester Clean Air Zone aims to improve air quality by encouraging some vehicle-owners to drive cleaner vehicles. Vehicles that do not meet the minimum requirements will be forced to pay a daily charge when driving in the zone. The measure, which is expected to launch during spring 2022, will affect light goods vehicles, heavy goods vehicles, buses, coaches, hackney cabs, private hire vehicles and minibuses.

TfGM are launching a cycle hire scheme in November 2021 with 1,500 bikes in response to the increased demand for cycling across Greater Manchester. More than 100,000 households will live within a five-minute walk of a docking station and e-bikes will be part of the fleet.

A bicycle infrastructure investment in Greater Manchester was implemented by building a 3 miles cycle route along the Wilmslow Road and Oxford Road corridor. The improved cycling infrastructure resulted in a significant increase in cycle volumes, which is estimated to have saved 873,5 tonnes of CO_2 during 2018.

Beelines is Greater Manchester's cycling and walking infrastructure proposal. The aim is to have a fully joined up cycling and walking network achieved through a 10-year, £1.5 billion infrastructure plan to create 1,800 miles of routes and 2,400 new crossings.

4.4 Food

Sub-Objectives

Anthesis

4.4 SUB-OBJECTIVES: FOOD
CURRENT CONTEXT

Scope of section

The *food system* encompasses the farm-to-fork journey of what we eat and represents between a quarter and a third of all greenhouse gas emissions globally. Figure 4.4.1 shows a breakdown of global emissions sources within the food production system. Of these emissions, around one third are the result of ruminant livestock, whilst less than a fifth of emissions from food production stem from supply chain activities.

Only around 50% of the food consumed within the UK is produced here, with food consumption responsible for around 150 $MtCO_2$ nationally each year. Manchester imports the overwhelming majority of its food from outside the city.

Key emissions sources

Emissions within the food system are the result of agricultural activities and practices. These include the use of fertiliser and fossil fuels used to power farm machinery as well as emissions directly from livestock themselves. Post-farm processes related to the transport and preparation of food also contribute to the food system's carbon impact. Since Manchester's in-boundary direct and indirect food system emissions are very small, the bulk of the city's impact in this sector is felt out-of-boundary. In order to *play its part* in decarbonising the national food system, the city must therefore position itself to influence the sector as a consumer, rather than a producer, of food.

Food Sub-Objectives
4.1 Promote sustainable diets
4.2 Reduce per capita food waste
4.3 Improve the sustainability of food supply chains
4.4 Improve food security

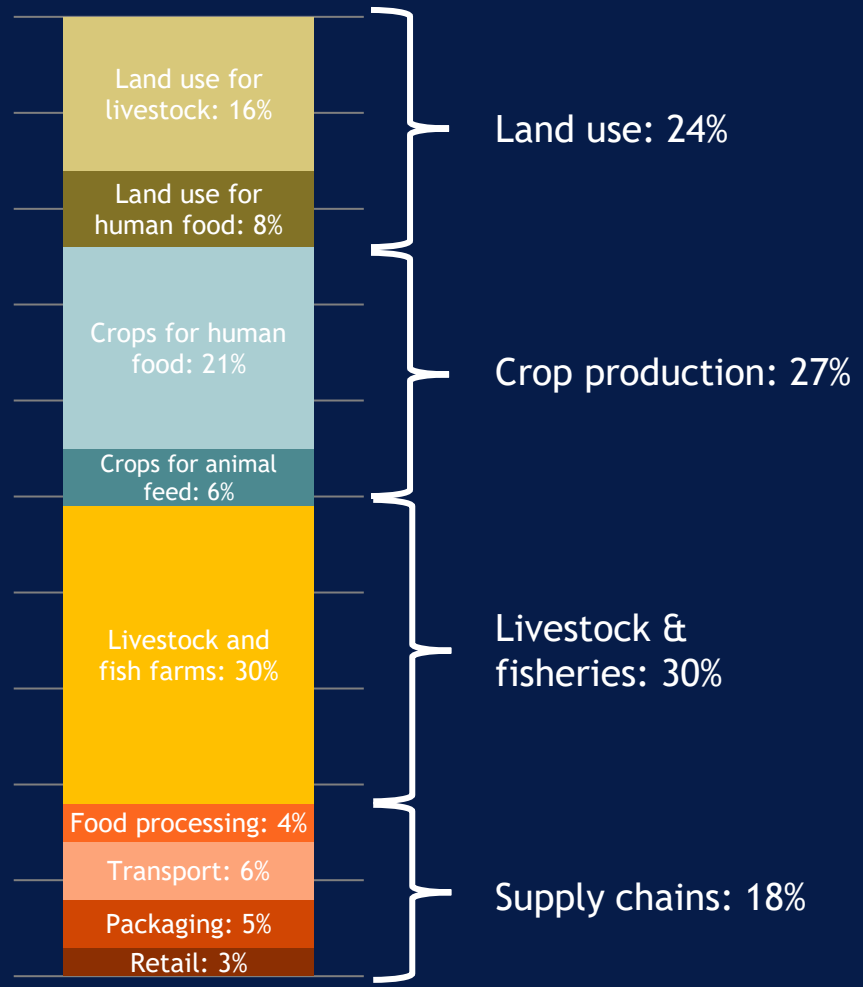


Figure 4.4.1: Global emissions from food production, broken down by source. Overall, contributions from these activities makes up around 25-35% of global emissions. Figure adapted from OurWorldinData.

4.4 SUB-OBJECTIVES: FOOD
POLICY AND PLANS

National UK Policy

- The Environment Bill established the Office for Environmental Protection as an independent body.
- The Future Farming and Countryside Programme is being delivered by DEFRA to invest in the environment, productivity, farmer resilience, plant and tree health and animal health and welfare.
- The Agriculture Bill sets out the development of a new agricultural system. Farmers and land managers in England will be rewarded in future with public money for "public goods".
- The UK government guide on increasing transparency in supply chains helps companies comply with the Modern Slavery Act. This guidance sets out what best practice looks like for companies to seriously root out contemporary slavery.

Greater Manchester Combined Authority

- The Greater Manchester Population Health Plan presents a strategic framework to best achieve health, wealth and wellbeing of Greater Manchester's population. One of the key factors presented is food, as a measure to tackle health issues.
- A Sustainable Food Vision for Greater Manchester provides inspiration on ways to achieve the 6 desired outcomes that would turn Great Manchester into a Sustainable Food City.
- Food Poverty Action Plan for Greater Manchester aims to create a framework for a change towards a more sustainable food system and eventually help reduce food poverty for people in Great Manchester.

Manchester City Council

- A Green and Blue Infrastructure Strategy for Manchester illustrates a vision of integrated green and blue infrastructure in all neighbourhoods. One objective is to improve the functionality and quality of green spaces. Sustainable food growing can significantly contribute to improving the functional value and usefulness of green spaces.
- Sustainable events guide with Manchester City Council provides checklists on aspects that can be considered for organising of sustainable events. There are checklists for 7 different areas and one of those is Food and drink traders.
- The Manchester Food Board Policy Statement, together with the accompanying Action Plan, presents an ambitious vision for Manchester's food system. The Policy statement helps identify barriers and opportunities and through a number of strategic priorities help create a resilient food system for the city.
- The Sustainable Food Mission (mission-led innovation strategy) for Manchester is a strategy that relies on cross-sectoral collaboration and engagement and focuses on 4 key areas: limitation of food loss and waste, reduction of reliance on meat, omitting single-use plastic and addressing food insecurity.
- The Food Futures Strategy is led by MHCC and aims to make local food healthier, better and more accessible through delivering the MFB's commitments and action plans.

4.4 SUB-OBJECTIVES: FOOD
INTERVENTION MILESTONES

What does a low carbon food system look like?

Emissions from the food system are not directly considered in the same way as emissions from the energy system within SCATTER. As an alternative, we have considered implications of Committee on Climate Change (CCC) pathways, which considers the food system as part of its *Balanced Net Zero* Pathway. This pathway has been designed to demonstrate the scale and nature of change necessary to achieve the **national** 2050 net zero target. The pathway sets out the following measures in relation to the food system:

- A 20% reduction in meat & dairy consumption by 2030, with a further 15% reduction in meat consumption by 2050, the result of reduced livestock numbers and grassland area
- A 50% reduction in edible food waste across the supply chain by 2030, rising to 60% by 2050
- Improvements to composting facilities resulting in a 23% reduction in emissions
- Changes to agricultural and horticultural practices and techniques

Reduced meat consumption implies that agricultural land is vacated by livestock herds, allowing more space to be restored to natural habitat or repurposed for other nature-positive activities. Vacated agricultural land could offer recreational benefits as well as alleviating flood risk and improvements to biodiversity and water quality.

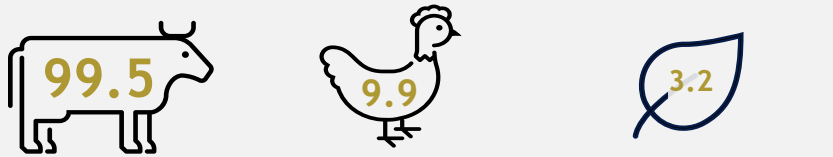
How can Manchester play its part?

Many of the decarbonisation measures set out by the CCC pathway are not directly relevant within Manchester's city boundary given the very low levels of in-boundary food production. Instead, the city and its residents should instead consider specific aspects of the food system that can be locally influenced.

These have been grouped as follows:

- **Increase the number of sustainable plant-based diets:** Currently, the production of animal protein represents the most intensive means of meeting our dietary needs from a land use and carbon emissions perspective (see box below). A just transition to increased plant-based diets would reduce emissions within the food system significantly.
- **Reduce per capita food waste:** Minimising the amount of food we throw away brings a multitude of environmental and social benefits. According to WRAP, food waste arisings from UK households and the hospitality, retail and wholesale sectors was around 9.5 million tonnes in 2020/21. Around 70% of this was edible food.
- **Improve the sustainability of food supply chains:** Manchester imports the majority of its food. Local suppliers should be favoured, but where imported food is required, suppliers who consider the carbon, water and land use implications of their produce should be favoured. Manchester can exercise its spending influence on the food system outside of the city in this way.
- **Improve food security:** The linkages between public health, social welfare and the climate emergency mean that work on sustainable diets should be aligned with that in other areas in order to ensure a just transition to net zero.

Comparing animal proteins and plant-based alternatives



$kgCO_2e$ released per kilogram of food produced

Source: Poore & Nemecek, 2018

4.4 SUB-OBJECTIVES: FOOD
SUMMARY TARGETS

The table below provides a summary of current context and targets for 2025 across each of the food sub-objectives. Since food system emissions are not considered explicitly as a sector within SCATTER, the below targets are based on a combination of international standards and initiatives, as well as Committee on Climate Change targets.

Sub-Objective	Current context	2025 Indicator (Not part of pathways)
4.1 Promote sustainable diets	• Four out of every five participants in Veganuary have since reduced their animal product consumption by at least 50% • Vegans account for approximately 2-3% of the UK population	• Reduce the amount of meat and dairy in food and supply chains by 20%
4.2 Reduce per capita food waste	• Between 2015 and 2018, per capita food waste of edible food fell just under 7% • In 2015, food waste was the equivalent of 156kg per person across household and supply chain waste	• Food waste per capita does not exceed 125kg per person
4.3 Improve the sustainability of food supply chains	• 5.5% of all food served outside of the home is procured by state-funded institutions	• Engage with all suppliers to state-funded institutions
4.4 Improve food security	• Around 3,000ha of land in the city is classified "farmed area" • There are around 20 food distribution centres within Manchester (Trussell Trust)	• Increase allotment coverage by 20%

C40 Guidance & Example

- Several C40 cities have signed the Good Food Cities Declaration which pledges to achieve a **Planetary Health Diet for all by 2030** (2,500 calories/day, maximum 16kg meat/person/year, maximum 90kg dairy/person/year).
- Good Food Cities also commit to reducing food loss and waste by 50% from a 2015 baseline by 2030.
- Example: Copenhagen developed in 2019 a new food strategy with a target of **25% less CO_2 emissions from public meals by 2025.**

National targets

- England is targeting the elimination of food waste to landfill by **2030**, which has already been already achieved in Greater Manchester through food waste collection for fertiliser production or incineration.
- There is currently no UK government target for meat and dairy consumption.

GMCA targets

- No food waste or meat and dairy consumption targets.

4.1 SUB-OBJECTIVES: FOOD
CASE STUDIES

C40 Case Studies

Los Angeles: Food Cycle LA aims to reduce the food that goes to landfill by diverting surplus food from retailers and bakeries to over 160 community organisations which serve people experiencing food insecurity. Food Cycle also provides resources to areas which are food deserts, where supply to fresh food is severely limited. In 2020, Food Cycle distributed over 1.5 million meals.

Stockholm: Through Stockholm's Food Waste to Energy, GHG savings are expected from the city's waste sector. By 2021, 70% of all food waste will be collected for conversion into biogas and automatically sorted in a plant using near-infrared technology.

Denmark: Denmark's Menu Box (måltidskasser) provides a box containing the exact amount of healthy food that is needed for each household. The service provides different menu choices and often organic and seasonal food choices are promoted, as well as sustainable packaging. The box is delivered to the door and the consumer avoids needing to buy anything that they do not need. 6% of Danish consumers use the Menu Box service and most are families with children.

National Case Studies

Cardiff: The city has developed a Food Strategy which aims to reduce the emissions associated with producing, processing, and transporting Food. The strategy also aims to tackle other challenges alongside climate action including health and inequality.

Manchester Case Studies

Growing Manchester is a programme that supports community food growing projects. It encourages and provides support to local people and communities for growing fresh, healthy and sustainable food.

Real Food Wythenshawe is a project that encourages and supports Wythenshawe's people – particularly the socially and economically underrepresented groups - to live a healthier and happier life through food-related activities. Learning how to cook, growing their own produce and occupying themselves with nature based activities are some of the activities offered in the project's two key areas: Green Doctor and Cooking with Confidence.

ESTA Foodprint Greater Manchester is a study on GHG emissions from food production and consumption in Greater Manchester. Among other information, a scenario with mitigation measures for Greater Manchester's food system is presented. The scenario shows that Greater Manchester's food system GHG emissions could be reduced by 15% by adopting those challenging but realistic measures.

4.5 The things we buy and throw away

Sub-Objectives

Anthesis

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY

CURRENT CONTEXT

Scope of Section

This thematic area is based on adopting a circular economy approach, similar to the challenge group identified in the Greater Manchester 5-year Environment Plan. Included in this thematic area is waste management as well as sustainable production and consumption. Whilst consumption is heavily linked in with waste and production, consumption-based emissions and actions are covered elsewhere in Framework 2. The waste measures described here relates to all waste streams; reuse, open and closed-loop recycling, combustion and composting and landfill. We can think of reducing the quantity of waste as a demand-side reduction, linking it to more efficient waste collections and saved costs associated with waste processing. Increasing the proportion of waste sent for recycling represents the second step in the process for mitigating emissions from waste disposal. This section also includes emissions arising directly from industrial processes where materials are chemically or physically transformed.

Key Emissions Sources

Approximately 1.1 million tonnes of waste are collected by local authorities across Greater Manchester each year. The facilities used to manage Greater Manchester's waste include 20 Household Waste and Recycling Centres, 5 Mechanical Treatment facilities and an Energy Recovery facility.

The Things We Buy and Throw Away Sub-Objectives
5.1 Reduce the quantity of waste
5.2 Increase recycling rates
5.3 Shift away from fossil fuels and reduce industrial process emissions

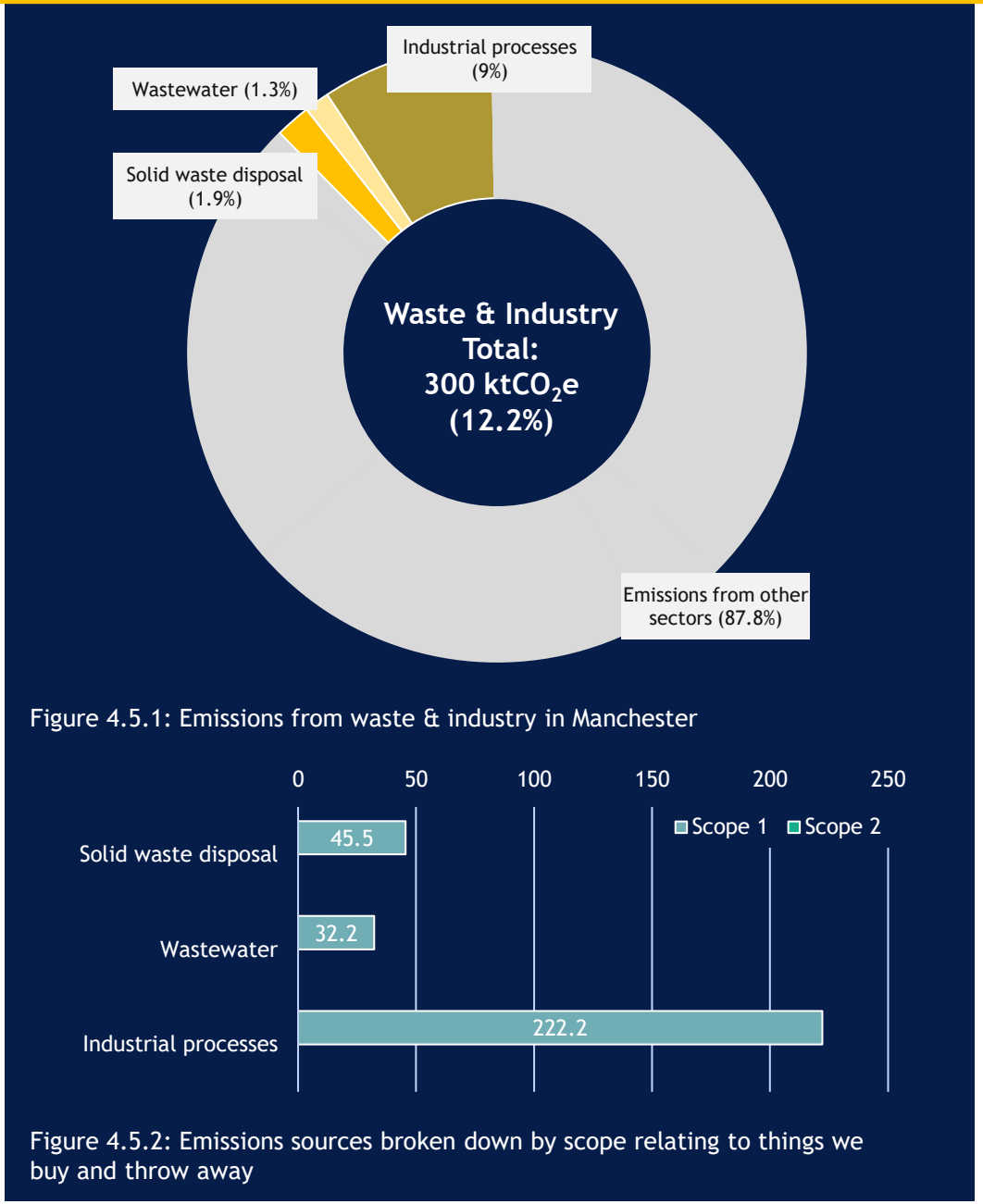


Figure 4.5.1: Emissions from waste & industry in Manchester

Figure 4.5.2: Emissions sources broken down by scope relating to things we buy and throw away

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
POLICY AND PLANS

National UK Policy

- Our Waste, Our Resources: A Strategy for England sets out how the country will preserve resources by minimising waste, promoting resource efficiency and moving to a circular economy.
- Waste and Recycling: Making Recycling Collections Consistent in England The government are working with partners to implement a more consistent recycling system, expected to come into effect in 2023.
- Waste Prevention Programme for England aims to supporting a resource efficient economy, reducing impact whilst promoting sustainable economic growth.
- Industrial decarbonisation strategy sets out how industry can decarbonise in line with net zero while remaining competitive.
- Industrial decarbonisation action plans - government and industry commitments to reduce emissions and improve efficiency.

Greater Manchester Combined Authority

- Greater Manchester Local Industrial Strategy identifies clean growth as a future opportunity, including supporting energy and material efficiency measures.
- 5-year Environment Plan Sector on Production and Consumption of resources. The priorities includes moving to a circular economy through more sustainable production, consumption and waste management.
- Sustainable Consumption & Production Plan 2021-2025 builds on the 5-year plan focusing on the actions needed to move to a circular economy and support more sustainable living.
- Greater Manchester Joint Waste Development Plan identifies sites and management policies to meet GM's future waste management needs.
- Zero waste strategy – in development.

Manchester City Council

- Waste storage and collection guidance for new developments provides guidance for developments to plan and design refuse collection and storage and recycling facilities. The aim is for developments to encourage residents to recycle. The guidance is accompanied by a Waste Performa for planning applications.
- Decarbonising consumption in Manchester identifies 5 consumption hotspots for Manchester, including Waste & Wastewater and Manufactured goods. It also provides recommendations on low hanging fruit and more ambitious changes.
- Our Manchester Industrial Strategy sets out the vision and delivery plan for developing a more inclusive economy. Under the pillar 'Place' includes strategic initiatives on New developments being inclusive and zero carbon and Innovative investment models to improve the environment.

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY

SUMMARY TARGETS

The first two sub-objectives within the Things We Buy and Throw Away thematic area relate directly to waste, sub-objective three relates to industrial emissions. SCATTER models the waste carbon reduction from reducing the volume of waste which is treated in the most polluting ways. This is achieved through reducing overall waste volumes as well as increasing the rate of recycling in line with the waste hierarchy. Emissions reduction from industry are modelled through shifting away from fossil fuels as well as more efficient processes.[1]

Sub-Objective	2025 Indicator (Higher Ambition)
5.1 Reduce the quantity of waste: Considers changes in the overall weight of waste produced across all streams from domestic, commercial and industrial activity. Reducing the quantity of waste is a priority when examining the waste hierarchy: reduce, reuse, recycle.	At least a 17% reduction in the volume of waste
5.2 Increase recycling rates: Considers the different destinations for waste streams, with the aim of less waste going to landfill.	More than 9% increase in the recycling rate from 2018
5.3 Shift away from fossil fuels and reduce industrial process emissions: Considers the electrification of energy consumption in industrial processes and activity. Considers annual reductions in process emissions via a reduction in the production index of various industries. Separate trajectories are included for chemical, metal, and mineral sectors, with all other industrial activity grouped as "other industry".	Electricity consumption is more than 40% of total industrial energy consumption Process emissions reduced by at least: 10% for chemicals, 6% for metals, 8% for minerals and 37% other industries

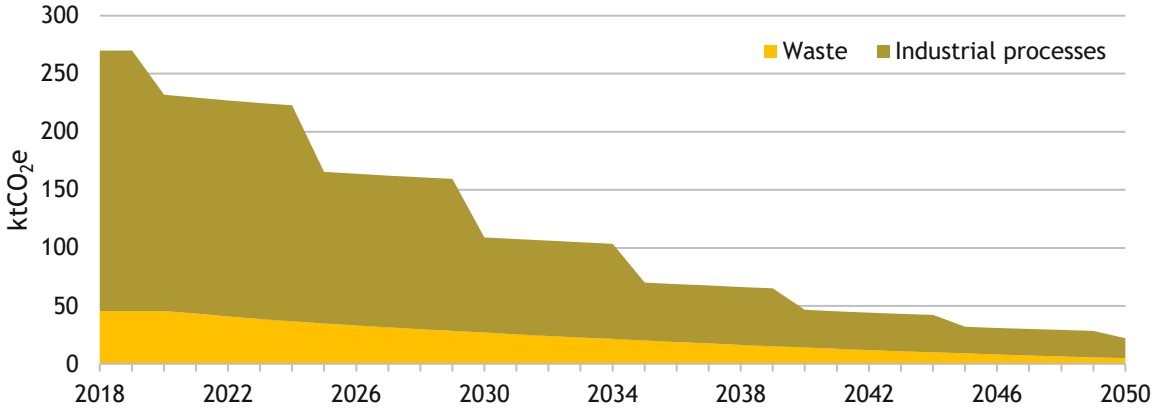


Figure 4.5.3: SCATTER Higher Ambition Pathway for the things we buy and throw away, which includes emissions from waste and industrial processes.

C40 Guidance & Example

Several C40 cities have signed the Zero Waste Declaration which pledges to reach at least **70% diversion from disposal by 2030** and reduce the municipal solid waste generation per capita by at least **15% by 2030** compared to 2015.
New York City has set a goal of reducing the amount of waste by **90% by 2030** from a 2005 baseline. It is also aiming to send zero waste to landfill by the same date.

National Targets

- UK target to recycle 65% of municipal waste by **2035.**
- England targets include all plastic packaging being recyclable/reusable by **2025,** doubled resource productivity by **2050** and all avoidable waste eliminated by **2050.**
- The UK Government are introducing a tax on packaging which does not meet a minimum threshold of 30% recycled content from **April 2022**.

GMCA Targets

- Eradicate avoidable single use plastics on the GMCA public estate by **2024.**
- GMCA is targeting 55% household recycling by **2024** and at least 90% diversion from landfill by **2021.**
- 38% reduction in industrial emissions by **2025.**

[1] See page 22 for more information on how to interpret the SCATTER analysis

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
CURRENT CONTEXT & TARGETS FOR 2025

The table below provides a summary of current context and minimum targets for 2025 across each of the things we buy and throw away sub-objectives. The following targets are expected to be achieved by 2025 in order to meet the SCATTER Higher Ambition pathway.

Sub-Objective	Current Context	2025 Indicator (Higher Ambition)
5.1 Reduce the quantity of waste	• 159,943 tonnes of household and 7,360 tonnes of non-household waste was collected by Manchester City Council in 2019/20.[1] • From 2018-2019 to 2019-20, the volume of waste collected by the Council increased by 2.4% from households and decreased by 5.5% from non-households. [1]	• 17% reduction in the volume of waste
5.2 Increase recycling rates	• The household recycling rate in 2019-20, based on Local Authority collected waste was 40.4%.[1]	• 9% increase in recycling rate from 2018

5.3 Shift away from fossil fuels and reduce industrial process emissions	• In the UK, 35% of energy consumed by the industrial sector in 2019 was electric.[2]
	• Industrial carbon emissions in the UK including those from energy-intensive industries have halved since 1990, which has mainly been due to efficiency gains, fuel switching, a change to industrial structure of the UK and re-location of production overseas.[3]
	• Since 1990 the chemical sector has improved its energy efficiency by 35%.[4]
		• Electricity consumption is 40% of total industrial energy consumption by 2025
		• Process emissions reduced:
		  • 10% for chemicals
		  • 6% for metals
		  • 8% for minerals
		  • 37% other industries

[1] BEIS Local Authority Collected Waste.
[2] DEFRA Fly tipping incidents and actions taken in England
[3] DUKES Energy Consumption by final user
[4] BEIS. Oil Refining - Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan
[5] BEIS. Chemicals Sector - Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
INTERVENTION MILESTONES

5.1 Reduce the quantity of waste

The first step in improving emissions from waste is a reduction in the total volume of waste or wastewater produced. This reduction covers waste from households, commercial and industrial usage, construction and demolition.

The DEFRA dataset on local authority collected waste identified that in Manchester, each household generated an estimated 412.6 kg of waste from April 2019 to March 2020. Across the city, 40.4% of this household waste was sent for reuse, recycling or composting. Very little commercial waste is collected by any of the 10 district councils with the majority of this waste type collected by a range of private operators. This means that data on commercial waste is somewhat limited.

Local authorities have reported large increases in household waste arisings during the COVID-19 outbreak and huge falls in commercial waste arisings, according to the results of the ADEPT COVID-19 Waste Impacts Survey.

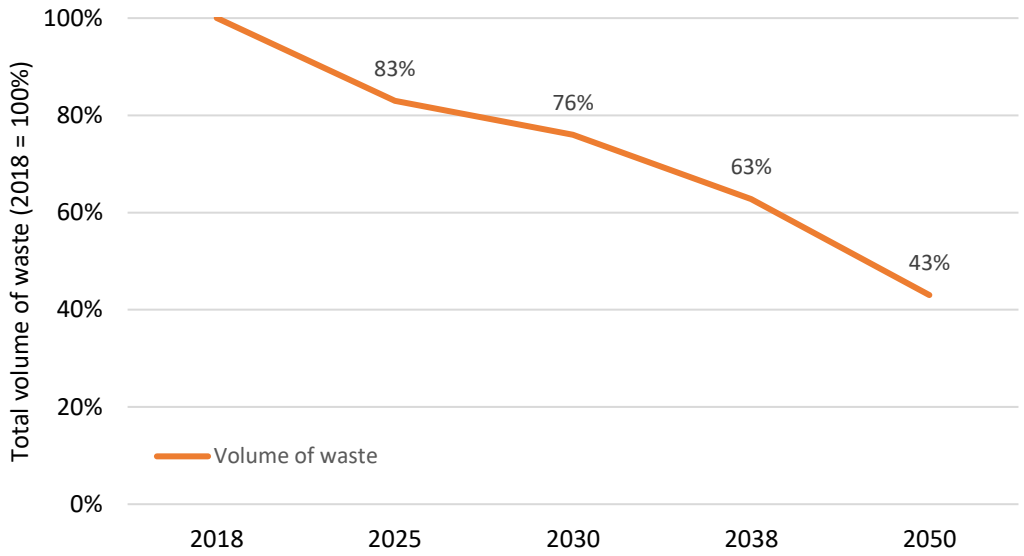


Figure 4.5.4: Reduction in quantity of waste as modelled by SCATTER.

Current Context	Target achieved by 2025
159,943 tonnes of household and 7,360 tonnes of non-household waste was collected by Manchester City Council in 2019/20. The volume of household waste collected by the Council increased in 2019-20 by 2.4% from 2018-19 levels.	Total volume of waste is 83% of 2018 levels

Table 4.5.1: Current context and target to be achieved by 2025 for reducing the quantity of waste in Manchester.

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
INTERVENTION MILESTONES

5.2 Increase recycling rates

After reducing the volume of waste outright, the second SCATTER intervention considers changes to the amount of waste that is recycled. SCATTER trajectories incorporate EU targets for recycling rates, with the Higher Ambition pathway projecting a more rapid transition to increased rates of recycling. The growth in recycling rate across Manchester needed to follow the Higher Ambition pathway is illustrated in figure 4.5.5.

The GMCA is responsible for the management and disposal of municipal waste. GMCA has set the following targets relating to increasing recycling rates:

- Achieve 55% household recycling by 2025
- Obtain a 60% recycling rate across the 20 Household Waste Recycling Centres located in Greater Manchester by 2021
- Divert at least 90% of waste from landfill by 2021

To support these aims, communication and behavioural change projects are delivered under Recycle for Greater Manchester, who work in partnership with all 9 local councils (Wigan operates a separate unitary disposal), WRAP and other stakeholders.

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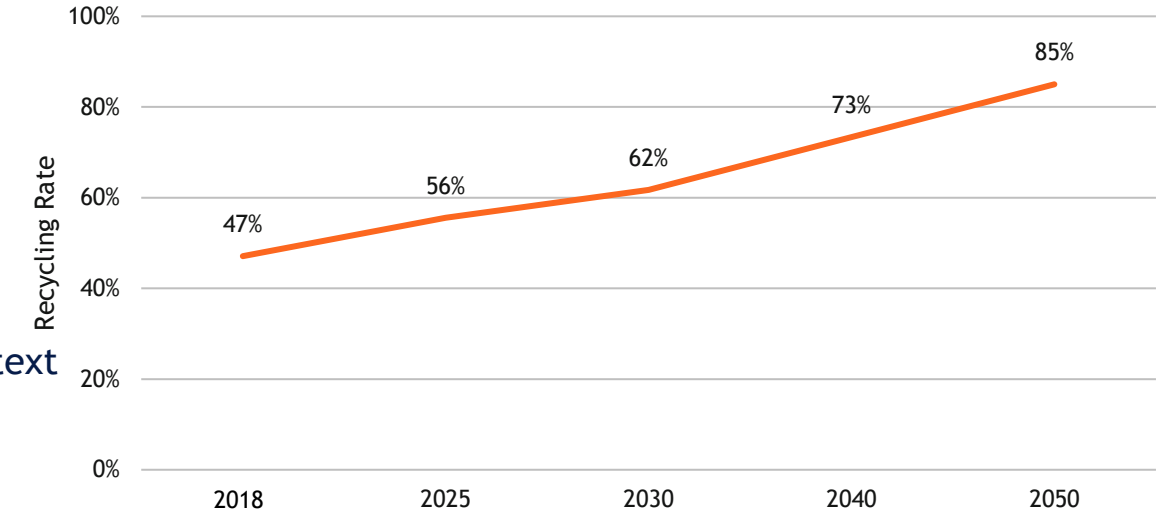


Figure 4.5.5: Growth in recycling rate across Manchester utilising a baseline recycling figure of 47% in 2018

Current Context	Target achieved by 2025
GMWDA outline that household recycling rate in 2017/18 was 47.1%. 18,270 fly tipping incidents recorded in the Manchester in 2019-20.	9% increase in the recycling rate

Table 4.5.2: Current context and target to be achieved by 2025 for increasing recycling rates in Manchester.

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
INTERVENTION MILESTONES

5.3 Shift away from fossil fuels and reduce industrial process emissions

a) Shift away from fossil fuels

This intervention considers changes to the energy consumption in industrial processes, with the trajectories focused on the electrification of industry and the transition away from carbon-intensive fuels. For the chemicals, metals and minerals industries, SCATTER models the changing use of fuels for these processes, shifting off the most high-carbon fuels (i.e., fuel oil) in favour of transition fuels such as natural gas and electricity. Progress to date indicates that in the UK, 35% of energy consumed by the industrial sector in 2019 was electric.

The Our Manchester Industrial Strategy outlines the development of low carbon technology and clean growth as a priority for industry across the region. Working collectively with the GMCA and the Greater Manchester Local Enterprise Partnership (GMLEP), Manchester City Council can support businesses with accessing regional and national funding for low to zero carbon product and process development for industry.

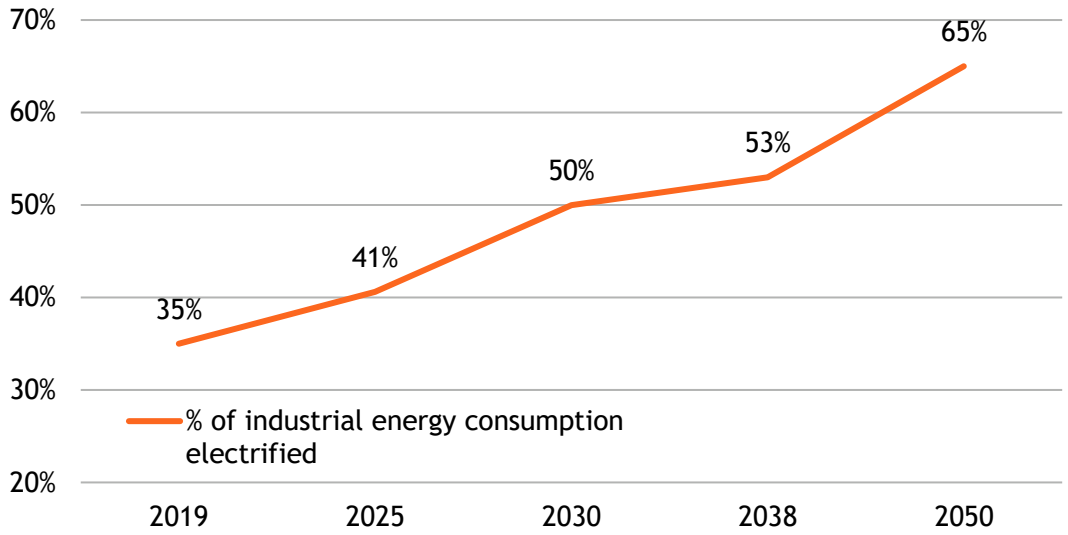


Figure 4.5.6: Modelled changes in fuel consumption for industrial processes and activities

Current Context	Target achieved by 2025
In the UK, 35% of energy consumed by the industrial sector in 2019 was electric.	• Electricity consumption is 40% of total industrial energy consumption by 2025

Table 4.5.3: Current context and targets to be achieved by 2025 for shifting away from fossil fuel-based technology in Manchester.

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
INTERVENTION MILESTONES

b) Reduce industrial process emissions

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

Separate trajectories are included for chemical, metal and mineral sectors, with all other industrial activity grouped together (labelled as "other" industry.

Manchester City Council and MCCA can ensure that the council has a programme in place for supporting efficiency improvements within local industry. Across the city, businesses need to review procurement policies and ensure products and services are sourced with a view of reducing overall supply chain emissions. Following this, businesses can identify areas where efficiencies in production can be improved, such as the adoption of a circular economy model.

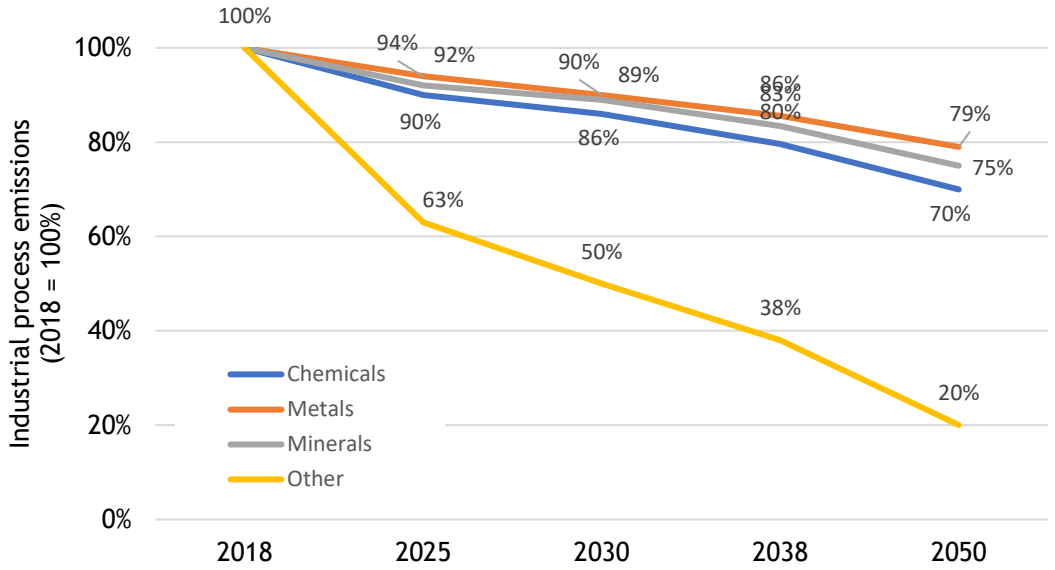


Figure 4.5.7: Modelled changes in fuel consumption for industrial processes and activities

Current Context	Target achieved by 2025
Industrial carbon emissions in the UK including those from energy-intensive industries have halved since 1990, which has mainly been due to efficiency gains, fuel switching, a change to industrial structure of the UK and re-location of production overseas.	Process emissions reduced: • 10% for chemicals • 6% for metals • 8% for minerals • 37% other industries

Table 4.5.4: Current context and targets to be achieved by 2025 for more efficient processes in Manchester.

4.5 SUB-OBJECTIVES: THE THINGS WE BUY AND THROW AWAY
CASE STUDIES

C40 Case Studies

Houston: The City of Houston Building Materials Reuse Warehouse works with a network of local community organisations working to keep reusable building materials out of the landfills and to put them into the hands of those that can use them. As of November 2018, the program has diverted 4,500 tonnes of material from landfill. The Reuse Warehouse has given away 90% of diverted construction materials to over 700 non-profit organisations, schools, universities, and government agencies.

New York City: The NYC Department of Sanitation offered organic collection service to New Yorkers and converted more than 46,000 tonnes of food and yard waste into compost and renewable energy over one year. DSNY's textile and electronic waste recycling programs supported the diversion of 5,000 tonnes of electronics and 2,500 tonnes of textiles from landfill over 12 months until June 2020.

Click to add text

Paris: As part of the implementation of the Paris Zero Waste Strategy, Paris has developed initiatives including increased collection of bio-waste, city-wide resources to teach repair skills and 30,000 new public recycling bins. Since the adoption of the zero-waste strategy, 80,000 tonnes of waste have been reduced.

National Case Studies

London: The city is aiming to be zero waste. By 2026 no biodegradable or recyclable waste will be sent to landfill and by 2030 65 per cent of London's municipal waste will be recycled. As part of this target, the city has set up a London Waste and Recycling Board which will oversee funding and lobbying.

Manchester Case Studies

One Manchester uses a place-based approach to deliver change in communities. They have previously run innovation competitions in the region and are now investing in the growth of two locally based social enterprises, developing a wood and textile recycling business.

Manchester Repair Cafes run approximately once a month across Greater Manchester where volunteers help to repair items and teach new skills. Stitched up are a not-for-profit that run workshops and events in Greater Manchester.

Plastic Shed is a Community Benefit Society based in Stockport. They run plastic recycling workshops, produce recycled products and provide drop-in sessions for people who want to repurpose their plastic waste.

Want not Waste is a University of Manchester student-led initiative. They operate a zero-waste shop, deliver workshops and upcycling afternoons, run a waste reduction blog and host teracycle stations.

Three Renew Shops have opened across Manchester in partnership between GMCA and SUEZ selling household items donated by residents at local household waste recycling centres.

4.6 Green Infrastructure & Nature-based solutions

Sub-Objectives

Anthesis

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

CURRENT CONTEXT

Scope of Section

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

The net contribution of emissions from the natural environment to Manchester's overall emissions total is zero, however, 0.1% of the borough's emissions come from livestock and 0.1% of total emissions are sequestered, giving a net emissions total from the natural environment of 0%.

Key Emissions Sources

The urban nature of the city means that emissions from the natural environment are relatively low. Under the Tree Action MCR programme, Manchester City Council is committing over £1 million to plant thousands of trees across the city wards.[1] Following a mapping exercise, the city wards with the fewest existing trees will be targeted first.[1]

Green Infrastructure and Nature-based solutions Sub-Objectives
6.1 Increase tree coverage and tree planting
6.2 Land use management

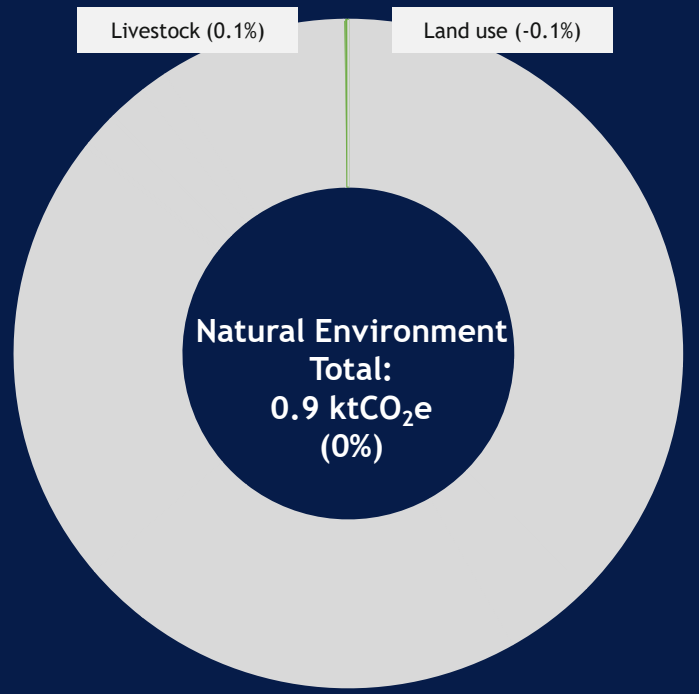


Figure 4.6.1: Emissions from natural environments in Manchester

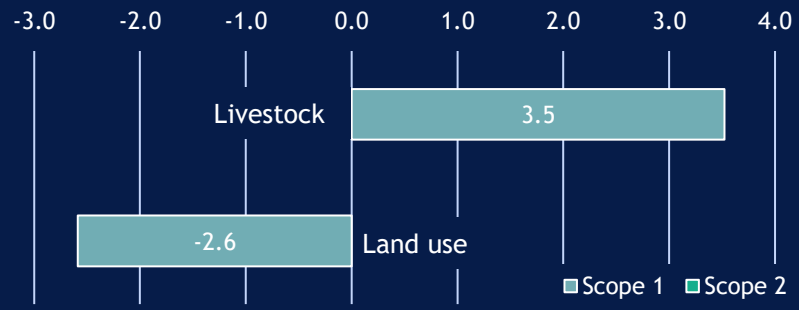


Figure 4.6.2: Emissions sources broken down by scope relating to the natural environment

[1] Manchester million-pound tree planting project

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

POLICY AND PLANS

National UK Policy

- The 25 Year Environment Plan includes commitments to create new forests/woodlands, incentivise tree planting, explore innovative finance; and increase protection of existing trees
- Land use: Policies for a Net Zero UK (2020) includes converting 22% of agricultural land (mostly from livestock) to forestry
- Woodland Trust Emergency Tree Plan recommends Local Authorities write an Emergency Tree Plan and set targets for tree planting.

Greater Manchester Combined Authority

- Places for Everyone: Enhancement of Biodiversity and Geodiversity is a joint development plan which will maximise the use of brownfield land and urban spaces while protecting Green Belt land from the risk of unplanned development.
- The Five-Year Environment Plan for Greater Manchester 2019-2024 outlines the five key aims for the region which include to protect, maintain and enhance the natural environment and achieving environmental net gain.

Manchester City Council

- Our Rivers, Our City includes plans to assess the functionality of local rivers and streams.
- Manchester Biodiversity Strategy (Developed In Local Context) details the habitats and species in Manchester and determines the factors that can cause loss of their biodiversity.
- Grow Green & Ignition Manchester City is part of the collective funded by the EU Horizon 2020 programme for Research and Innovation to create climate and water resilient, healthy, and liveable cities by investing in nature-based solutions.
- Tree Action Plan 2016-2020 encouraged and facilitated projects to manage and protect trees.
- Green and Blue Infrastructure Strategy & Action Plan states that by 2025, the city's communities will have access to parks and greens paces and safe green routes for walking, cycling and exercise throughout the city.

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

SUMMARY TARGETS

The use of green spaces and natural environments has a significant role in acting as a carbon “sink” – meaning that it removes carbon from the atmosphere in the form of trees, soil or other natural features. The natural capital interventions included in the SCATTER tool are not intended as offsetting measures but rather to increase potential in line with national tree cover goals.

Sub-Objective	2025 Indicator (Higher Ambition)
6.1 Increase tree coverage and tree planting: Considers the increase in the proportion of land which is forest cover. Tree planting considers the changes to the coverage of trees outside of woodland, through new trees being planted and maintenance of existing trees.	**Tree planting outside of woodlands increases by over 15% from 2019, equivalent to over 920 hectares**
6.2 Land use management: Considers changes to the green belt, grassland and cropland coverage.	**Maintain existing green spaces**

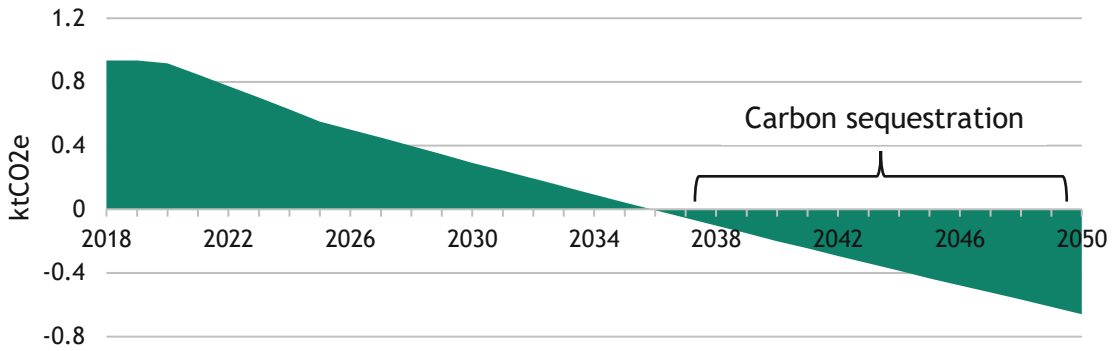


Figure 4.6.3: SCATTER Higher Ambition Pathway for green infrastructure & nature-based solutions.

C40 Guidance & Example

Several C40 cities have signed the Urban Nature Declaration which pledges to attribute **green** or permeable **spaces** a **30-40%** of the total **built-up** city surface **area**. Cities will also ensure that 70% of the city population can **access green** or blue public spaces within a **15-minute walk or bike ride, by 2030.**
As part of Milan's Resilience Strategy the city plans to introduce ca **3 million trees** in the city and its peripheral areas **by 2030.**

National Targets

- 7,000 hectares of new woodlands to be planted per year by **2024.**
- 30,000 hectares of trees to be planted per year by **2024.**
- The UK government plans to introduce a legally binding target for biodiversity for England.

GMCA Targets

- Plant one million trees by **2024.**
- Achieve a net gain in biodiversity for new development by **2040.**

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

CURRENT CONTEXT & TARGETS FOR 2025

The table below provides a summary of current context and minimum targets for 2025 across each of the things we buy and throw away sub-objectives. The following targets are expected to be achieved by 2025 in order to meet the SCATTER Higher Ambition pathway.

Sub-Objective	Current Context	2025 Indicator (Higher Ambition)
6.1 Increase tree coverage and tree planting	• Trees currently cover 5% of Manchester City Centre, whereas city-wide there is an estimated 20% coverage[1] • Tree planting outside woodlands is currently reported at around 800 hectares across Manchester[2]	• Tree planting outside of woodlands increases by 15% from 2019, equivalent to 920 hectares.
6.2 Land use management	• In 2018, there was approximately 64.4 ha of rough grassland in Manchester, equating to 0.6% of total land area[3]	• Maintain existing green spaces.

[1] Manchester Tree Action Plan 2016-20
[2] Per SCATTER analysis
[3] Ministry of Housing, Communities and Local Government - Land Use

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

INTERVENTION MILESTONES

6.1 Increase tree coverage & tree planting

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

Lone trees instead relate to smaller wooded areas, hedgerows, trees contained within gardens and so on. The sequestration potential of carbon dioxide per ha of trees is based on academic research, which stipulates that for a tree whose canopy coverage extends to 25m^2, the lifetime uptake of carbon is around 750kgCO_2.

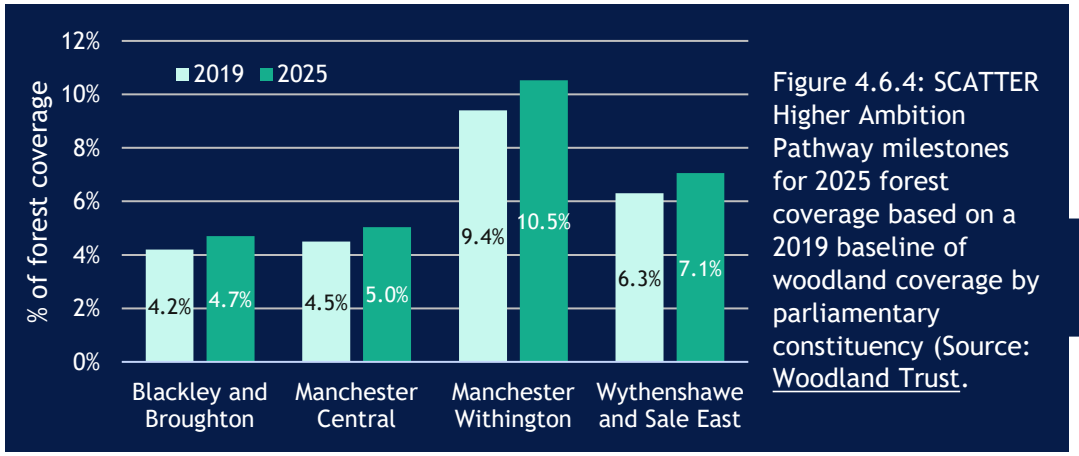


Figure 4.6.4: SCATTER Higher Ambition Pathway milestones for 2025 forest coverage based on a 2019 baseline of woodland coverage by parliamentary constituency (Source: Woodland Trust.

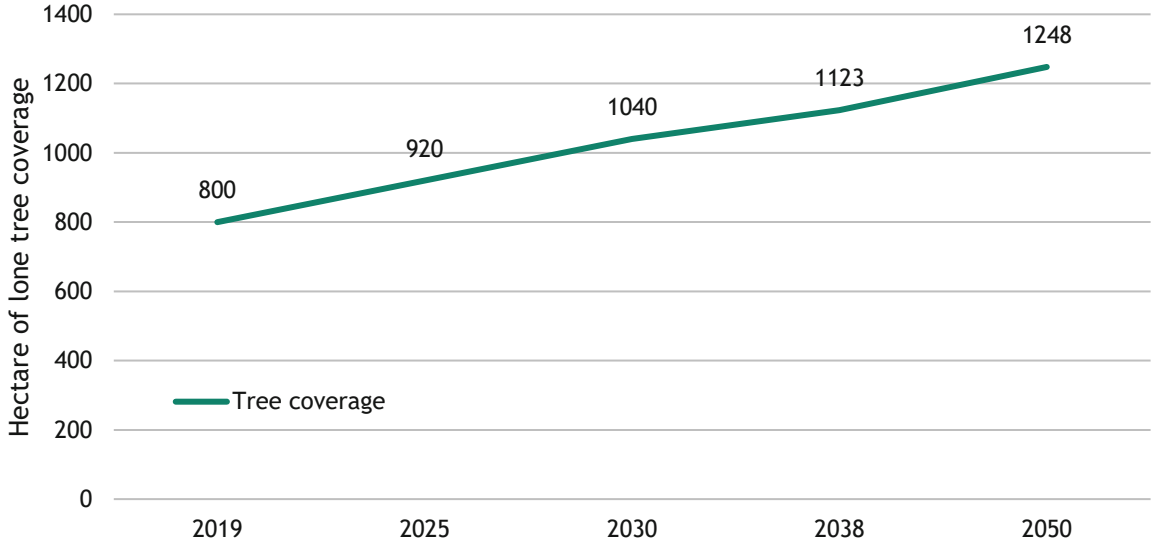


Figure 4.6.5: SCATTER Higher Ambition Pathway milestones for tree planting outside of woodlands (including lone trees, hedges and small woodlands).

Current Context	Target achieved by 2025
Trees currently cover 5% of Manchester City Centre, whereas city-wide there is an estimated 20% coverage. Tree planting outside woodlands is currently reported at around 800 hectares across Manchester.	Tree planting outside of woodlands increases by 15% from 2019, equivalent to 920 hectares

Table 4.6.1: Current context and targets to be achieved by 2025 for tree coverage & tree planting in Manchester.

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

INTERVENTION MILESTONES

6.2 Land use management

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

Manchester's Green and Blue Infrastructure Strategy highlights the importance of green spaces in the city centre, with most residents currently having access to an area of natural or semi-natural greenspace over two hectares in size within half a mile of their homes. Green spaces are becoming increasingly important across the city, especially as housing development density increases, and they host a number of co-benefits in relation to health and wellbeing.

Current Context	Target achieved by 2025
In 2018, there was approximately 64.4 ha of rough grassland in Manchester, equating to 0.6% of total land area·	Maintaining existing green spaces

Table 4.6.2: Current context and targets to be achieved by 2025 for land use management in Manchester.

4.6 SUB-OBJECTIVES: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

CASE STUDIES

C40 Case Studies

Milan: The vertical forest in Milan consists of two towers with ”living” facades. In total, the vertical forest consists of 800 trees and thousands of plants which filter sunlight, act as carbon sequestrators, reduce the buildings’ energy demands and attract fauna. The vegetation is equivalent to 30,000m^2 of woodland.

Copenhagen: Copenhagen Strategic Flood Masterplan is a strategy that aims to retain rainwater in the upper catchment, to provide drainage for lower lying areas and to implement green and blue solutions in existing projects.

Toronto: Toronto has developed an Urban Forests Grants and Incentives programme to plant over 13,000 trees and achieve the city’s 40% canopy cover target. Programmes are tailored for different stakeholders, such as the Corporate Tree Planting programme and the Backyard Tree Planting Programme, and include technical support as well as funding.

National Case Studies

London: London's Living Roofs and Walls policy, after 10 years of implementation has reached the desirable results in 2019, as 1.5 million m^2 of London’s roofs have turned into green roofs.

Liverpool: Investment in green space is a key focus of Liverpool’s climate strategy. The city participating in a European project looking at the links between nature-based solutions and mitigation.

Manchester Case Studies

My wild city is a 4-year project aiming for the development of a biodiversity strategy for Manchester. After a 1-year public consultation an action plan was developed with the key goals being: creation of engagement with nature, development of collaboration opportunities to support the actions and improving the natural spaces.

City of Trees is a movement with the aim to introduce Green Infrastructure solutions into Greater Manchester. The project’s objectives include planting of 3 million trees within 5 years, restoring 2,000 hectares of unmanaged woodland back into community and engaging people.

The Ignition project aims to develop innovative ways to finance natural solutions to improve Greater Manchester’s resilience. The main goal is to increase the urban Green Infrastructure coverage by 10% by 2038 from a 2018 baseline.

Mayfield Park – Manchester’s first city centre public park is part of the proposed urban development of the Mayfield site. This will include 6.5 acres of green space.

5. Engaging and Empowering Others

Who needs to be involved?

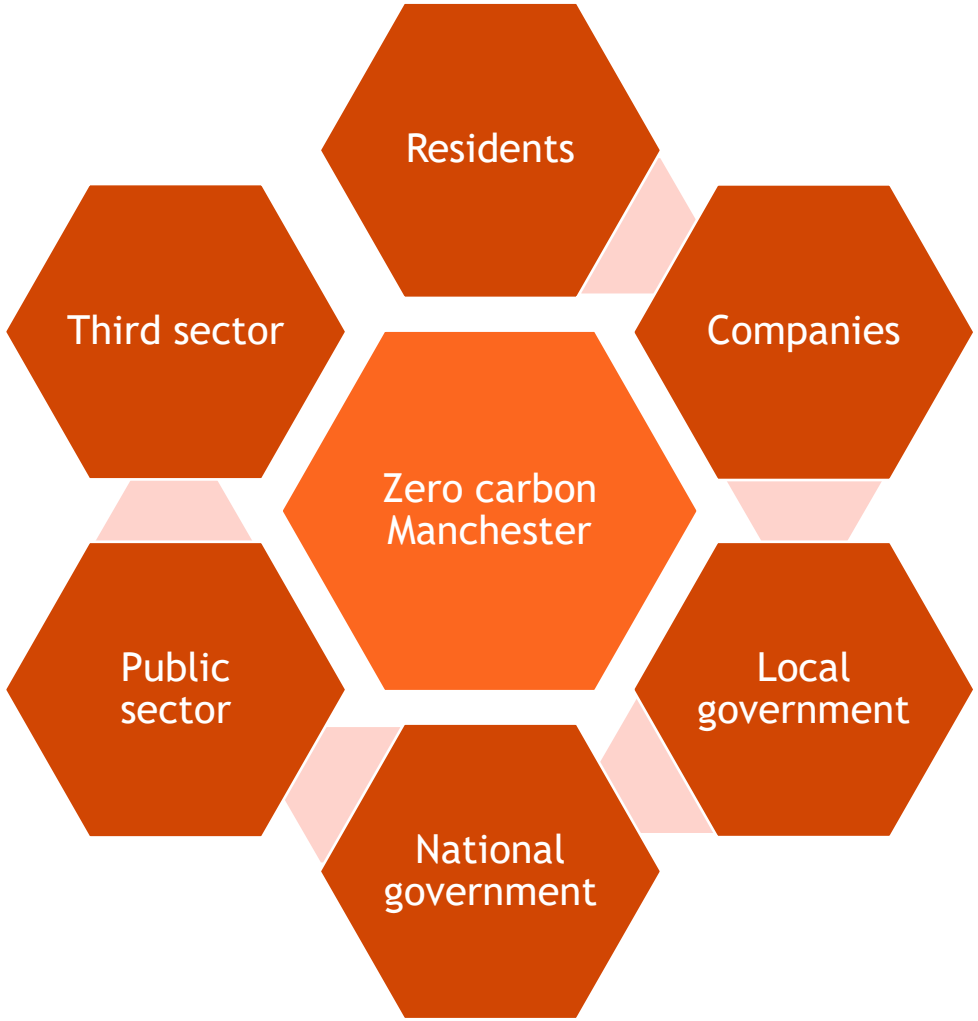
5. ENGAGING AND EMPOWERING OTHERS
IMPORTANCE OF COLLABORATION

Everyone will need to play their part

In order to create a city that is inclusive, healthy, sustainable and prosperous, every resident, business, and organisation in Manchester will need shift their actions and behaviour in order to meet our shared vision of being zero carbon by 2038.

Every organisation will need to consider how they can contribute to Manchester's goal in their daily lives. This will not be easy and there are challenges in order to make the changes necessary to meet our targets.

The following section lays out the actions residents and companies can specifically take to help Manchester, while also recognizing there are barriers which they each face in implementing climate actions. There is support available for residents and companies to go further faster, however Manchester City Council and Manchester Climate Change Agency recognise that more will need to be done to help enable change to occur at a local level.



5.1 Residents

Anthesis

5.1 ENGAGING AND EMPOWERING OTHERS: RESIDENTS

ROLE OF RESIDENTS

Residents play an important part in helping to achieve Manchester's 2025 target and long-term targets.

- **Behaviour change:** Citizens can make changes in how they live and move which can help reduce emissions.
- **Reducing consumption:** Where residents chose to spend their money can help signal to the market an increase demand for more sustainable products.
- **Community engagement:** Residents can help shape and create neighborhoods that meet their daily needs close to home.
- **Encourage change:** Residents have a powerful voice to call for change from their employers, companies, local and national governments.
- **Spread the word:** By talking about climate change with others, residents in Manchester can help create the dialogue and encourage others to also act.

> *"Reaching Net Zero will require more involvement from people in engaging with the emissions reductions required, and reducing or adapting demand for energy-intensive services"*
>
> - Committee on Climate Change, Sixth Carbon Budget

5.1 ENGAGING AND EMPOWERING OTHERS: RESIDENTS
ENABLERS AND BARRIERS FOR RESIDENTS

There is an increasing awareness amongst individuals and communities on the climate emergency and a desire for individuals to play their part in delivering carbon reductions. People face a number of enablers which support them to act however there are still several barriers which prevent further action. This research has been carried out in conjunction with the resident's survey to gather local context alongside wider research.

Enablers

General awareness: There is growing public engagement on climate change issues and increasing awareness about the need to make changes. A recent poll by the UN Development Programme found that two-thirds of people across the world said climate change is a global emergency, with that increasing to over 80% in the UK. There is also continuing media coverage of climate change in newspapers and on social media and TV. In addition, climate strikes across Manchester by groups such as Youth Strike 4 Climate have helped to raise awareness of the issue.

Access to greener products: There is a growing availability of more eco-friendly products and services available on the market for consumers to choose. For example, the number of trademarks for new vegan food reached a record high last year. There are also affordable changes for consumers to make such as switching to LED bulbs which have a short payback period. However, there are also times where a lack of accessible products and services acts as a barrier.

Data and ICT: A Committee on Climate Change Report into Behaviour Change, Public Engagement and Net Zero highlighted the importance of data and ICT as enabling behaviour change. This could enable consumers to make more informed decisions about technologies and provide product information. However, this can act as a barrier where data and information are lacking for certain communities.

Barriers

Technical Awareness: Despite the increased general awareness of climate change, knowledge of the changes that need to be made has been cited as a barrier. For instance, a lack of information was cited as barrier to selecting more ethical brands.

Lifestyle: Another barrier to reducing an individual's carbon footprint is the time required and ease of acting in everyday life. Things like current obligations, family and routine can prevent people from doing more. However, lifestyle changes such as more working from home following the COVID-19 lockdown may continue.

Budget: The cost of making changes is often cited as a key barrier. For example, renewable energy products and locally produced items are perceived as too expensive.

Policy: Local, regional and national policies can act as a barrier if regulations do not support individuals to act. Knowing how to change or influence local or national policy can prevent individuals from making change.

Physical: Physical limitations such as a lack of infrastructure and facilities or access to a technology can also prevent individual action.

Social: This includes barriers such as buy-in from the community and culture change. This could also relate to a perceived lack of influence and the belief that individual action will not make an impact.

5.1 ENGAGING AND EMPOWERING OTHERS: RESIDENTS
SUPPORT FOR RESIDENTS

Work to Date

Manchester Climate Change Agency and Manchester City Council have already conducted engagement with residents on climate change and produced a number of resources to help local residents get involved. These resources should be built upon and can be used to support resident actions.

Commonplace: In Our Nature

In Our Nature is an online collaboration platform for Manchester residents. The aim of the site is to support residents to work together to find new and creative ways to make Manchester a greener, healthier and more connected city. The site includes practical tips on reducing impacts, information of community initiatives and opportunities for residents to get involved and have their say.

Existing surveys

A number of community surveys have recently been conducted to gather sector specific insights and information on attitudes to climate change. These surveys have been used to inform the resident consultation and actions. They include:

- Youth Survey; Voluntary Sector Survey; MCCA Resident and Community Survey; Ignition Survey; Engagement of youth and play providers; Manchester Zero Carbon Campaign; CVS Climate Crisis Survey

Carbon Literacy

Carbon Literacy Training involves supporting businesses, residents and communities to learn about climate change science, context and action. The training was founded in Manchester and was recognized at COP21 as one of 100 Transformative Action Programs.

Actions Guidance

- The existing actions developed for Manchester Residents and Businesses (15 Actions to become a zero carbon city) focus on key action areas and include links to local resources.
- The city has also published guidance on commonplace (see opposite), called Tips for Change which provides further resources on reducing impacts.
- The GMCA 5-year Environment Plan also designates actions for residents to help achieve the city-region's targets.
- There are other resources available on ways for individuals to reduce their footprint including: Count us in campaign; WWF things you can do; Grantham Institute - 9 things you can do about climate change; Friends of the Earth - What can I do to stop climate change?

Ward Engagement

Engagement and resources specifically aimed at wards in Manchester are being developed to support action at a community scale. This includes climate change summits and support for the creation of climate change action plans for the wards.

Community Assembly

The Community Assembly has taken place across August and September to support residents in Manchester to take action on climate change. The assembly was made up of representatives from across Manchester who, over a seven-week period, heard from experts and discussed issues such as transport, energy, food and agriculture and fashion. The group will now work together to turn this into a manifesto outlining what action should be taken, which will be presented to Manchester City Council and brought to COP26.

5.1 ENGAGING AND EMPOWERING OTHERS: RESIDENTS
ACTIONS FOR RESIDENTS

A series of possible actions for residents have been developed by MCCA following a review of existing resources and guidance. To ensure a link into the implementation plan, the resident actions have been categorised in line with the six thematic areas in the framework. It is recognised that not all residents will be able to carry out all of the actions but these represent some of the commonly cited actions.

Buildings

- Install a new more efficient boiler
- Insulate your home's loft space and walls (cavity walls)
- Install exterior wall insulation and cladding
- Install renewable technology to heat your home (Air Source Heat Pump/ Ground Source Heat Pump)

Renewable energy

- Switch to a renewable energy supplier
- Install solar panels to generate electricity
- Install solar panels to heat water

Transport

- Drive less and cycle or walk more
- Join a car sharing scheme
- Work from home more and commute less
- Invest in an electric vehicle or hybrid car
- Loan a car when I really need to drive
- Choose not to fly as often

Food

- Eat less meat and dairy products
- Buy more food in season in the UK
- Buy locally sourced foods where available
- Try not to waste food
- Eat more plant-based foods
- Become a vegetarian
- Become a vegan

Things we buy and throw away

- Recycle waste
- Buy less stuff less often
- Buy fewer clothes and make them last longer
- Buy eco and/or ethical brands
- Repair things when needed
- Avoid single-use plastic
- Use an ethical bank

Green infrastructure and nature-based solutions

- Make a home for nature by planting for bees and wildlife
- Grow plants and food and left green spaces
- Protect existing green spaces
- Get involved in national nature or wildlife campaigns, like City of Trees, RSPB or National Trust
- Get involved in local campaigns like In Our Nature

Engaging and Empowering others

- Talk to others about climate change and ask what we can all do
- Ask your local councillor and/or politician what they are doing
- Learn about the climate emergency
- Join a national or local campaign group

Other possible actions not listed:

- Invest in energy efficient appliances
- Get a smart meter
- Reduce demand for heating and electricity

5.1 ENGAGING AND EMPOWERING OTHERS: RESIDENTS
SURVEY RESULTS

A survey for residents to provide input into the development of Framework 2 and provide insight on resident led actions was launched from September to October. **Part 1** of the survey asked about existing actions:

Buildings

28%
of people responding had insulated their home

19%
of people responding had put in a new gas boiler

Renewable energy

60%
of people responding had switched to renewable energy

6%
of people responding had installed solar panels

Transport

62%
of people responding drive less and cycle/walk more

52%
of people responding work from home more

6%
of people responding use an EV or hybrid

41%
of people responding choose to fly less

11%
of people responding loan a car when needed or have no car

Things we buy and throw away

73%
of people responding recycle their waste

58%
of people responding buy fewer clothes

47%
of people responding repair things when needed

46%
of people responding avoid single use plastics

43%
of people responding buy eco/ethical brands

20%
of people responding use an ethical bank

Food

72%
of people responding try not to waste food

45%
of people responding buy locally sourced

53%, 44% and 28%
of people responding eat less meat and dairy, eat more plant-based diets and are vegetarian or vegan

Green infrastructure and nature-based solutions

51%
of people responding grow plants, food and leave green spaces

47%
of people responding make a home for nature

33% and 23%
of people responding are involved in national and local nature/wildlife campaigns respectively

Engaging and Empowering others

66%
of people responding had learnt about the climate emergency

60% and 21%
of people responding had talked to others about climate change and contacted their councillor

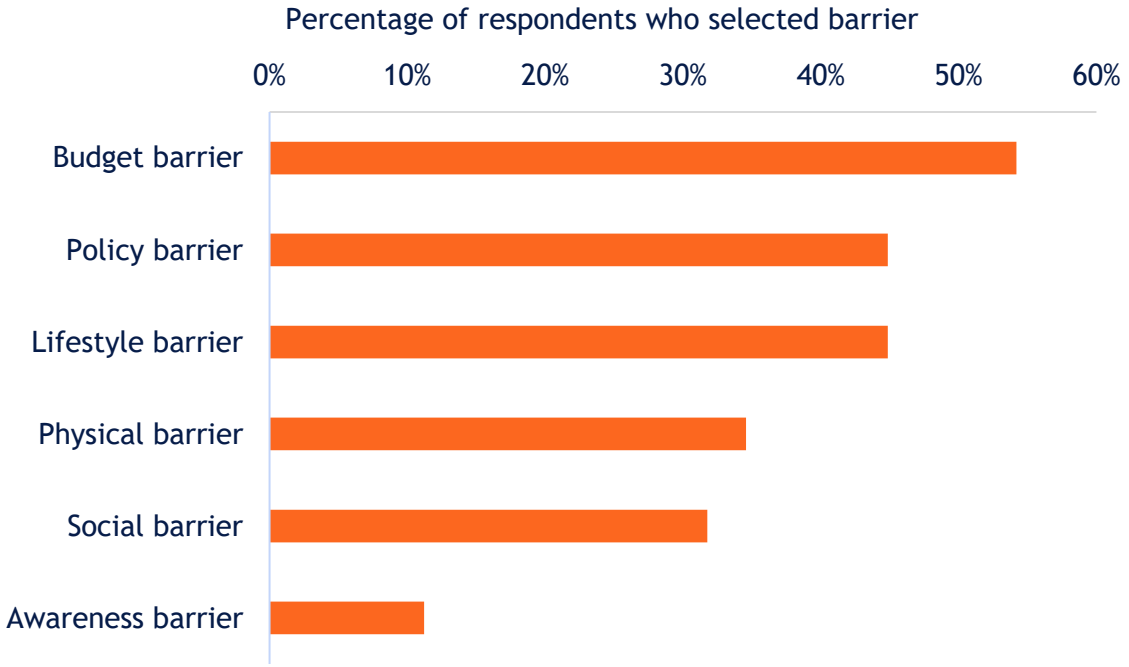
5.1 ENGAGING AND EMPOWERING OTHERS: RESIDENTS
SURVEY RESULTS

Part 2 - The second part of the survey focused on gathering information on barriers and additional support required by residents in order to inform the implementation plan (see Chapter 6).

56%
of people responding were positive when asked their opinion on the city's 2025 target.

84%
of people responding were worried about the effect of climate change on their home, work or family

57%
of people responding were worried about the future impact of climate change in their local area

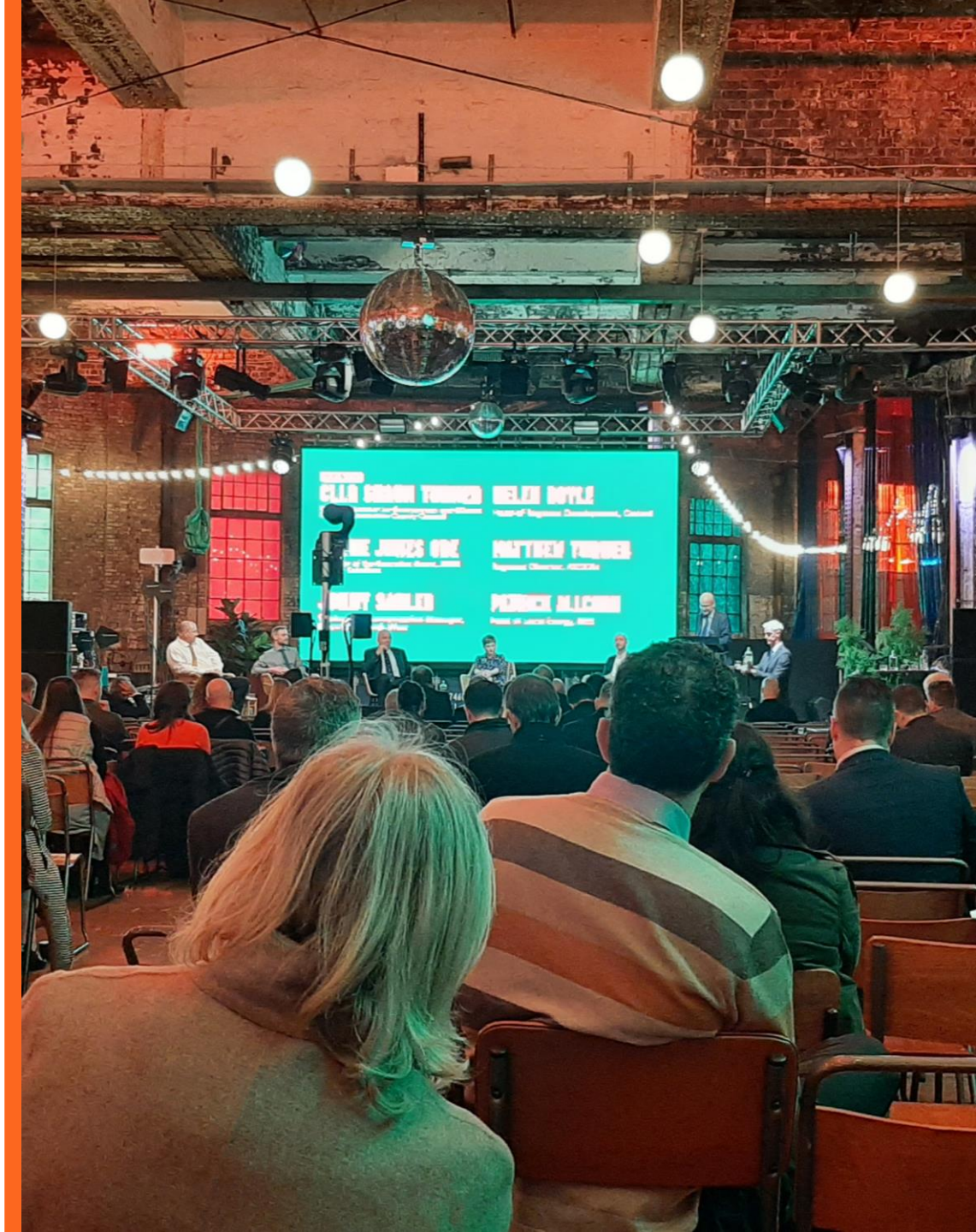


Key Results

Respondents also provided comments on what more support they need to act on climate change. A range of comments were provided related to different sectors.

- The most common sector comments were related to was Transport on issues around active travel and public transport infrastructure as well as access and costs of this. EV cost and charging was also mentioned.
- There were several general comments left in regard to leadership, involvement of businesses and education. Several people left comments on greater financial support for making changes.
- The building sector had several comments in particular around those in flats or rented accommodation facing barriers in improving the building. Finance and skills were also referenced in a number of responses.
- Other areas of support mentioned including around recycling options, access to locally grown food and protection and access to green spaces.

5.2 Businesses



Anthesis

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES

THE ROLE OF BUSINESSES

Businesses have a big role to play in helping Manchester reach its target to rapidly decarbonise and be a zero-carbon city by 2038.

- **Scale of emissions reduction potential**: Companies can enact emissions reduction activities which will not only reduce their own emissions, but also support Manchester as a city to reduce its emissions.
- **Innovation**: Businesses can trial new technologies and business models. By investing in innovative solutions, we can test new models and work to scale them across the city.
- **Influence customers, clients and employees**: Companies can influence behaviour change among the people and networks they engage to encourage others to act.
- **Influence supply chain**: Using their purchasing power, companies can influence their local and global supply chains to take meaningful climate action by reducing emissions within their supply chain and increase resilience.
- **Develop local solutions**: Companies can provide new solutions to local issues. Companies can invest and create new products and services that serve the local community.
- **Create local jobs**: Companies who tackle climate change will be more resilient to future changes in the market. There is also opportunity to create new inclusive, local jobs for the future.

Manchester Climate Change Partnership

Established in February 2019, the Partnership brings together organisations from the city's public, private, community, faith, education and academic sectors that share the common goal to achieve the ambitious objectives and targets set out in the Manchester Climate Change Framework 2020-25. Members of the partnership will:

1) Take urgent action within the scope of their own activities, and
2) Work collaboratively through the Partnership to help others in the wider Manchester community

Zero Carbon Business Programme

Manchester is participating in the City-Business Climate Alliance (CBCA) initiative from C40, CDP and the World Business Council for Sustainable Development.

Through this initiative, Manchester aims to launch a new Zero Carbon Business Programme to support Manchester-based businesses to take the necessary actions to reduce their emissions to net zero.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
ENABLERS AND BARRIERS FOR COMPANIES TO ACT

Companies are increasingly becoming aware of the impacts of climate change and the importance of taking action. A survey by the British Chamber of Commerce and Drax reported that 68% of respondents found COVID-19 and lockdown restrictions have made them more environmentally conscious. Companies are being driven to change by investor demand, the changing policy landscape, leadership and consumer demand. However, to meet the challenge of reaching net zero companies still struggle. Across the UK and globally companies share similar challenges such as financial, technical, policy uncertainty, and struggle to deliver.

Enablers

Investor demand: Large investors such as BlackRock and Aviva have stated that they will divest from companies who do not align with climate science. Initiatives such as the Net Zero Asset Manager Initiative, demonstrates the increasing pressure of investors on companies to align with net zero. Investors are increasingly asking for companies to integrate ESG considerations into the management of their assets.

Policy landscape: From 2023, all publicly listed UK companies with a premium listing will be required to comply with the Taskforce for Climate-related Financial Disclosure requirements. With more policy changes and direction as outlined in the new Net Zero Strategy, companies will look to align with national government.

Leadership: Over 2,000 companies have now set a science-based target, with over 200 companies in the UK having set a target. It has also been found that companies who make public commitments are more driven by brand awareness and environmental concerns than companies with no public commitment. Companies that have strong climate targets can have a competitive advantage in recruitment and retention.

Consumer demand: In a UK government study 83% of participants said climate change was a concern. Another study showed that climate change is now in the top three issues which consumers expect business to take action on (up from 17th in 2018). In addition, a key driver for almost a third of consumers, was ethical and sustainability issues which impacted their purchasing decisions.

Barriers

Lack of finance: Companies struggle to access the finance needed to implement emissions reductions. The British Chamber of Commerce found that lack of finance was one of the top barriers to act on climate.

Technical understanding: A survey by British Chamber of Commerce found that only 11% of firms were measuring their climate footprint. Without understanding their emissions companies struggle to act and understand where to prioritise their investments and reduction strategies.

Policy uncertainty: Companies need clear regulation and a stable policy environment to help drive innovation and the growth of new markets. When policy changes and creates uncertainty, companies struggle to navigate how to best implement changes.

Delivery and skills: Companies need the right skills and talent to deliver emissions reductions which will be influenced by both supply and demand. The principles of a just transition will also be critical, as analysis has showed that approximately 28,000 jobs in the coal, oil and gas industries could be lost in England by 2030. However, as we start to decarbonise, more green jobs will be increase requiring reskilling a significant part of our workforce.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
SURVEY RESULTS: SMES

In September 2021, companies in Manchester had one month to respond to a survey asking about the climate actions they were taking, what enabled them to take action and what barriers they faced. Companies had the choice of two surveys to complete from, one for larger companies and one for SMEs. Below are the results of the survey for SMEs.

18
responses

13
companies said climate change is a priority for their company

14
companies have taken actions to reduce their energy use

11
companies have engaged or are in the process of engaging with their landlord on increasing the energy efficiency of their building(s)

17
companies encourage or are in the process of encouraging their clients/customers/employees to cycle, walk and use public transport

8
companies have or are in the process of switching some of their owned/leased passenger vehicles and/or vans to electric

14
companies currently or are in the progress of following circular economy principles

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
SURVEY RESULTS: LARGE COMPANIES

In September 2021, companies in Manchester had one month to respond to a survey asking about the climate actions they were taking, what enabled them to take action and what barriers they faced. Below are the results of the survey for large companies.

10 responses

6 companies said climate change is a priority for their company

5 companies are actively engaged in efforts to adapt to the impacts of climate change and become more resilient

6 companies are making capital investments aimed at reducing emissions

7 companies take environmental considerations into account when they buy or procure products and services

7 companies are considering sustainability in any new build construction

6 companies have a pipeline of energy efficiency projects

6 companies have switched to 100% renewable energy

6 companies encourage their clients/customers/employees to cycle, walk and use public transport

5 companies have or are in the process of switching some of their owned/leased passenger vehicles and/or vans to electric

2 companies are in the process of encouraging plant-based diets at work events and meetings

4 companies currently incorporating circular economy principles

6 companies have or are in the process of investing locally in nature based solutions

3 companies have a science based target

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES

SURVEY RESULTS: LARGE COMPANIES

Below are the top enablers and barriers identified by companies in Manchester who responded to the survey.

Sector	Top enablers	Top barriers
Change in governance and financial structures	• Customer/client demand • Leadership	• Financial constraints • Technology barriers
Educate customers/clients/employees	• Customer/client demand • Leadership	• Limited capacity • Financial constraints
Reduce emissions from buildings	• Cost considerations • Emerging technologies • Leadership • Value alignment	• Financial constraints • Technology barriers
Increase the use of renewable energy	• Customer/client demand	• Financial constraints
Reduce emissions from transport	• Leadership • Cost considerations • Emerging technologies • Value alignment	• Financial constraints • Technology barriers
Reduce emissions from food	• Cost considerations • Customer/client demand • Leadership • Value alignment	• Lack of customer/client demand
Reduce emissions from waste	• Leadership • Regulatory requirement	• Technology barriers • Limited capacity
Act to support nature	• Leadership • Value alignment	• Limited capacity
Top enablers and barriers identified by SMEs	• Customer/client demand • Leadership	• Financial constraints • Limited capacity

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
ACTIONS FOR COMPANIES

Companies play a key role in helping reduce emissions in Manchester. Companies will need to make significant changes to the way they operate and implement the most ambitious actions to support Manchester's target. Below are some actions companies can take to help meet Manchester's target.

Category	Action	Action type	Impact and Considerations
Buildings	Invest in energy efficiency projects in your buildings	Implementation	• The buildings sector is the largest emission source. Investing into a multiple energy efficiency projects will help Manchester reduce emissions.
	Install LED lighting	Implementation	• This is an easy cost-efficient measure companies can take to reduce carbon.
	Engage with your landlord and/or tenants on net zero	Communication & Engagement	• The ability of a company to make changes in their office or other physical space depends if they are the tenant or landlord. Engaging in these conversations can help increase demand for change.
	Use a building management system to increase efficiency	Implementation	• This action can help increase the efficiency and use of a building, and therefore contribute to the reduction of energy used.
	Ensure new build construction projects meet a carbon performance standard	Implementation	• As companies look to build and construct more buildings, there needs to be considerations into the environmental impacts and carbon cost.
	Carry out a whole-life-cycle carbon assessment (WLCA) on all projects using a consistent methodology	Implementation	• WLCA examine the carbon emissions of a building from construction, the use of the building, and its demolition and disposal. It is encouraged that the data obtained be made open-sourced for sharing.
	Collaborate with clients, suppliers and other actors across the built environment to drive net zero construction and renovations	Communication & Engagement	• Reducing emissions in the built environment requires collaboration across different stakeholders to be efficient and effective when implementing changes.
Education	Deliver carbon literacy training	Communication & Engagement	• While this action won't directly reduce emissions, it is important that people understand the concepts around climate change.
	Encourage and educate your customers, clients and employees to take action	Communication & Engagement	• Companies can access a diverse network of stakeholders to influence. By frequently engaging them on climate we can help encourage more of a dialogue on how to implement solutions.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
ACTIONS FOR COMPANIES

Category	Action	Action type	Impact and Considerations
Emissions & targets	Measure and report your CO_2 emissions	Policy & Strategy	• By regularly measuring your emissions, companies are better places to manage and strategically reduce them.
	Implement the recommendations of the Taskforce on Climate-related Financial Disclosures (TCFD)	Policy & Strategy	• Aligning to the TCFD is an effective way to link climate-related financial information across a global standard to help improve decision making and transparency.
	Set a science-based target	Policy & Strategy	• Setting a target in line with what science demands ensures businesses make their fair share contribution to limiting the impacts of climate change. To track and monitor progress companies should set short- and long-term targets.
	Set a science-based target for nature	Policy & Strategy	• Science based targets for nature enables companies to align their efforts with global nature-related sustainability efforts.
	Minimise the use of offsets	Policy & Strategy	• Companies should first reduce and avoid emissions before they look to offset their remaining emissions that are hard to tackle. Approaches to offsetting should be valid and transparent.
Governance & finance	Ensure climate change is addressed at the highest level of corporate leadership	Policy & Strategy	• Climate considerations need to be integrated and embedded at all levels in a company including leadership levels to ensure its importance is recognised and acted on.
	Consider ESG into all financial investments	Policy & Strategy	• Financial decisions need to support climate priorities to ensure that they are supported and implemented and not
	Encourage meaningful action within your supply chain	Communication & Engagement	• A company's supply chain often has a large carbon footprint than the companies' direct operations. It is important to engage your supply chain and ask that they lower their carbon footprint.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
ACTIONS FOR COMPANIES

Category	Action	Action type	Impact and Considerations
Green infrastructure & nature-based solutions	Invest in local nature-based solutions	Implementation	• Investing in nature-based solutions not only help protect the environment but also provide economic and social benefits.
	Actively promote the use and protection of local green spaces	Communication & Engagement	• By encouraging the use of green spaces, it can protect the environment and help improve the mental and physical health of your stakeholders.
Food	Encourage plant-based diets	Communication & Engagement	• By reducing meat and dairy consumption companies can help tackle deforestation and its impacts. Companies can also amplify and support the growing market of alternative proteins.
	Reduce and eliminate food waste	Implementation	• By reducing your company's food waste, there is a reduced pressure on land and water resources, results in a reduction of emissions and increases food availability.
	Amplify growing market for alternative sources of protein		• By supporting the production and consumption of plant-based foods companies can support the availability, access and affordability of alternatives.
Renewable energy	Switch to 100% renewable electricity	Implementation	• By switching your electricity to renewable energy through on-site generation or procurement, companies can support the transition to clean energy.
	Maximised the installation of renewable energy generation from solar thermal and PV	Implementation	• Manchester will need to increase the amount of installed renewable energy generation to meet its target. Companies can support this target by investing in renewable energy projects.
	Replace your gas boilers with heat pumps	Implementation	• Shifting off gas systems will significantly help reduce emissions in Manchester if companies take actions to help decarbonise their heat.
	Invest in renewable energy storage	Implementation	• Investing in storage solutions can help increase

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
ACTIONS FOR COMPANIES

Category	Action	Action type	Impact and Considerations
Things we buy & throw away	Separate recyclable materials for collection	Implementation	• Companies should focus on separating recyclable materials for collection and aim to make recycling as easy as possible for employees and customers. Companies can also educate on the waste hierarchy of refuse, reduce, reuse, recycle, rot and recovery.
	Adopt circular economy strategies	Implementation	• Circular economy policies aim at sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products.
	Reduce single-use plastics	Implementation	• Discourage the use of single-use plastics in the workplace such as plastic cutlery, disposable cups, sellotape, bubble wrap, plastic packaging etc.
	Educate and drive consumers and employees appetite for circular economy	Communication & Engagement	• Educate and encourage the use of life cycle thinking and encouraging the use of repaired and recycled products where possible.
Transport	Encourage clients, customers and employees to cycle, walk or use public transport	Communication & Engagement	• Companies can help reduce emissions in transportation in Manchester by providing incentives to clients, customers and employees to change how they travel.
	Embrace teleworking	Policy & Strategy	• For relevant companies, they should consider long-term agile working outside of the COVID-19 pandemic recovery.
	Develop and enforce a sustainable travel policy	Policy & Strategy	• A clear policy with recommendations for employees can provide guidance of a travel hierarchy and outline more sustainable low-carbon options for employees.
	Transition all corporate fleets including passenger vehicles and vans to electric	Implementation	• While the preference is still to reduce car travel, companies should support the adoption of EV vehicles to help reduce emissions.
	Provide opportunities for electric charging at the workplace	Implementation	• Consider locating new offices near public transport and/or with limited parking facilities. The parking that is available encourage the use of EV vehicles over non-EV vehicles.
	Discourage/reduce business aviation travel	Policy & Strategy	• Companies through their sustainable travel policy and other mechanisms can help reduce and limit their participation in aviation travel. Encourage virtual meetings or travelling by more sustainable options.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
LOCAL SUPPORT FOR COMPANIES

Below are organisations and projects in Manchester that can support companies take climate action.

Manchester Climate Change Partnership is made up of 60 members, across ten sectors, with responsibility for 20% of Manchester's direct CO_2 emissions. Its members also have reach into the remaining 80% through their staff, students, customers, tenants, football fans, theatre-goers, worshippers, and others.

Manchester City Council offers advice, support and grants for businesses in Manchester.

Bee Net Zero takes a collaborative approach to helping businesses on their journey to becoming net zero. Bringing together networks, organisations and support programmes from across Greater Manchester.

Electricity North West works with stakeholders to help pave the way for the growth of renewable energy. They have information and steps on how companies can reduce their energy bills and take action.

Greater Manchester Chamber of Commerce has over 4500 members, the Chamber of Commerce provides support to companies through networking opportunities, HR support and other varied services.

Greater Manchester Green Growth programme is run by the Growth Hub supports Manchester businesses to drive the transition to a vibrant, sustainable and low carbon economy. Support is provided to companies from on-site diagnostics, workshops and knowledge sharing.

Greater Manchester Local Enterprise Partnership (LEP) supports businesses to adapt to the changing demands. It helps to identify and develop the skills they need and contributes to an environment that attracts investors.

Groundwork have an extensive network of SME clients across Manchester across various sustainability service offerings.

Ignition is £4 million EU-funded project develops packages of climate resilience projects for commercial investment. The aim of this project is to increase the use of nature-based solutions in Greater Manchester.

Manchester Investment Development Agency Service (MIDAS) is an inward investment promotion agency for Manchester, with the aim to secure significant levels of new investment for the city region and to create and safeguard jobs.

Pro-Manchester Green Economy Group looks at ways organisations can become more sustainable and support this agenda. It also highlights opportunities for businesses operating in this sector.

Transport for Greater Manchester (TfGM) host a business travel port providing advice to companies on safer travel, rethinking the commute, business grants supporting cycling and walking, flexible public transport tickets and journey planning.

Manchester is participating in the City Business Climate Alliance (CBCA) initiative from C40 Cities, CDP and World Business Council for Sustainable Development. Through this initiative, Manchester aims to launch its Zero Carbon Business Programme to support Manchester-based businesses to take the necessary actions to reduce their emissions to net zero.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
NATIONAL SUPPORT FOR COMPANIES

Below are organisations and projects in the United Kingdom that can support companies take climate action.

BEIS Finance and Support Finder allows you to view and search for grants that are available to companies.

Business in the Community (BITC) supports their members through guidance, resources and events. They support business to set targets, develop inclusive action plans with employees, suppliers and community stakeholders.

British Chamber of Commerce has developed a Net Zero Hub with tools and resources to help companies achieve net zero.

Energy Technology List is a government list updated by BEIS, which provides details of energy-saving products for businesses and the public sector.

Federation of Small Businesses provides support to small businesses with services including advice, financial expertise, support and provide a collective voice to government.

Grants Online allows you to search for grants and funding opportunities.

Innovate UK is part of UK Research and Innovation. They drive productivity and economic growth by supporting businesses to develop and realise the potential of new ideas, including those from the UK's research base.

National Energy Foundation has a tool allows you to find companies who specialize in renewable energy technology in your area.

Office for Zero Emission Vehicles provides guidance, policy and funding information for the transition to electric vehicles.

UK Business Climate Hub is for small businesses in the UK to commit to taking climate action and access different tools and initiatives. This is part of the SME Climate Hub, a global commitment part of the Race to Zero. To view their list of tools available, click here.

UK Green Building Council is a charity uniting the UK building industry using sustainability as a catalyst. They collaborate, enable, advocate and inspire progressive action.

WRAP is a charity design, develop, convene, manage and support collaborative change programmes, mobilizing stakeholders to reduce the end-to-end environmental impacts in production and consumption of food, textiles and plastic packaging.

5.2 ENGAGING AND EMPOWERING OTHERS: BUSINESSES
INTERNATIONAL SUPPORT FOR COMPANIES

Below are organisations and projects based globally that can support companies take climate action.

1.5°C Business Playbook provides guidelines for how to set a climate strategy and move to action. The Playbook highlights key actions to reduce your own emissions and those from your value chain emissions, as well as how to integrate climate in your business strategy and contribute to climate action in society.

CDP is a global nonprofit operating a disclosure platform for companies, investors, cities and regions to measure and manage their risks and opportunities on climate change, water security and deforestation.

ISO 20400 (International standard for sustainable procurement) provides guidance to organisations on the integrating sustainability within procurement.

Race to Zero is global campaign aims to rally leadership and support from businesses, cities, regions, investors for a health resilient, zero carbon recovery. Company can join through Business Ambition for 1.5 C - Our Only Future, The Climate Pledge, Exponential Roadmap Initiative, the SME Climate Hub and B Corporation.

Science Based Targets Initiative (SBTi) drives ambitious climate action in the private sector by enabling companies to set science-based emissions reduction targets.

Taskforce for Climate Related Financial Disclosures (TCFD) established by the Financial Stability board, they have developed recommendations for more effective climate-related disclosures. The UK government has announced its intention to make TCFD aligned disclosures mandatory across the economy by 2025, with a significant portion of mandatory requirements in place by 2023.

World Business Council for Sustainable Development (WBCSD) is a global, CEO-led organisation of over 200 leading businesses to accelerate the transition to a sustainable world. View their vision for 2050 which outlines key actions companies can take.

UN Global Compact is a global initiative calling companies to align strategies and operations with universal principles on human rights, labour, environment and anti-corporation and take actions that advance societal goals. To view their programmes for companies, click here.

We Mean Business is a global nonprofit coalition working with businesses to take action on climate. The partners help to deliver key initiatives and activities to accelerate the transition to a just and climate resilient net-zero economy.

Worldwide Fund for Nature (WWF) is a global conservation organisation working to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature. WWF works with companies to change behaviour and drive conservation results that would not be possible otherwise.

6. Implementation Plan 2022-2025
How to meet these targets?

6. IMPLEMENTATION PLAN
OVERVIEW

What is included in the Implementation Plan?

For each sector, we provide:

- **Carbon Savings and Costs:** Possible cumulative carbon savings if the KPIs in Chapter 4 are achieved by 2025 alongside the relative costs of implementation. The estimates of costs and carbon are high-level indicative estimates which are most useful when used in relative terms.
- **Barriers:** Barriers to action which have been informed by research on common barriers in these sectors as well as the responses from the resident and business consulations.
- **Co-benefits of Action:** An overview of the co-benefits of action per sector which contribute to the headline objectives in the Manchester Climate Change Framework 2020-25. A co-benefit is a positive result in one area brought about by an action at an objective in another area. Co-benefits help stakeholders build the case for action.
- **Actions:** Actions to indicate specifically *how* Manchester can achieve the KPIs (key performance indicators) outlined in Chapter 4 and achieve the headline objectives in the Manchester Climate Change Framework 2020-25. A timescale has been given for each action based on ease and required resources. 'Immediate' actions may cover the 'low-hanging fruit' actions. 'Short' actions may involve greater mobilisation of resources and include updates to policy and infrastructure. The actions also include relevant partners and implementation considerations mentioned during research and consultation, these are not exhaustive lists and other partners/considerations may be applicable.
- **Working Together:** A summary of actions required from stakeholders across the city, wider region and country.

How were the actions developed?

Actions were developed to target any gaps to the KPI targets discussed in Chapter 4 and the headline objectives in the Manchester Climate Change Framework 2020-25. Gaps were identified following:

- A review of current local, regional and national policy
- A review of work to date in each sector
- A consideration of local factors, such as the urban nature of Manchester
- A review of international best practice and guidance from C40 Cities and the UK's Climate Change Committee
- Consultation with residents, businesses and other relevant organisations in Manchester on actions and barriers

Types of approaches

The following implementation plan focuses on top-down actions and aims to unblock some of the barriers that are currently limiting and preventing action by stakeholders across the city.

Relevant partners have been identified where possible for actions. These include residential, commercial and municipal stakeholders at the city and regional level, such as community groups, property developers, and Greater Manchester Combined Authority.

6. IMPLEMENTATION PLAN
CONSIDERING COSTS

Indicative costings for different activities have been given where possible for each sector within the plan. Estimates are based on successful delivery of the level of action set out by the SCATTER Higher Ambition Pathway.

There are different types of cost to consider when evaluating carbon reduction actions, which can be helpful to define:

- **Capital expenditure (capex)** represents funds used to acquire, replace or upgrade a fixed asset e.g., the showroom price of an electric vehicle
- **Operational expenditure (opex)** represents funds spent or earned in the use and maintenance of that asset throughout its life e.g., the price of charging point electricity used to power the electric vehicle
- **Marginal cost** represents *additional* expenditure incurred as a result of choosing a low carbon option over a higher-carbon alternative e.g., the difference between the showroom price of an electric vehicle versus a diesel equivalent
- **Annualised costs** represent a combined yearly capex and opex cost associated with a given initiative. The upfront capex is averaged over the lifetime of the project/asset (equivalent to a depreciation charge) and combined with any in-year operational cost/savings to provide a single number to compare assets like for like.

Each of these financial metrics represents an important consideration for the business case for different actions and are not always directly comparable. Estimates given within the plan reflect this, with an attempt made to clearly define the type and specific nature of each cost.

It should be noted that costs given in this plan are high-level estimates only and that forward-looking cost models are inherently limited in accuracy. Estimates are not intended to act as definitive costings and are instead better used as a means of appreciating the scale and nature of the financial implications of different activities.

Methodology

Estimates are based on a comparison between the cost of a baseline case (the "BAU") and the Higher Ambition equivalent within SCATTER for each sector. Estimates have been made in isolation for different interventions based on specific research and data contexts. Where possible, an attempt has been made to enable like-for-like comparison between estimates made for different activities within the same sector. Cost assumptions are themselves based on government datasets and underlying research papers, most notably the CCC's Sixth Carbon Budget.

Costs have also been aligned to Manchester's 2025 target where appropriate. For a full description of the method used for each costing, please see Appendix 6.

6.1 Buildings

Implementation Plan

Anthesis

6.1 IMPLEMENTATION PLAN: BUILDINGS
CARBON SAVINGS AND COSTS

3 SUB-OBJECTIVES

CARBON SAVINGS to 2025
674 $ktCO_2e$

COSTS to 2025
£707m

FUNDING

Sub-Objective	Priority Areas
1.1 Improve energy efficiency in buildings	1.1.1 Privately owned non-domestic buildings 1.1.2 Public sector buildings 1.1.3 Privately owned and rented residential properties 1.1.4 Greater Manchester Housing Providers 1.1.5 New public and private sector developments
1.2 Shift off gas heating systems	1.2.1 Private sector buildings 1.2.2 Public sector buildings 1.2.3 Greater Manchester Housing Providers
1.3 Low carbon and energy efficient cooking, lighting and appliances	1.3.1 Private sector buildings 1.3.2 New private sector buildings 1.3.3 Public sector buildings 1.3.4 Greater Manchester Housing Providers

Category	Sub-sector	Cumulative carbon savings 2020-2025
Heating, cooling and hot water	Domestic buildings	382 $ktCO_2e$
	Non-domestic buildings	227 $ktCO_2e$
Lighting, appliances and cooking	Domestic buildings	25 $ktCO_2e$
	Non-domestic buildings	40 $ktCO_2e$

Sector	Description	Capex (£m)	Opex (£m)*
Domestic buildings	Retrofit of existing homes	450.4	NE
	Marginal cost of Passivhaus-equivalent over Part L during construction	39.3	NE
	Retrofit of heating and cooking systems	93.3	-2.4
Non-domestic buildings	Energy efficiency measures	117.9	0.5
	Heating systems	7.6	NE

- Salix Finance
- Green Homes Grant Local Authority Delivery Scheme
- Affordable Warmth Scheme
- Green Deal
- The Energy Company Obligation (ECO) scheme
- Domestic & Non-Domestic Renewable Heat Incentives
- Public Sector Decarbonisation Scheme
- BEIS Heat Networks Investment Programme
- Green Heat Network Fund (GHNF) Transition Scheme

*Negative opex costs indicate that the sub-objective has lower operational costs relative to a BAU scenario.

6.1 IMPLEMENTATION PLAN: BUILDINGS
BARRIERS

General Barriers to Implementation

- Policy and national legislation will vary greatly between now and 2050 and may not be ambitious enough
- There are competing priorities for planning policy e.g., the need to deliver Manchester's affordable homes target by 2025
- The capital cost to retrofit, lack of available funding opportunities and project payback may discourage prospective work
- Building on the Green Jobs Taskforce report, there is a need for job upskilling to create a new generation of engineers, assessors and technicians to deliver energy efficiency measures and decarbonised heating
- Both surveys highlighted that limited access to carbon reduction expertise acted as a barrier, especially within the building sector which is often deemed too complex
- Business and resident tenants may be unable to make improvements to buildings they rent

Barriers to Residents

- Residents want to see a simplified process and greater access to grants or products associated with building energy efficiency
- Responsibility for implementing energy efficiency measures and changes to heating systems usually lies with the landlord and given that 28% of Manchester's housing stock is currently privately rented, tenants are unable to directly enact change

Barriers to Businesses

- Businesses can move faster with heating and energy efficiency action, but are generally waiting on consistent government policy
- There are limited funding opportunities and a lack of ongoing information about grants or initiatives to promote the green agenda, especially for SMEs
- Some organisations lack capacity for a green agenda due to limited financial, technical and human resource
- A lack of leadership on climate change from C-Suite Executives or those in senior positions.

"As I am currently a student living in shared student housing, I am unable to make modifications such as switching to a renewable energy supplier, changing the boiler and insulation of installing solar panels."

Response from resident survey

"There is a need for standardised terminology as well as ways of measuring, reporting and certifying carbon in developments both in terms of operational energy, whole life and embodied carbon."

Response from business survey

6.1 IMPLEMENTATION PLAN: BUILDINGS
CO-BENEFITS

It can be helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of buildings in Manchester will offer co-benefits across economic, social and environmental spheres:

Inclusive, zero carbon and climate resilient economy

- Investing in energy efficient buildings can lead to reduced costs for space heating and cooling and for cooking and lighting. In Greater Manchester approx. 13 % of all households live in fuel poverty (they cannot afford to adequately heat their houses).
- If all of Manchester's households invested in energy efficiency and low carbon options, energy bills could be cut by £47 million a year.
- 9800 jobs could be supported in the North West by an energy efficiency programme in the UK.
- Investing £1 in keeping homes warm is estimated to reduce direct health costs by £0.42

Health and well-being

- Adopting energy efficient measures can result in improved comfort levels (energy efficient systems can produce less noise and are cleaner), improved lighting and better temperature control.
- An improved indoor climate can create health benefits, such as fewer diseases and reduced mortality.
- High energy bills can create financial stress. Energy efficiency measures that result in reduced energy costs can help the prevention of mental disorders (e.g anxiety, depression).
- People working in energy efficient buildings are less likely to suffer from fatigue, headaches or skin irritations.

Climate adaptation and resilience

- More sustainable design can help to enhance surrounding natural assets and make better use of nature to enhance building resilience to a changing climate.
- Some energy efficient appliances can also save water.
- Energy efficiency and local energy generation can reduce energy security concerns and help build local energy resilience.

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.1 Priority Area: Privately owned non-domestic buildings

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.1.1 Support businesses in accessing green finance by providing resources for guidance and advice via business networks	Communication & Engagement	Immediate	The Growth Company, The Business Growth Hub	
1.1.1.2 Investigate using Section 106 developer contributions to deliver net zero projects	Research & Design	Short	Manchester City Council & GMEF, Property Developers	• Consult with the Greater Manchester Environment Fund (GMEF) as this may have already been considered as a means of providing income into the fund
1.1.1.3 Signpost and promote retrofit and funding opportunities for businesses	Communication & Engagement	Immediate	GM Retrofitting Task Force	• In partnership with the GM Retrofitting Task Force
1.1.1.4 Encourage annual energy measurement and reporting of non-domestic buildings	Communication & Engagement	Immediate	Businesses	• Consider reduced business rates or other financial incentives (nudge) to provide an evidence base to support new construction standards
1.1.1.5 Set up a platform through which businesses can achieve sustained collaboration, identify funding opportunities and showcase leading examples of decarbonisation	Communication & Engagement	Short	The Growth Company, The Business Growth Hub	
1.1.1.6 Encourage businesses to sign up to the UK Green Building Council's Net Zero Carbon Buildings Commitment	Communication & Engagement	Immediate	GMCA	

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.2 Priority Area: Public sector buildings

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.2.1 Obtain an average Display Energy Certificate (DEC) rating of A by 2024 for all council-owned buildings where economically viable	Implementation	Short	GMCA	• Manchester City Council should lead by example through this action and encourage the wider city to follow suit • Public sector buildings include Greater Manchester Fire and Rescue, Greater Manchester Health and Social Care Partnership • GMCA has an existing target for Local Authorities to obtain an average DEC rating of D or better by 2024 and C or better by 2030 for their public buildings where economically viable
1.1.2.2 Communicate financing opportunities and guidance on DEC scoring for energy efficiency measures in existing public sector buildings	Communication & Engagement	Immediate	Public Sector Organisations	• DEC ratings are important to provide an indication of the energy efficiency of a public building and must be accompanied with a list of measures to improve the rating. Poorly performing buildings can then be identified and targeted for improvement
1.1.2.3 Require annual energy audits for all public sector buildings	Communication & Engagement	Immediate	Public Sector Organisations	• Annual energy audits will assist with monitoring and reporting of annual emissions • Should include community schools, as part of Ashden Low Carbon Schools Programme
1.1.2.4 Work with the health care sector to include sustainability indicators in building reviews	Communication & Engagement	Short	Manchester Health & Care Commissioning and the Manchester University NHS Foundation Trust, Community Schools	• In line with GMCA, work with the Manchester Health & Care Commissioning and the Manchester University NHS Foundation Trust

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.2 Priority Area: Public sector buildings (continued)

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.2.5 Update policy to ensure any new properties built in the council's portfolio are built to the highest energy efficiency standards	Policy & Strategy	Short		• Highest energy efficiency standards include Passivhaus for domestic, BREEAM Outstanding for non-domestic
1.1.2.6 Develop a decarbonisation plan for all council owned or affiliated buildings and tailor support to the worst performing properties	Implementation	Short		
1.1.2.7 Implement annual standardised measurement and reporting of operational efficiency of all public sector buildings	Implementation	Immediate	GMCA	• Manchester City Council to lead the way and set a standard of reporting through its own buildings

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.3 Priority Area: Privately owned and rented residential properties

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.3.1 Consider green accreditation schemes for private landlords and incentives to improve the energy efficiency of domestic buildings	Communication & Engagement	Short	Landlords	• Include access to finance, suppliers, installers and discounted EPC surveys • Those living in rented accommodation have less control over improvements to the buildings they live in.
1.1.3.2 Lobby national government to raise the minimum energy efficiency standards (MEES) from the current D up to a C for private rented properties and improve enforcement	Policy & Strategy	Short	National Government	• Aim to capture non-compliance and provide support to tenants and landlords where needed. Additional resource will be required to ensure adequate enforcement
1.1.3.3 Signpost and promote retrofit opportunities and funding	Communication & Engagement	Immediate	Residents	• Develop a system of support for residents to signpost and promote opportunities • Initially target domestic housing areas with the most need and those carrying out renovations • Responses from the Manchester resident's survey cited the need for more information on technologies and suppliers
1.1.3.4 Set up a mechanism for residents to collaborate and showcase leading examples of decarbonisation	Communication & Engagement	Immediate	Residents	• An example showcase is Bristol Green Doors Open Home Events
1.1.3.5 Utilise household fuel poverty data to identify 'hotspots' of low energy efficiency properties to target engagement and financing opportunities to these households	Research & Design	Immediate	Registered Social Landlords	

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.3 Priority Area: Privately owned and rented residential properties

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.3.6 Widely publicise opportunities associated with improving basic energy efficiency standards to owner-occupied homes	Communication & Engagement	Immediate	Residents	• Opportunities should include measures such as loft insulation and filling cavity walls and provide communications
1.1.3.7 Support households in accessing ECO3 funding by providing guidance and advice	Communication & Engagement	Immediate	Residents	• Assess if funding from the Green Homes Grant Local Authority Delivery scheme is still available to the Council • Utilise powers under ECO3 Local Authority Flexible Eligibility to enable the Council to qualify private sector residents as eligible for funding
1.1.3.8 Collaborate with local training colleges and educational centres to ensure skills to deliver deep and medium retrofit are within local workforce	Communication & Engagement	Short	Local Training Colleges	• Having trusted suppliers and installers was listed by residents as an area of additional support needed

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.4 Priority Area: Greater Manchester Housing Providers and Private Social Landlords

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.4.1 Build all new homes to net zero carbon standards	Implementation	Short	GMHP, Manchester Housing Providers' Partnership, Private Social Landlords	• All social housing should be built to net zero carbon standards ahead of the 2028 GMCA goal in line with the recommendations of the Greater Manchester 5 Year Environment Plan • Continue to work with Greater Manchester Housing Providers (GMHP) through the Manchester Housing Providers' Partnership • Align work with the recommendations from the GMCA New Build Group
1.1.4.2 Prioritise energy efficiency improvements and maximise funding for the worst-performing houses, i.e. those with EPC rating D-G	Implementation	Immediate	GMHP, Residents	• Work with GMHP
1.1.4.3 Achieve a minimum C SAP (Standard Assessment Procedure) Rating by 2025 for all existing homes	Communication & Engagement	Short	GMHP, Residents	• Support GMHP • The action is in line with the upcoming Future Homes 2 Standard

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.1 Improve Energy Efficiency

By 2025: 5,500 households have received medium retrofit, 44,300 households have received deep retrofit
15% reduction in domestic energy demand, 12% reduction in non-domestic energy demand

1.1.5 Priority Area: New public and private sector developments

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.1.5.1 Require all new developments to be built to net zero carbon standards	Policy & Strategy	Immediate	GMCA	• All developments should be net zero operational carbon from 2023 at the latest in line with the Manchester Climate Change Framework 2020-2025 • GMCA have a goal for all new developments to be net zero carbon by 2028
1.1.5.2 Develop a Sustainable Design and Construction Supplementary Planning Document	Policy & Strategy	Short	Developers	• The document should dispel cost misconceptions, promote whole life cost models and support higher development standards
1.1.5.3 Encourage all new dwellings to seek a 90% energy reduction beyond Part L of the 2013 Buildings Regulations	Implementation	Immediate	GMCA	• A 90% reduction should be aimed for, with a 19% reduction as a minimum in line with GMCA targets
1.1.5.4 Explore mechanisms to incentivise developers to exceed building standards	Communication & Engagement	Short	Developers	• Such as the Manchester Standard for Net Zero Carbon New Buildings • Deliver the Manchester Standard for Net Zero Carbon New Buildings enabler action plan

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.2 Shift off gas heating systems

By 2025: 12% of non-domestic heating systems are district heating, 20% of domestic heating systems are heat pumps

1.2.1 Priority Area: Private sector buildings				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
1.2.1.1 Develop low carbon heat networks and explore opportunities for expansion	Implementation	Short	Vital Energi, Allied London	• Continue to work in close partnership with Vital Energi to create the Manchester Civic Quarter Heat Network • Continue to support the development of district heating networks across the new St John's neighbourhood • Conduct feasibility studies for additional low carbon district heat networks and other micro-networks across the city, such as at Roundthorn Industrial Estate • Review feasibility of heat & power sub-objectives against the Local Area Energy Plan (Published after this report)
1.2.1.2 Encourage and provide guidance to businesses on low carbon heating solutions	Communication & Engagement	Immediate	Businesses	
1.2.1.3 Support households in accessing funding for installation of heat decarbonisation measures	Communication & Engagement	Immediate	Residents	
1.2.1.4 Require all new large developments to evaluate the viability of connecting to an existing or planned heat network, or install a site-wide of communal heat network solution	Policy & Strategy	Immediate	Developers	• In line with GMCA • 'Large developments' are defined as all new residential developments that are '10 dwellings or more' or other developments over 1,000m2

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.2 Shift off gas heating systems

By 2025: 12% of non-domestic heating systems are district heating, 20% of domestic heating systems are heat pumps

1.2.2 Priority Area: Public sector buildings

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.2.2.1 Ensure guidance and finance opportunities are provided to public services to encourage uptake of low carbon heating systems	Communication & Engagement	Short	Public Services	
1.2.2.2 Review opportunities for low carbon heating systems within council-owned or affiliated buildings	Implementation	Immediate		• Manchester City Council should lead the way with its own buildings and encourage the public sector to follow suit

1.2.3 Priority Area: Greater Manchester Housing Providers

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.2.3.1 Collaborate to review the installation of low carbon heating systems (ASHP, CHP etc) within social housing	Implementation	Short	GMHP	• Work with GMHP

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.3 Low carbon and energy efficient cooking, lighting and appliances

By 2025: Lighting and appliance energy demand decreases for domestic buildings by 21% and commercial buildings 7%, 15% increase in electric fuel usage for domestic cooking and 5% increase in commercial cooking

1.3.1 Priority Area: Private sector buildings

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.3.1.1 Provide guidance and support to businesses and residents on low carbon energy efficient appliance and lighting improvements	Communication & Engagement	Immediate	GMCA	• Organisations such as the Energy Saving Trust provide exemplary guidance
1.3.1.2 Carry out an energy efficiency education campaign for residents	Communication & Engagement	Short	Residents	• Ensure that residents are 'getting the basics right' in line with GMCA 5-year plan, e.g. fitting LEDs, turning off appliances when not in use, upgrading home insulation

1.3.2 Priority Area: New private sector buildings

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.3.2.1 Encourage all new build private sector buildings to only provide electric cooking appliances	Policy & Strategy	Short	Property Developers	• Uptake may be limited without legislation • Lobby national government to ban the sale of gas boilers

6.1 IMPLEMENTATION PLAN: BUILDINGS
ACTIONS

1.3 Low carbon and energy efficient cooking, lighting and appliances

By 2025: Lighting and appliance energy demand decreases for domestic buildings by 21% and commercial buildings 7%, 15% increase in electric fuel usage for domestic cooking and 5% increase in commercial cooking

1.3.3 Priority Area: Public sector buildings

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.3.3.1 Work with and support the public sector to review appliance and lighting energy efficiency	Communication & Engagement	Short	GMHSCP	• Support the health care sector in partnership with GMHSCP, work with and support the Manchester Health & Care Commissioning and the Manchester University NHS Foundation Trust
1.3.3.2 Develop and implement an appliance and lighting energy efficiency review for all council-owned or affiliated buildings	Implementation	Short		
1.3.3.3 Explore financing opportunities to deliver improvements to lighting and appliances in community schools and council affiliated leisure centres	Communication & Engagement	Short	Schools and Leisure Centres	

1.3.4 Priority Area: Greater Manchester Housing Providers

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
1.3.4.1 Carry out lighting and appliance improvements to social housing	Implementation	Short	GMHP	• Support GMHP

6.1 IMPLEMENTATION PLAN: BUILDINGS
WORKING TOGETHER

National

National Government
- Provide funding for heat networks and other zero carbon heating technologies e.g. heat pumps
- Provide funding for retrofitting and energy efficiency measures
- Decarbonise the national energy grid

Homes England
- Build zero carbon homes

UKGBC
- Promote the Net Zero Carbon Buildings Commitment

Greater Manchester

Manchester Climate Change Agency
- Encourage annual energy measurement, audit and reporting of non-domestic and public sector buildings, including schools
- Work with the health sector to include sustainability indicators in building reviews
- Review feasibility of heat & power sub-objectives against the Local Area Energy Plan (Published after this report)

GM Retrofitting Task Force
- Signpost and promote retrofit and funding opportunities

Greater Manchester Housing Providers
- Achieve C+ SAP ratings by 2025 and review the installation of low carbon heating systems
- Conduct feasibility studies for low carbon district heat networks
- Continue to build net zero carbon new homes
- Prioritise the worst performing houses for improvements
- Carry out lighting and appliance improvements

Health Care Providers
- Include sustainability indicators in building reviews
- Review appliance and lighting energy efficiency

Manchester

Manchester Residents
- Explore funding and resources promoted for heat decarbonisation measures
- Engage with educational campaigns and forums
- Explore training opportunities at colleges and educational centres

Manchester Businesses
- Explore green finance and resources made available
- Explore retrofit funding opportunities and installing low carbon heating solutions
- Sign up to net-zero buildings commitments
- Engage with educational campaigns and forums
- Consider adopting annual energy measurement, audit and reporting of buildings

Property developers
- Engage with campaigns and forums
- Follow design guides and Supplementary Planning Documents
- Meet or exceed the Manchester Standard for Net Zero Carbon New Buildings
- Evaluate the viability of connecting to an existing or planned heat network for large developments

Registered Social Landlords
- Use household fuel poverty data to target engagement, improvements and financing

The Growth Company/Business Growth Hub
- Provide resources and guidance to support Small & Medium businesses in accessing green finance
- Set up a platform for businesses to collaborate, identify funding opportunities and showcase decarbonisation measures

6.2 Renewable Energy

Implementation Plan

Anthesis

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
CARBON SAVINGS AND COSTS

3
SUB-OBJECTIVES

CARBON SAVINGS to 2025
*753 $ktCO_2e$

COSTS to 2025
£172m

FUNDING

Sub-Objective	Priority areas
2.1 Increase solar photovoltaic capacity	2.1.1 Private sector installations 2.1.2 Council-owned or affiliated property installations
2.2 Increase wind capacity	2.2.1 Opportunities for wind power
2.3 Explore other renewable technologies	2.3.1 Opportunities and barriers for renewable energy 2.3.2 Renewables projects by businesses 2.3.3 Residents, schools, public sector & community groups

Category	Cumulative carbon savings 2020-2025
Energy Supply	753 $ktCO_2e$

Sub-category	Sub-sector	Capex (£m)	Opex (£m)
PV	Large-scale PV (>10kW)	1.5	1.2
	Small-scale PV (<10kW)	57.5	11.8
Wind	Offshore wind	19.3	28.1
	Onshore wind	31.6	20.6
Other renewables		0.4	0.2
Total		**110**	**62**

- Renewable Heat Incentive
- Smart Export Guarantee
- Rural Community Energy Fund
- Community Energy Fund

* Please note carbon savings for energy supply and demand interventions should not be aggregated to avoid double counting

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
BARRIERS

General Barriers to Implementation

- Renewable technologies are often viewed as high maintenance or onerous
- Despite a 50% reduction in the cost of solar panels in the UK since 2011, installation is still perceived to be expensive
- The dense urban nature of the borough means there are space limitations for large-scale solar or wind farms or other large-scale renewables
- Installing renewable technologies in listed buildings may be more expensive
- Battery technologies and energy storage opportunities are yet to catch up with solar PV
- Ensuring skills to install and maintain renewable technologies are within Manchester's workforce

Barriers to Residents

- Lack of motivation from landlords to install solar panels given that the grid is continuously decarbonising
- Significant initial up-front cost to install solar PV for residents
- Lack of financial incentives for renewable installation

Barriers to Businesses

- Lack of clarity on national renewable energy policy
- Incentives may be needed if there is no significant organic interest
- SMEs in particular may struggle to fund the installation of renewables as the cost is often prohibitive, COVID-19 may further limit the funds available for businesses
- There is a need for standardised and holistic frameworks for renewable installation rather than ad-hoc projects often carried out in isolation

> *"Residents need financial support in the form of green grants and cheaper products to make buying renewables for our homes a possibility."*
>
> *Response from resident survey*

> *"There is a need to educate and de-mystify the renewable technologies that are currently available."*
>
> *Response from business survey*

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
CO-BENEFITS

It can be helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of Manchester's energy will offer co-benefits across economic, social and environmental spheres:

Inclusive, zero carbon and climate resilient economy

- Increasing local renewable energy supply provides protection and resilience against future fossil fuel price increases. Renewables reduce the risk of large-scale failure due to being modular installations.
- In the UK, low carbon and renewable energy activities generated £46.7bn turnover in 2018, directly employing 224,800 people (full-time equivalents).

Health and well-being

- Improved energy affordability can deliver health benefits by reducing the risks of illness due to living in inadequately heated homes.
- Reductions in fuel poverty through improving access to low-cost energy within the Council's housing stock.
- Wind, solar and hydropower produce little or no air pollution, minimising any negative impacts on health.
- Renewable energy does not have dangerous residues or pollutants which cause multiple health problems.

Climate adaptation and resilience

- Renewable energies like solar help to reduce air pollution and long-term health risks of living in industrially polluted areas.
- Increasing local renewable energy supply on a smaller scale, such as putting solar panels on rooftops rather than solely building large-scale solar farms, reduces land use conflicts for green spaces.
- As the production of renewable energy (solar and wind power) requires negligible amounts of water, it does not contribute to water scarcity concerns.
- By using renewable energy, natural resources are protected and not depleted nor destroyed.

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
ACTIONS

2.1 Increase solar photovoltaic capacity
By 2025: 344.7 MW local PV installed, 346.5 MW of large-scale PV installed

2.1.1 Priority Area: Private Sector Installations

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
2.1.1.1 Collaborate with local training colleges and educational centres to ensure skills to install solar panels are within the local workforce	Communication & Engagement	Immediate	Local Training Colleges	
2.1.1.2 Consult with residents on the benefits of installing solar panels and the potential opportunities from initiatives like solar streets	Communication & Engagement	Immediate	Residents	
2.1.1.3 Provide a solar map for businesses and residents to indicate how appropriate their building is for rooftop solar panels	Research & Design	Short	External consultants	

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
ACTIONS

2.1 Increase solar photovoltaic capacity
By 2025: 344.7 MW local PV installed, 346.5 MW of large-scale PV installed

2.1.2 Priority Area: Public sector property installations				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
2.1.2.1 Collaborate to facilitate installation of solar panels within the city's social housing	Implementation	Short	Manchester Housing Providers	• Work with GMHP
2.1.2.2 Investigate suitable opportunities for installing solar panels public sector buildings	Research & Design	Immediate		
2.1.2.3 Procure renewable energy tariffs from GM sources where possible when procuring contracts for electricity supply	Implementation	Short	Local energy producers	• In line with GMCA

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
ACTIONS

2.2 Increase wind capacity

By 2025: 12.3 MW local wind installed, 7.4 MW of large-scale onshore wind installed, and 231.8 MW of large-scale offshore wind installed

2.2.1 Priority Area: Opportunities for wind power				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
2.2.1.1 Encourage residents to generate own energy by installing renewable energy generation technologies	Communication & Engagement	Short	Residents	
2.2.1.2 Explore opportunities to invest in the development of a wind farm outside of the city	Research & Design	Immediate	Energy producers	
2.2.1.3 Collaborate with local training colleges and educational centres to ensure skills to install wind turbines are within the local workforce	Communication & Engagement	Short	Local Training Colleges	

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
ACTIONS

2.3 Explore other renewable technologies
By 2025: 0.2 MW of local hydro installed

2.3.1 Priority Area: Opportunities and barriers for renewable energy				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
2.3.1.1 Mandate that new industrial developments demonstrate that opportunities for using waste heat locally have been explored	Policy & Strategy	Immediate	GMCA	• Action is in line with the GMCA Places for Everyone Strategy
2.3.1.2 Coordinate action with Electricity North West (ENWL) on initiatives to significantly increase the demand on electricity for heating/ power (as opposed to fossil fuels) and to identify opportunity areas for investment	Communication & Engagement	Short	Electricity North West	• Review feasibility of heat & power sub-objectives against the Local Area Energy Plan (Published after this report)
2.3.1.3 Support the development of a Local Area Energy Plan	Policy & Strategy	Immediate	Energy Systems Catapult, GMCA	• Manchester's Local Area Energy Plan developed by the Energy Systems Catapult and GMCA

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
ACTIONS

2.3 Explore other renewable technologies
By 2025: 0.2 MW of local hydro installed

2.3.2 Priority Area: Renewable projects by businesses

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
2.3.2.1 Explore ways to expand on or develop opportunities around large scale energy storage solutions in collaboration with key businesses	Research & Design	Immediate	Businesses	• Review feasibility of heat & power sub-objectives against the Local Area Energy Plan (Published after this report)
2.3.2.2 Provide support for SMEs to access funding and collaborate on energy projects through a shared platform	Communication & Engagement	Immediate	Businesses	
2.3.2.3 Develop business-owned renewable technology projects in commercial areas through collaboration and partnerships	Communication & Engagement	Short	Businesses	
2.3.2.4 Create a framework to allow businesses to buy power in aggregation rather than in isolation	Research & Design	Immediate	The Growth Company	• Explore a partnership with The Growth Company • Explore Power Purchase Agreements • The council is considering PPA following a study into renewable energy options in Manchester
2.3.2.5 Encourage businesses to install renewable electricity generation at premises and consider partnering with community energy groups	Communication & Engagement	Immediate	Businesses	• Power Paired is a partnership service for renewable energy generation

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
ACTIONS

2.3 Explore other renewable technologies
By 2025: 0.2 MW of local hydro installed

2.3.3 Priority Area: Residents, schools, public sector & community groups

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
2.3.3.1 Consult with residents and other key stakeholders to develop a clean energy target for the city	Policy & Strategy	Immediate	Residents	
2.3.3.2 Encourage residents to switch to a renewable energy supplier	Communication & Engagement	Immediate	GMCR Business and Residential Groups	• The Big Clean Switch is a resource which can assist in switching to a renewable energy supplier
2.3.3.3 Provide support for residents and schools such as grants, loans or subsidies to install renewable technology	Communication & Engagement	Short	Residents & Schools	• Finance for installing renewables was cited as a key barrier during the resident's survey
2.3.3.4 Collaborate to explore opportunities to purchase green energy and assess opportunities for generating onsite renewables	Communication & Engagement	Immediate	GMHSCP	• Work with GMHSCP partners in the city
2.3.3.5 Support community-led initiatives for renewable and low carbon energy	Communication & Engagement	Short	GMCR Residents and Schools	• Such as Greater Manchester Community Renewables • The co-operative model is an example initiative

6.2 IMPLEMENTATION PLAN: RENEWABLE ENERGY
WORKING TOGETHER

National

National Government
- Decarbonise the energy grid
- Support commercial renewable energy
- Support and fund community energy projects
- Support the development of large-scale energy storage

National Grid
- Decarbonise the energy grid
- Support the development of renewable energy projects
- Support the development of large-scale energy storage

Greater Manchester

Greater Manchester Housing Providers
- Install solar panels on social housing
- Explore green energy opportunities

Greater Manchester Combined Authority
- Support MCC to mandate waste heat opportunities in industry

Greater Manchester Health & Social Care Partnership
- Explore green energy opportunities

Electricity North West
- Coordinate with MCCA on initiatives to increase the demand on electricity for heat and power to displace fossil fuels

Energy Systems Catapult
- Engage further on the Local Area Energy Plan

Greater Manchester Community Renewables
- Encourage residents and businesses to switch to a renewable energy supplier
- Support community-led initiatives for renewable and low carbon energy

Manchester

Manchester Residents
- Have your say in consultations
- Switch to a renewable energy supplier
- Consider grants, loans and subsidies to install renewables
- Get involved with community-led renewable energy
- Engage with resources and campaigns to install renewable energy and increase demand for electricity for heat/power

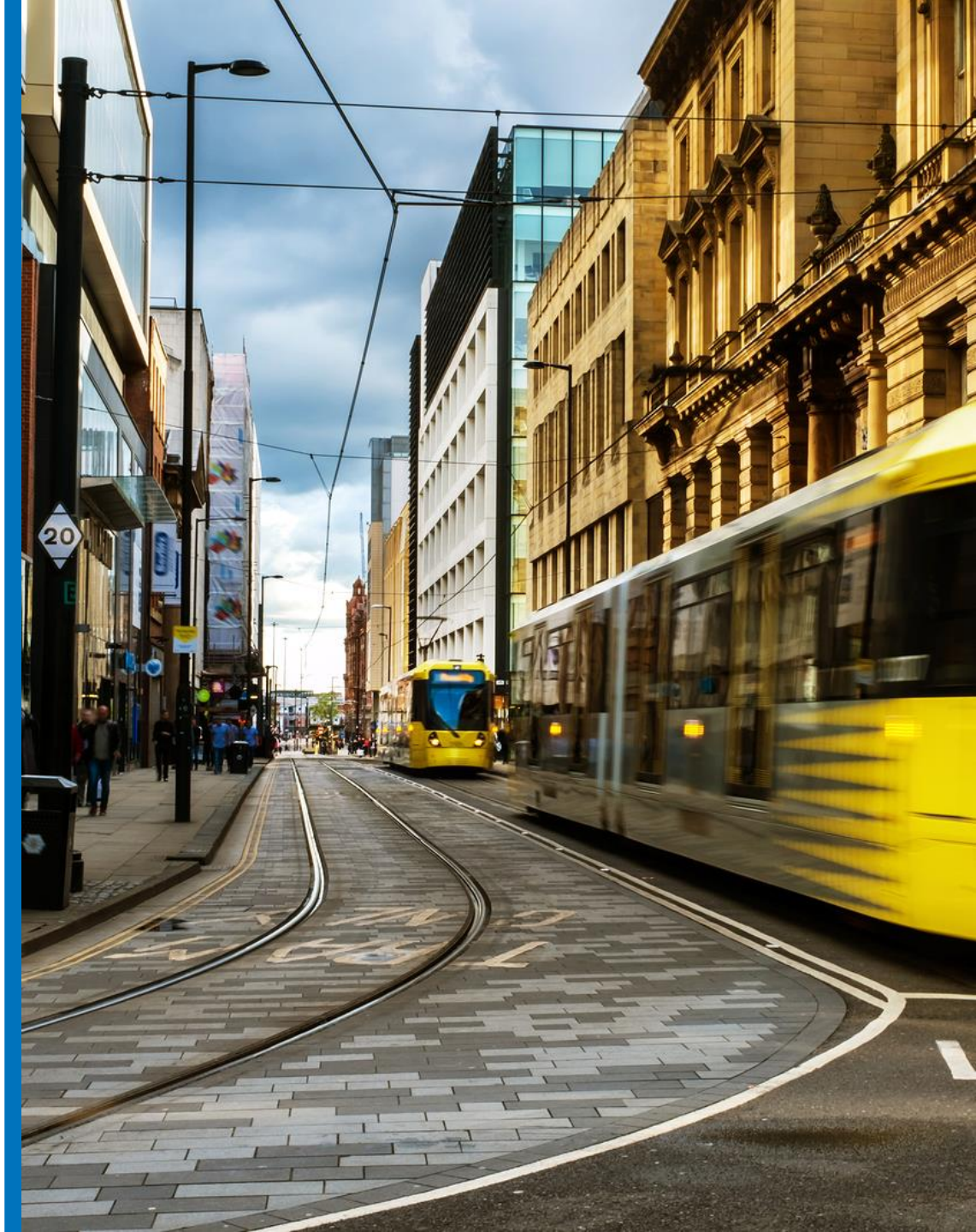
Manchester Businesses
- Consider grants, loans and subsidies to install renewables and explore collaboration
- Switch to a renewable energy supplier
- Explore renewable Power Purchase Agreements and large-scale energy storage solutions
- Consider collaborating on renewable technology projects
- Agency to review feasibility of heat & power sub-objectives against the Local Area Energy Plan (Published after this report)

Educational Centres
- Provide training to develop skills for renewable energy installation in the local workforce
- Consider grants, loans and subsidies to install renewables

6.3 Transport

Implementation Plan

Anthesis



6.3 IMPLEMENTATION PLAN: TRANSPORT
CARBON SAVINGS AND COSTS

4
SUB-OBJECTIVES

CARBON SAVINGS to 2025
409 $ktCO_2e$

COSTS to 2025
£82m

FUNDING

Sub-Objective	Priority areas
3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less	3.1.1 Active travel 3.1.2 Public transport 3.1.3 Reduced private vehicle use
3.2 Travel shorter distances	3.2.1 Agile working 3.2.2 Connected neighbourhoods
3.3 Switch to electric vehicles	3.3.1 Uptake of electric vehicles 3.3.2 Installations of electric vehicle infrastructure
3.4 Improve freight emissions	3.4.1 Decarbonised freight transport 3.4.2 Reduced freight journeys and improved efficiency

Category	Cumulative carbon savings 2020-2025
Road transport	409 $ktCO_2e$

Sub-Category	Sub-sector	Capex (£m)	Opex (£m)
Infra-structure	Cars/ vans/ motorcycles - infrastructure	3.8	NE
	HGVs/ buses - infrastructure	0.1	NE
	Rail - infrastructure	4.8	NE
New vehicles	Cars/ vans/ motorcycles - new vehicles	146.6	-52.0
	HGVs/ buses - new vehicles	12.3	-5.6
	Rail - new vehicles	0.0	-2.3
	Demand reduction	NE	-25.6
Total		**168**	**-86**

- DfT Active Travel Capability Fund
- Fix Your Bike Voucher Scheme
- The Electric Vehicle Homecharge Scheme
- DEFRA Air Quality grant programme
- Workplace Charging Scheme
- Plug-in Vehicle Grant
- On-Street Residential Chargepoint Scheme
- City Region Sustainable Transport Fund
- GM Active Travel Fund

6.3 IMPLEMENTATION PLAN: TRANSPORT
BARRIERS

General Barriers to Implementation

- Cycle routes are often built in isolation rather than being considered as part of the wider cycle network
- Space may be constrained in the city centre for additional active travel pathways
- Conflict between pushing for increased uptake of electric vehicles and prioritising active travel
- Electric vehicles have a higher upfront costs and there is currently a lack of infrastructure to support them
- Lack of funding for the electrification of buses, there's a need for central government to support bus operators

Barriers to Residents

- There is limited capacity within residential areas for EV infrastructure, terrace housing may not have space for EV charging
- Only 26% of GM households have access to a bike and this drops to just 16% for those living in flats
- A TfGM study in 2011 found the most cited barriers to cycling were lack of dedicated cycle lanes and road safety

Barriers to Businesses

- Lack of cycle confidence and safety concerns over commuting to work on dangerous or busy roads via active travel methods
- Lack of bike sharing and bike storage opportunities
- Developers need more control to allocate land for sustainable travel e.g., cycle lanes
- Remote working patterns may change depending on the development of COVID-19

> *"I cycle to most places or use public transport; however, the roads are dangerous, they're too fast and often don't have a good network of cycle lanes. Many people will not cycle because of the safety element."*
>
> *Response from resident survey*

> *"We need tools to measure audience travel, staff commuting and business travel in an easy-to-use format that anyone can use."*
>
> *Response from business survey*

6.2 IMPLEMENTATION PLAN: TRANSPORT
CO-BENEFITS

It can be helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of transport in Manchester will offer co-benefits across economic, social and environmental spheres:

Inclusive, zero carbon and climate resilient economy

- Electric vehicles are cheaper to run, costing £2-4 to charge for 100 miles whereas diesel cars cost around £13-£16 for 100 miles. Pure EVs are also usually cheaper to service and maintain.
- Increasing active travel could save the NHS £17bn within 20 years by reducing the prevalence of conditions such as type 2 diabetes, dementia, heart disease and cancer.
- Better public transport links will save households money as they do not need to own a car.
- Good transport accessibility can reduce the densification of an area, creating potential for economic activity as well as improving local service provision.

Health and well-being

- A reduction in particulate matter (PM) and nitrogen oxides (NO_x), pollutants created mainly by diesel vehicles, leads to a reduction in air pollution and associated health benefits. Particulate matter and NO_x have been linked to around 40,000 deaths a year in the UK.
- Improving air quality helps to reduce health inequalities as air pollution levels have been found to have a strong association with deprivation levels.
- Increased physical activity due to active travel will help to reduce obesity figures. An estimated 60% of adults are overweight or obese in Manchester, with a 65% estimate for the North West of England.

Climate adaptation and resilience

- Considerable improvements in air quality and noise reduction from vehicles increase an individual's quality of life.
- Driving less reduces the demand for land used for roads and car parking, providing an opportunity for more green spaces.
- Reductions in air pollution and less fuel leaks from petrol or diesel vehicles can improve the health of ecosystems.

6.3 IMPLEMENTATION PLAN: TRANSPORT ACTIONS

3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less

By 2025: ~5% reduction in road transport use and minimal increase in rail transport

3.1.1 Priority Area: Active Travel

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
3.1.1.1 Engage with residents in key areas of inequality and poverty within the city to identify barriers to active travel	Communication & Engagement	Short	Residents	• Safety and infrastructure were cited as barriers in the resident's survey
3.1.1.2 Consult on and expand the development of active/low traffic neighbourhoods across the city of Manchester	Implementation	Short	Transport for Greater Manchester, Residents	
3.1.1.3 Include requirements in building and planning policy which further incentivise active travel	Policy & Strategy	Short	Developers	• Requirements should include secure storage and drying rooms
3.1.1.4 Collaborate to promote funding and support available to businesses to encourage active travel	Communication & Engagement	Immediate	Transport for Greater Manchester, Businesses	• Work with Transport for Greater Manchester
3.1.1.5 Collaborate to promote the upcoming cycle hire scheme and other ride-sharing opportunities to businesses, higher education institutions, community groups and tourists	Communication & Engagement	Immediate	Transport for Greater Manchester, Businesses, Higher Education institutions, community groups and tourists	• Work with Transport for Greater Manchester
3.1.1.6 Collaborate to increase the resilience of the active travel modes to adverse weather conditions including heatwave planning to create comfortable outdoor environments e.g. increased shading	Implementation	Short	Transport for Greater Manchester	• Work with Transport for Greater Manchester

6.3 IMPLEMENTATION PLAN: TRANSPORT
ACTIONS

3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less

By 2025: ~5% reduction in road transport use and minimal increase in rail transport

3.1.2 Priority Area: Public Transport

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
3.1.2.1 Increase the capacity of public transport on key routes connecting the city with Greater Manchester	Implementation	Short	Transport for Greater Manchester, Public transport providers	• In response to the forecasted increase in public transport trips in the TfGM City Centre Strategy • Residents also cited the cost of public transport as a barrier to action during the survey. • Consider impact of COVID-19 pandemic as the use of public transport may be reduced due to safety concerns of passengers.
3.1.2.2 Require new developments to maximise access to multiple modes of public transport	Policy & Strategy	Short	Public transport providers	
3.1.2.3 Collaborate to increase the resilience of the public transport system to adverse weather conditions including heatwave planning	Implementation	Short	Transport for Greater Manchester, Public transport providers	• Work with Transport for Greater Manchester

6.3 IMPLEMENTATION PLAN: TRANSPORT
ACTIONS

3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less

By 2025: ~5% reduction in road transport use and minimal increase in rail transport

3.1.3 Priority Area: Reduced private vehicle use				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
3.1.3.1 Actively campaign to reduce short trips to discourage driving for commutes or school runs	Communication & Engagement	Immediate	Residents, Businesses and Schools, Greater Manchester Combined Authority	• Align action with Greater Manchester's Clean Air Zone
3.1.3.2 Collaborate to integrate ticketing across all modes of public transport	Implementation	Short	Transport for Greater Manchester, Public transport providers	• Work with Transport for Greater Manchester
3.1.3.3 Organise a scheme offering mobility credits for alternative transport for the able-to-pay market to scrap cars	Implementation	Short	Residents, public transport providers	
3.1.3.4 Expand, support and promote existing car sharing schemes and clubs in the city for residents and businesses	Implementation	Short	Transport for Greater Manchester, Residents and Businesses	

6.3 IMPLEMENTATION PLAN: TRANSPORT
ACTIONS

3.2 Travel shorter distances

By 2025: 17% reduction in the average number of passenger miles travelled per person

3.2.1 Priority Area: Agile Working

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
3.2.1.1 Provide guidance and support to businesses/large employers to maintain recent behaviour changes around working from home, and reduced business travel, brought about by the Covid-19 pandemic	Communication & Engagement	Immediate	Businesses, neighbouring areas	• Collaborate with neighbouring areas where a significant number of Manchester's residents work • Continue to prioritise the encouragement of active travel for journeys alongside agile working

3.2.2 Priority Area: Connected Neighbourhoods

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
3.2.2.1 Assess which residential areas of the city do not have essential amenities within walking distance and should be prioritised for investment in core services, to reduce the need for short car journeys	Research & Design	Immediate	Developers	• In line with C40 guidance for 'complete' neighbourhoods • Use the refresh of the Local Plan to ensure neighbourhoods are better connected and more people-focused
3.2.2.2 Require core services (such as shops, hospitals and schools) to be strategically located to reduce length of journeys	Policy & Strategy	Immediate	Developers	• In line with C40 guidance for 'complete' neighbourhoods
3.2.2.3 Encourage large residential developments to be mixed-use with services and amenities in walking distance	Policy & Strategy	Short	Developers	• In line with C40 guidance for 'complete' neighbourhoods • Use the refresh of the Local Plan to ensure neighbourhoods are better connected and more people-focused

6.3 IMPLEMENTATION PLAN: TRANSPORT
ACTIONS

3.3 Switch to electric vehicles

By 2025: 63% of vehicles are EV or HEV, 87% of buses and trains are electric

3.3.1 Priority Area: Uptake of electric vehicles				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
3.3.1.1 Organise EV leasing opportunities and funding schemes to enable lower-income communities to access EVs	Implementation	Short	Transport for Greater Manchester, Residents	
3.3.1.2 Expand opportunities for e-bikes, e-cargo bikes and electric vehicles	Implementation	Short	Transport for Greater Manchester, Residents and Businesses	• Use the results of the e-HUBS pilot
3.3.1.3 Provide guidance and support to businesses with fleets of vehicles regularly travelling in the city centre to access EVs e.g. coach companies	Communication & Engagement	Immediate	Transport for Greater Manchester, Businesses	
3.3.1.4 Lobby central government to decarbonise the national rail network	Policy & Strategy	Short	UK government, National Rail	• Electrify where possible and replace with hybrid and hydrogen trains elsewhere

3.3.2 Priority Area: Installations of electric vehicle infrastructure				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
3.3.2.1 Co-ordinate the installations of electric vehicle infrastructure with key workplaces, key residential areas and on-street parking locations	Research & Design	Short	Transport for Greater Manchester, Residents and Businesses	• Installations in key workplaces and off-road spaces such as car parks should be prioritised due to space restrictions in residential areas e.g. terraced housing
3.3.2.2 Implement EV-ready building codes and establish preferred EV parking policy in Local Plan	Policy & Strategy	Short	Developers	

6.3 IMPLEMENTATION PLAN: TRANSPORT
ACTIONS

3.4. Improve freight emissions

By 2025: 6% reduction in road freight mileage, 47% reduction in energy used per mile travelled

3.4.1 Priority Area: Decarbonised freight transport				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
3.4.1.1 Develop an e-cargo bike scheme for local businesses and deliveries	Implementation	Short	Transport for Greater Manchester, Businesses	
3.4.1.2 Collaborate to encourage and support suppliers to utilise rail and water freight opportunities, extended delivery windows, higher loading and reduced emptyrunning	Communication & Engagement	Short	Transport for Greater Manchester, Local freight industry	• Work with Transport for Greater Manchester
3.4.1.3 Assess the feasibility of local distribution hubs for home deliveries in the city which utilise low carbon "Last Mile" deliveries and customer collection	Research & Design	Immediate	Transport for Greater Manchester, Logistics and distribution companies	• Develop mobility hubs promoting sustainable last mile deliveries and micro mobility solutions alongside EV leasing and car sharing opportunities
3.4.1.4 Collaborate to increase infrastructure suitable for electric freight vehicles, such as suitable charging hubs	Implementation	Short	Transport for Greater Manchester, Local freight industry	• Work with Transport for Greater Manchester

6.3 IMPLEMENTATION PLAN: TRANSPORT
ACTIONS

3.4. Improve freight emissions

By 2025: 6% reduction in road freight mileage
47% reduction in energy used per mile travelled

3.4.2 Priority Area: Reduced freight journeys and improved efficiency

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
3.4.2.1 Support and require large fleets operating in the city, such as waste services, to practice route optimisation	Communication & Engagement	Immediate	Transport for Greater Manchester, Businesses	
3.4.2.2 Encourage businesses across the city to use procurement policies to favour local suppliers e.g. local produce if providing food	Communication & Engagement	Immediate	Businesses	
3.4.2.3 Create forums & groups for businesses to explore consolidating journeys, e.g. restaurants based near each other could use the same supplier	Communication & Engagement	Immediate	Businesses	
3.4.2.4 Collaborate to encourage and support suppliers to utilise extended delivery windows, higher loading and reduced empty running	Communication & Engagement	Short	Transport for Greater Manchester, Local freight industry	• Work with Transport for Greater Manchester

6.3 IMPLEMENTATION PLAN: TRANSPORT
WORKING TOGETHER

National

National Government
- Decarbonise the national rail network
- Fund active travel schemes
- Improve EV charging infrastructure nationally to facilitate longer journeys
- Encourage public transport use
- Fund public transport infrastructure to support improved capacity and modal shift

National Rail
- Decarbonise the national rail network

Greater Manchester

Transport for Greater Manchester
- Facilitate active travel through Low Traffic Neighbourhoods, funding, cycle hire schemes and increasing resilience
- Improve public transport capacity and resilience
- Integrate public transport ticketing and promote car sharing
- Facilitate EVs through funding and pilot opportunities and increasing EV infrastructure
- Support the decarbonisation of transport and improvement of efficiency in the freight industry

Public Transport Providers
- Work with TfGM to increase capacity, accessibility and resilience of public transport
- Work with TfGM to integrate public transport ticketing
- Work with TfGM to develop mobility credits in exchange for scrapping cars

Manchester

Manchester Residents
- Have your say in MCC consultations
- Consider car sharing schemes
- Reduce short trips in private cars
- Consider schemes for mobility credits
- Consider EV and e-bikes leasing and trial opportunities

Manchester Businesses
- Maintain and support agile working
- Support car sharing schemes
- Reduce short trips in private cars
- Consider installing EV infrastructure
- Update procurement policies to favour local suppliers
- Get involved with campaigns and forums
- Optimise and consolidate journeys by fleets and deliveries and consider local distribution hubs
- Consider e-cargo bikes and rail and water freight
- Consolidate freight journeys

Developers
- Develop infrastructure in line with MCC guidance
- Provide active travel and EV charging facilities

6.4 Food

Implementation Plan

Anthesis

6.4 IMPLEMENTATION PLAN: FOOD
CARBON SAVINGS AND COSTS

4
SUB-OBJECTIVES

CARBON SAVINGS to 2050
~50 $ktCO_2e$

COSTS to 2050
-£76m

FUNDING

Sub-Objective	Priority areas
4.1 Promote sustainable diets	4.1.1 Low carbon food procurement 4.1.2 Engagement on low carbon diets
4.2 Reduce per capita food waste	4.2.1 Reporting standards and targets 4.2.2 Resources for households and residents
4.3 Improve the sustainability of food supply chains	4.3.1 Supply chain engagement and policy
4.4 Improve food security	4.4.1 Social welfare 4.4.2 Local food production

Category	Carbon savings at 2025
Reduce per capita food waste	47$ktCO_2e$*
Increase the number of plant-based diets	

**based on a direct population scaling of CCC estimates. Please note that only a very small proportion of these savings relate to Manchester's direct and indirect emissions.*

Category	Capex (£m)	Opex (£m)
Reduce per capita food waste	-	-0.26
Increase the number of plant-based diets	-	-76

- Vegan Society Grant
- School Fruit and Vegetable Scheme
- Healthy Start Scheme
- Agricultural Transition Plan

6.4 IMPLEMENTATION PLAN: FOOD BARRIERS

General Barriers to Implementation

- Personal preferences towards eating meat and dairy
- Plant-based foods are often perceived to be more expensive than their non-vegan or vegetarian counterparts
- Locally produced food may be at a higher price compared to large-scale retail
- Lack of priority and engagement with issues surrounding food waste
- Lack of knowledge and understanding of food perishability
- Overbuying food and food management
- Lack of direct engagement with supply chains and ability to influence

Barriers to Residents

- Lack of desire of self or family to alter current diet
- Residents feel that they are unable to directly influence food supply chains
- The perception that the responsibility of food waste lies with the food industry and supermarkets rather than with the individual consumer or household

Barriers to Businesses

- Limited accessibility and choice of vegan or vegetarian foods at business events
- Management of waste infrastructure and lack of segregated food waste bins in offices or place of work
- Perceived lack of time to consume food in an office environment, leading to increased food wastage
- Lack of transparency across food supply chains

"Residents need more access to green spaces and places where we can grow and learn about food."

Response from resident survey

"The emissions associated with growing, manufacturing and transporting the food products that we sell in stores accounts for the vast majority of our climate impact and are the most material for us to address as a business."

Response from business survey

6.4 IMPLEMENTATION PLAN: FOOD
CO-BENEFITS

It can be helpful to consider the added co-benefits of given measures when planning climate action. The decarbonisation of Manchester's food system will offer co-benefits across economic, social and environmental spheres:

Inclusive, zero carbon and climate resilient economy

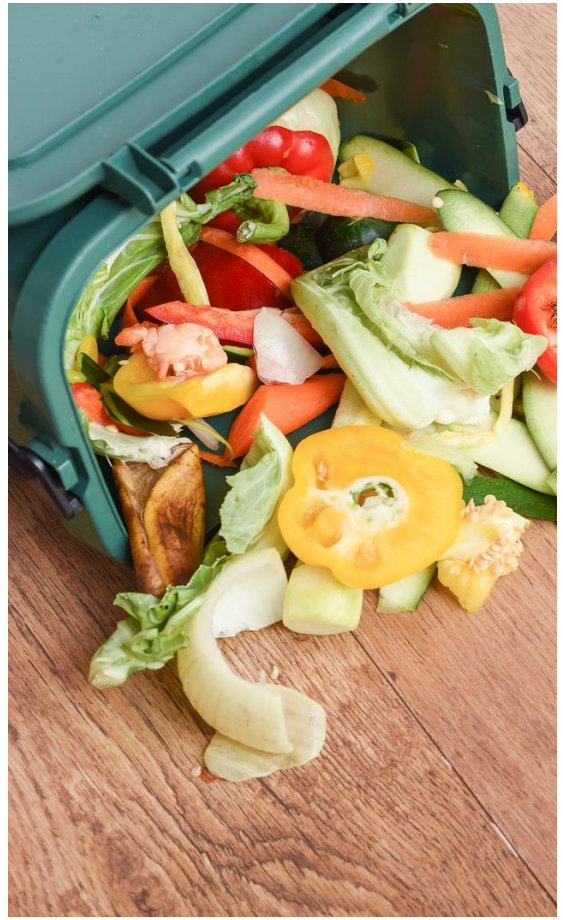
- £185 million of health and social care expenditure in Manchester is attributed to tackling overweight and obesity-related ill health
- Supporting local, sustainable SMEs can create economical benefits. For every £1 spent at a SME, 63p remains in the local economy, in contrast to 40p from purchases made at a larger business. As a result, there is a circulation of wealth in the local economy
- A move to a more sustainable food system can aid in tackling food poverty by providing equal access to healthy, affordable and appropriate meals for all

Health and well-being

- Measures to adopt more sustainable diets can significantly affect health issues related to nutrition. An estimated 60% of adults are overweight or obese in Manchester, with a 65% estimate for the North West
- Adopting the EAT-Lancet recommendations (which include reducing red meat and sugar consumption and increasing consumption of plant-based foods could reduce premature mortality from non-communicable diseases by 25%
- Community participation in local food growing can facilitate physical activity as well as healthier food options. Participation can also reduce stress, improve mood and increase confidence

Climate adaptation and resilience

- Supporting local sustainable SMEs can reduce transport emissions from imported products
- Local food production enables the food sector to withstand any major changes by reducing vulnerability of the city in global demands and creating flexibility in the food chain
- Reducing food waste can significantly reduce carbon emissions. 8-10 % of global GHG emissions are caused by unconsumed (e.g. lost or wasted) food
- The GHG emissions of Greater Manchester's food system could be reduced by 15% by adopting food-related measures suggested by a comprehensive study



6.4 IMPLEMENTATION PLAN: FOOD
ACTIONS

6.1 Promote sustainable diets

By 2025: Reduce the amount of meat and dairy in food and supply chains by 20%

6.1.1 Priority Area: Low carbon food procurement				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.1.1.1 Encourage action across the city by setting an example and aligning council food procurement to a low carbon, sustainable diet framework e.g. the Planetary Health Diet and encourage partners to do the same	Policy & Strategy	Immediate	Council suppliers	• Should specifically aim to reduce red meat and air-freighted consumption
6.1.2 Priority Area: Engagement on low carbon diets				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.1.2.1 Provide resources which outline best practice on reducing carbon footprints of residents through food choices	Communication & Engagement	Short	Manchester Food Board, Commonplace, Schools/community groups, Commonplace	• Aimed to influence behavioural change among residents
6.1.2.2 Engage with industry stakeholders on potential support for adopters of low carbon food alternatives	Communication & Engagement	Immediate	Industry professionals, Manchester Food Board	
6.1.2.3 Lobby national government for packaging labelling which considers the carbon impact of food	Policy & Strategy	Short	Other Local Authorities, UK Government, Lobbying groups	• Aimed to influence behavioural change

6.4 IMPLEMENTATION PLAN: FOOD
ACTIONS

6.2 Reduce per capita food waste

By 2025: Food waste per capita does not exceed 125kg per person

6.2.1 Priority Area: Reporting standards and targets

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
6.2.1.1 Encourage action across the city by setting an example and aligning the council's actions on the food system to a global standard and encourage partners to do the same	Policy & Strategy	Immediate	Manchester Food Board, C40 Cities	• A governance action to strengthen long term buy-in • Examples include the WRI Food Loss & Waste Reporting and Accounting Standard or the C40 Good Food Cities Declaration
6.2.1.2 Encourage action across the city by setting an example and reporting the council's own progress towards food waste reduction targets and encourage partners to do the same	Communication & Engagement	Immediate		

6.2.2 Priority Area: Resources for households and residents

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
6.2.2.1 Provide resources for residents on best practice for reducing food waste	Communication & Engagement	Immediate	Manchester Food Board, Commonplace, Schools, community groups, residents, Zero Carbon Communities Delivery Partnership	• Resources should be provided to residents and specifically reference household food waste
6.2.2.2 Ensure all households have food waste bins and have sufficient collections	Implementation		Manchester Food Board	• Including flats • The upcoming 2022 Waste Strategy may influence food waste management action

6.4 IMPLEMENTATION PLAN: FOOD
ACTIONS

6.3 More sustainable food supply chains

By 2025: Engage with a minimum of 75% of food suppliers (by spend)

6.3.1 Priority Area: Supply chain engagement and policy				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.3.1.1 Encourage action across the city by setting an example and engaging the council's own supply chain and challenge partners to set their own food waste reduction targets under the "*Target, Measure, Act*" approach and encourage partners to do the same	Communication & Engagement	Short	Suppliers, Manchester Food Board	• A governance action which ensures full spread of MCC influence
6.3.1.2 Engage with industry stakeholders to encourage the decarbonisation of their supply chains	Communication & Engagement	Immediate	Industry professionals	• Aim to influence behavioural change at the commercial level
6.3.1.3 Lead the way by adopting a "deforestation-free" food procurement policy and encourage partners to do the same	Communication & Engagement	Immediate	Suppliers, Manchester Food Board	• Initiatives such as the Accountability Framework set out guidance and definitions for mitigating supply chain impacts on natural ecosystems
6.3.1.4 Lobby for implementation of recommendations set out in the National Food Strategy Part 2	Policy & Strategy	Immediate	Other Local Authorities, UK Government, Lobbying groups	• A governance action

6.4 IMPLEMENTATION PLAN: FOOD
ACTIONS

6.4 Improve food security
By 2025: Increase allotment coverage by 20%

6.4.1 Priority Area: Social welfare

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
6.4.1.1 Create linkages between social work around food security and work around sustainable diets	Implementation	Short	Manchester Food Board, Social work organisations, Schools, community groups	• Links up with existing work and is designed to de-silo activity in each area and leverage joint resource • Encourages political buy-in to a sustainability issue within the context of a social health issue) • Improve food education in the city through cooking workshops, budgeting support and community growing groups
6.4.1.2 Play a greater role in supporting the voluntary food redistribution sector and encourage partners to do the same	Communication & Engagement	Immediate	Food redistribution sector, Manchester Food Board, Volunteers	• Align with the Sow the City project • Engage with the food sector to develop links

6.4.2 Priority Area: Local food production

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
6.4.2.1 Protect and maintain land that is currently used for growing within the city boundary	Implementation	Short	Land owners	• Link to resilience sub-group • Use the Local Plan refresh to identify more areas for local food production as well as protecting areas of current food production • A number of respondents in the resident's survey mentioned the need for support to access locally grown food.

6.4 IMPLEMENTATION PLAN: FOOD
WORKING TOGETHER

National

National Government

- Introduce labelling on food packaging highlighting the carbon impacts of items
- Implement the recommendations outlined in the National Food Strategy Part 2
- Set reduction targets for meat and dairy consumption

Greater Manchester

Manchester Food Board

- Provide resources outlining best practice on reducing the carbon footprint of food
- Provide resources outlining best practice for reducing food waste
- Engage with industry stakeholders and support to adopt low carbon food alternatives and the decarbonisation of supply chains
- Link social work to improve food security and work to improve the sustainability of diets

Manchester

Manchester Residents

- Have your say in consultations
- Engage with resources provided to reduce food waste and reducing the carbon footprint of diets
- Get involved with local food growing initiatives

Manchester Businesses

- Engage with resources and campaigns
- Adopt low carbon food alternatives
- Decarbonise food supply chains
- Support the food redistribution sector and identify opportunities to donate

Manchester Food Board

- Work with industry stakeholders on potential support for adopters of low carbon food alternatives
- Provide resources outlining best practice on reducing our carbon footprint in food
- Provide resources outlining best practice for reducing food waste

6.5 Things we buy and throw away

Implementation Plan

Anthesis

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
CARBON SAVINGS AND COSTS

3
SUB-OBJECTIVES

CARBON SAVINGS to 2025
84 $ktCO_2e$

COSTS to 2025
<£1m

FUNDING

Sub-Objective	Priority areas
5.1 Reduce the quantity of waste	5.1.1 Waste management strategy 5.1.2 Reuse initiatives and the sharing economy 5.1.3 The waste hierarchy
5.2 Increase recycling rates	5.2.1 Businesses, sustainable products and the circular economy 5.2.2 A local circular economy 5.2.3 City recycling services 5.2.4 Recycling education and awareness for residents and schools 5.2.5 Improved best practice for businesses
5.3 Shift away from fossil fuels and reduce industrial process emissions	5.3.1 Innovation and low carbon technologies 5.3.2 Procurement and supply chains 5.3.3 Education and knowledge sharing

Category	Cumulative carbon savings 2020-2025
Solid Waste Disposal	5 $ktCO_2e$
Industrial Processes	79 $ktCO_2e$

Category	Capex (£m)	Opex (£m)
Solid Waste Disposal	NE	-4.3
Industrial Processes	4.2	NE

- UK Research and Innovation's Strategic Priorities Fund
- Industrial Strategy Challenge Fund

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
BARRIERS

General Barriers to Implementation

- Confidence within the GMCA's waste collection services
- Recycling across the UK is not varied enough in what you can recycle and there is large amounts of confusion about what can or can't be recycled
- There is currently limited opportunity to recycle within Manchester city centre, although the Council are spending £250,000 on 51 smart bins at rubbish hotspots including Piccadilly Gardens, Albert Square, St Peter's Square and London Road
- Lack of funding to develop low carbon waste management infrastructure
- Shifting away from fossil fuel-based technologies within industry requires a collected effort across GMCA as part of the GM Local Industrial Strategy

Barriers to Residents

- Minimum space for residents to recycle, especially those living in high-rise flats
- The pandemic and online shopping has led to an increase in consumption
- COVID-19 may impact the ability of repair groups and shops to operate due to social distancing and safety concerns

Barriers to Businesses

- Added time and effort for businesses to recycle and segregate waste
- The existing high recycling rates may discourage stakeholders from taking immediate action
- The Council may face resistance to reduced general waste collections from organisations with insufficient waste storage facilities
- Businesses have limited control over upstream and downstream activity of products

"The Council needs to provide better waste and recycling facilities for city dwellers, including food waste collection."

Response from resident survey

"Upstream and downstream activity accounts for over 90% of our carbon footprint and is something over which we have much less control, especially as an organisation which deals with multiple small suppliers rather than a few large ones."

Response from business survey

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
CO-BENEFITS

It can be helpful to consider the added co-benefits of given measures when planning climate action. Reducing waste and increasing the reuse of materials in Manchester will offer co-benefits across economic, social and environmental spheres:

Inclusive, zero carbon and climate resilient economy

- Reducing the quantity of household and commercial waste results in lower costs from waste collection and processing. There is also potential to generate income through this process e.g. composting.
- Increased recycling rates have the potential to create more jobs. If a target of a 70% recycling rate is reached in the UK, 50,000 new jobs could be created.
- A zero-waste strategy builds a circular economy where one person's 'waste' is a resource for something new. Resources can be recirculated through our economy instead of being used once and then disposed or destroyed.

Health and well-being

- Waste reduction can promote social inclusion by creating jobs, volunteer schemes and training opportunities as well as improving access to reduced price goods for lower income families. For example, community fridges and share libraries can support communities.
- Working towards zero waste also helps to mitigate food poverty and hunger by enabling edible surplus food to be recovered and shared through food banks and charities in local areas.

Climate adaptation and resilience

- Alongside reduced air pollution and water pollution, recycling and reusing can reduce raw material mining waste created in the manufacture of resources.
- Increased recycling rates reduce pollution and benefits our health. For example, using recycled glass decreases air pollution by 20% and related water pollution by 50%.
- Reducing waste can lead to cleaner streets and communities.
- In addition to reduced greenhouse gas (particularly methane) emissions, zero-waste systems reduce impacts on surface and groundwater, odours and the presences of vermin, birds and other carriers of communicable disease at dumpsites.

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.1 Reduce the quantity of waste
By 2025: 17% reduction in the volume of waste

5.1.1 Priority Area: Waste management strategy				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
5.1.1.1 Support the development of a zero-waste strategy for the city	Policy & Strategy	Short	GMCA	• Work is already underway to inform this with GMCA, aligned with Manchester's carbon targets
5.1.1.2 Take part in pilots on improving waste management and finding innovative solutions to existing challenges	Implementation	Short	Housing Providers, GMCA, Universities, Research Bodies	• Collaborate with housing providers and GMCA to deliver pilot projects

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.1 Reduce the quantity of waste
By 2025: 17% reduction in the volume of waste

5.1.2 Priority Area: Reuse initiatives and the sharing economy

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.1.2.1 Work with community groups to deliver repair cafes and signpost/promote repair organisations or initiatives	Communication & Engagement	Short	Housing Providers, Community Groups, Businesses offering repairs, Neighbourhood Officers, Residents	• Manchester Repair Café and Stitched Up run events in Greater Manchester
5.1.2.2 Work with organisations and community groups to develop the sharing economy	Communication & Engagement	Short	Registered Housing Providers, Organisations, Community groups, Residents	• Example community initiatives include Library of Things • Promote exchange initiatives • Example organisations include Freegle
5.1.2.3 Support right to repair legislation and lobby for further expansion	Policy & Strategy	Immediate	UK Government, other Local Authorities, lobby groups	
5.1.2.4 Identify or provide community grants for groups to set up local initiatives to help encourage re-use and repair	Communication & Engagement	Short	Community groups, Residents, Neighbourhood officers, Zero Carbon Communities Delivery Partnership, Registered Housing Providers	
5.1.2.5 Develop targets for the re-use of materials from building deconstruction and promote adaptive re-use and salvage of re-usable materials	Policy & Strategy	Immediate	Construction Businesses, Landlords, Homeowners, Builders Material Merchants	• Consider developing a policy or building code in line with C40 recommendations

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.1 Reduce the quantity of waste
By 2025: 17% reduction in the volume of waste

5.1.3 Priority Area: The waste hierarchy

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.1.3.1 Provide or signpost information on minimising waste of water to residents, businesses and other organisations	Communication & Engagement	Immediate	Water companies, Businesses, organisations and residents	• In line with Decarbonising Consumption-based Emissions report, communications need to say more about wastewater treatment and its role in climate change
5.1.3.2 Co-ordinate with existing initiatives to encourage more carbon-neutral and waste-free consumption habits	Implementation	Immediate	GMCA, Consumption sub-group, Residents, Council staff, those employed in Manchester	• Link to ongoing work with the Consumption Sub-group and GMCA consumption initiative
5.1.3.3 Raise awareness of existing guidance on how to make items last longer	Communication & Engagement	Immediate	Commonplace, Residents, Zero Carbon Communities Delivery Partnership	• Existing guidance published on Commonplace
5.1.3.4 Assess the potential for discentives for waste production such as 'Pay as you throw'	Research & Design	Short	GMCA, Businesses, MCCP, GMSBP	• In line with C40 guidance • The upcoming 2022 Waste Strategy may influence future waste management actions
5.1.3.5 Work with others to reduce waste crimes	Implementation	Immediate	GMCA, Environment Agency, GMP	• Work with GMCA and other GM boroughs to reduce flytipping.

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.2 Increase recycling rates
By 2025: 9% increase in recycling rate

5.2.1 Priority Area: Businesses, sustainable products and the circular economy

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.2.1.1 Support collaboration groups and forums that bring together businesses to drive this agenda and share best practice	Communication & Engagement	Immediate	MCCP, Circular Economy Club, GMSBP, Growth Hub, Innovation Board	
5.2.1.2 Develop a programme of support for businesses to be more sustainable in their operations producing goods and services	Implementation	Immediate	MCCP, GMSBP, GMCA	• Part of GM Industrial strategy and 5 Year Plan • Work with the Greater Manchester Sustainable Business Partnership • Identify funds and resources to support businesses
5.2.1.3 Provide or signpost guidance to SMEs on principles of circular economy and how to maximise this within their business	Communication & Engagement	Immediate	SMEs, Circular Economy Club	• Identify funds and resources to support businesses
5.2.1.4 Signpost local businesses who are leading the way in circular economy and innovation	Communication & Engagement	Immediate	Local Businesses	
5.2.1.5 Identify opportunities to create material 'loops' that circulate recovered materials back into local businesses	Research & Design	Short	External consultants, businesses, GMCA	• In line with C40 guidance

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.2 Increase recycling rates
By 2025: 9% increase in recycling rate

5.2.2 Priority Area: A local circular economy

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.2.2.1 Collaborate to develop a platform to raise awareness of the need for a circular economy and its benefits	Implementation	Short	GMCA, MCCP, Circular Economy Club	• Work with GMCA and partners
5.2.2.2 Maximise revenues from secondary materials by incentivising a local market for reuse of materials	Implementation	Short	Businesses, GMCA	• This could include expanding plastic recycling across Manchester, this was raised by residents in the survey.

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.2 Increase recycling rates
By 2025: 9% increase in recycling rate

5.2.3 Priority Area: City recycling services

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.2.3.1 Collect and analyse data on the waste stream to understand the issues arising and priorities going forwards	Research & Design	Immediate	GMCA	• Work with GMCA • Assess the changes in waste generation patterns during COVID-19 lockdown and identify opportunities.
5.2.3.2 Collaborate to develop co-ordinated recycling campaigns and raise awareness of existing resources	Communication & Engagement	Immediate	Recycle for Greater Manchester, Zero Carbon Communities Delivery Partnership	• Ensure recycling instructions and guidance are clear, consistent and further information is easy to find • Already good information on RfGM website e.g. A-Z of recycling
5.2.3.3 Collaborate to encourage waste services providers to adopt low carbon operations e.g. during waste treatment	Communication & Engagement	Short	GMCA, Waste service providers	• Work with GMCA
5.2.3.4 Review bin collections and infrastructure to identify areas for improvement	Research & Design	Short	GMCA	• The upcoming 2022 Waste Strategy may influence future waste and recycling management actions
5.2.3.5 Develop policy to phase out non-recyclable and single use items across the city	Policy & Strategy	Short	GMCA, Businesses, Refill Manchester	• Continue to support the Plastic-free campaign • Signpost and raise awareness of local refill shops and the current refill scheme
5.2.3.6 Work with Household Waste Recycling Centres to support individuals without a car to safely access the site and dispose of their household waste and recycling	Implementation	Immediate	HWRC, GMCA	• Changes to access to Household Waste Recycling Centres would need to carefully consider health and safety

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.2 Increase recycling rates
By 2025: 9% increase in recycling rate

5.2.4 Priority Area: Recycling education and awareness for residents and schools				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
5.2.4.1 Work with schools to deliver to children education programmes on recycling and circular economy	Communication & Engagement	Short	Recycle for Greater Manchester, Schools	• Co-ordinate with existing educational work by MCC
5.2.4.2 Collaborate to carry out specific analysis for flats and provide guidance to address the identified challenges to increased recycling rates	Research & Design	Short	GMCA, Tenants, landlords	• Work with GMCA
5.2.4.3 Lobby national government for packaging labelling which is clear and consistent for recycling instructions	Communication & Engagement	Immediate	Residents	
5.2.4.4 Deliver targeted enforcement for residents for who are not participating in recycling	Implementation	Short	GMCA, Residents, community groups/neighbourhoods	• Greater Manchester are currently exploring this

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.2 Increase recycling rates
By 2025: 9% increase in recycling rate

5.2.5 Priority Area: Improved best practice for businesses

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.2.5.1 Encourage waste and recycling reporting by developing a standardised waste reporting framework for businesses and the public sector	Research & Design	Immediate	MCCP, Businesses, public sector	• The upcoming 2022 Waste Strategy may influence future waste and recycling management actions
5.2.5.2 Engage with current research projects happening at a regional level on sustainable solutions for waste stream issues	Communication & Engagement	Immediate	GMCA, Local universities	• Current research projects include Reduces, CircBe, One Bin to Rule them all
5.2.5.3 Encourage businesses to segregate their waste through incentives and sharing best practice	Communication & Engagement	Immediate	Local Businesses, MCCP, Waste Companies	
5.2.5.4 Lobby for the creation of deposit return schemes or explore developing a local deposit scheme with businesses	Policy & Strategy	Short	MCCP, GMSBP, UK Government	• The upcoming 2022 Waste Strategy will address deposit return schemes

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.3 Shift away from fossil fuels and reduce industrial process emissions

By 2025: Electricity consumption is 40% of total industrial energy consumption by 2025,
Process emissions reduced by 10% for chemicals, 6% for metals, 8% for minerals, and 37% other industries

5.3.1 Priority Area: Innovation and Low Carbon technologies

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.3.1.1. Collaborate to identify or provide funding opportunities for innovation in industry, particularly resource efficiency	Communication & Engagement	Short	GMCA, Local industry, businesses, funding bodies	• Work with GMCA
5.3.1.2 Collaborate to deliver opportunities for energy and materials efficiency e.g. decarbonised heating systems	Implementation	Short	GMCA, GMSBP, Businesses, Training bodies	• Work with GMCA • Opportunities are identified in the GM Local Industrial Strategy
5.3.1.3 Ask partners to review their product and resource efficiency for improvements	Communication & Engagement	Short	MCCP, Circular Economy Club	
5.3.1.4 Support universities and other research bodies in developing their research into innovative solutions and technologies	Research & Design	Immediate	Universities, research institutes, Businesses, industry	• The development of graphene at Manchester University is an example of innovate solutions

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.3 Shift away from fossil fuels and reduce industrial process emissions

By 2025: Electricity consumption is 40% of total industrial energy consumption by 2025,
Process emissions reduced by 10% for chemicals, 6% for metals, 8% for minerals, and 37% other industries

5.3.2 Priority Area: Procurement and supply chains

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.3.2.1 Lead the way by continuing to include environmental criteria in procurement and contracts and embed sustainability in decision-making	Policy & Strategy	Immediate	Procurement teams, Suppliers	• The social value framework could be adopted
5.3.2.2 Lead the way by training procurement staff to ensure carbon is considered in decisions and encourage partners to adopt similar training practices	Implementation	Short	Carbon Literacy, Procurement teams, training bodies	• Carbon literacy is mentioned as an education program
5.3.2.3 Encourage other public sector organisations to adopt similar sustainable environment criteria in their procurement process	Communication & Engagement	Short	Public sector bodies, Health Sector, Education, Businesses, suppliers	

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
ACTIONS

5.3 Shift away from fossil fuels and reduce industrial process emissions

By 2025: Electricity consumption is 40% of total industrial energy consumption by 2025,
Process emissions reduced by 10% for chemicals, 6% for metals, 8% for minerals, and 37% other industries

5.3.3 Priority Area: Education and knowledge sharing

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
5.3.3.1 Set guidance and provide training for promoting zero and low carbon industrial processes and products	Communication & Engagement	Immediate	MCCP, GMSBP, Growth Hub	
5.3.3.2 Expand existing forums through which industry can achieve sustained collaboration	Communication & Engagement	Immediate	Local industry, MCCP, GMSBP, Growth Hub, GM Innovation Board	• Showcase leading examples of industrial decarbonisation and signpost carbon reduction support
5.3.3.3 Encourage local industry to measure and understand emissions and develop a carbon reduction strategy	Communication & Engagement	Immediate	Local industry, MCCP, CDP/CBCA	• Aim to be science-based in line with the rest of city targets

6.5 IMPLEMENTATION PLAN: THINGS WE BUY AND THROW AWAY
WORKING TOGETHER

National

National Government
- Phase out non-recyclable and single-use items
- Provide funding for community groups
- Support and expand right to repair legislation
- Support industry to develop low carbon technologies
- Develop deposit return schemes
- Require packaging labelling which is clear and consistent for recycling instructions

Greater Manchester

GMCA
- Develop waste management pilots
- Encourage more responsible consumption habits
- Assess the potential for discentives for waste production
- Develop a platform for raising awareness of the circular economy
- Collect and analyse data on the waste stream
- Identify or provide funding opportunities for innovation in industry

Recycle for Greater Manchester
- Develop coordinated recycling campaigns and raise awareness of existing resources
- Work with schools to deliver education programmes in schools
- Ensure labelling and recycling instructions are clear, consistent and further information is accessible
- Review bin collections and infrastructure to identify areas for improvement

Manchester

Manchester Residents
- Get involved with community groups and the sharing economy e.g. repair cafes
- Consider grants for community groups
- Engage with resources and guidance to reduce waste

Manchester Businesses
- Engage with resources and guidance to reduce waste
- Phase out non-recyclable and single-use items
- Adopt the standardised waste reporting framework
- Maximise circular economy opportunities in your operations

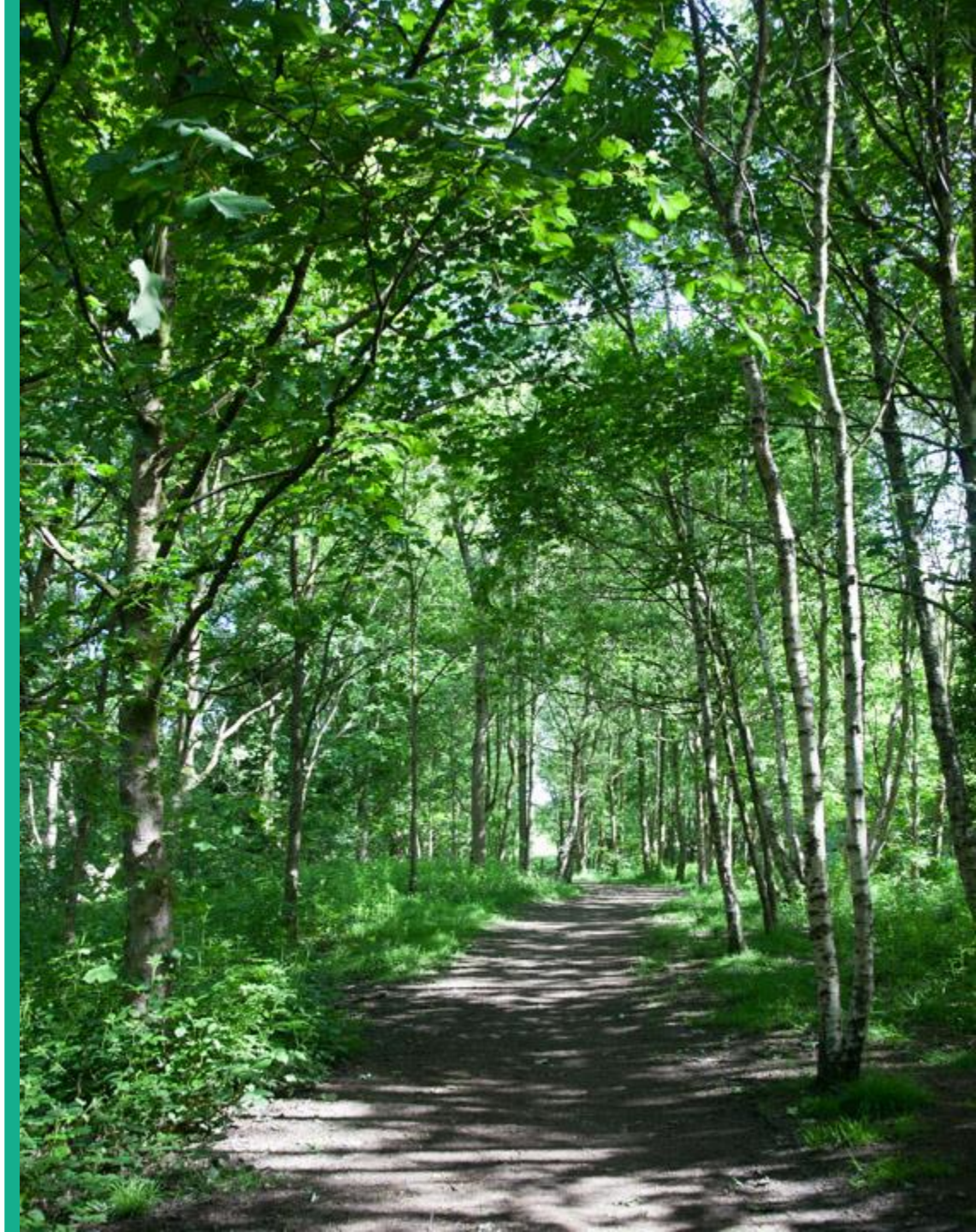
Industry
- Participate in forums
- Measure carbon emissions and develop a carbon reduction strategy

Universities
- Engage with other stakeholders on sustainable waste solutions

6.6 Green Infrastructure & Nature-based solutions

Implementation Plan

Anthesis



6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

CARBON SAVINGS AND COSTS

2
SUB-OBJECTIVES

CARBON SAVINGS to 2025
1.1 $ktCO_2e$

COSTS to 2025
<£1m

FUNDING

Sub-Objective	Goal/Priority areas
6.1 Increase tree coverage and tree planting	6.1.1 Maintain tree coverage 6.1.2 Increase tree coverage 6.1.3 Carbon offsetting
6.2 Land management	6.2.1 Maintain and enhance green space 6.2.2 Biodiversity in the city

Category	Cumulative carbon savings 2020-2025
Land use	0.7 $ktCO_2e$
Agriculture	0.4 $ktCO_2e$

Category	Capex (£m)	Opex (£m)
Planting new woodland	1.0	<0.1

- The Urban Tree Challenge Fund
- Local Authority Treescapes Fund
- England Woodland Creation Offer
- Groundwork Greater Manchester

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

BARRIERS

General Barriers to Implementation

- Tree planting and maintenance requires significant staff and volunteer time
- Manchester's high demand for housing is forcing out green space
- Space constraints for additional parks and green spaces, especially in the city centre
- The cost associated with purchasing land and difficulties with landowner agreements
- Education of the public on wild meadows as there is a perception that these areas are scruffy and unmaintained
- Validity and lack of understanding surrounding offsetting

Barriers to Residents

- GM Ignition Engagement found nature-based solutions, green and blue infrastructure were not well understood by participants. There was also a disconnect between the urban greenspaces and their effect on climate resilience
- Also, poorly designed green space was raised for its impact on the rate of antisocial behaviour

Barriers to Businesses

- Street trees do not score well in Biodiversity Net Gain assessments so there is little incentive to include them in development plans
- Increased requirements for car parking leads to conflicts between car parking and tree provision or green space
- Associated costs of developing an offsetting strategy with potential need for incentives if there are low levels of knowledge or interest

> *"Finance and/or human resources to better create and maintain our bio-diverse green spaces."*
>
> *Response from resident survey*

> *"We need more open and green spaces as well as trees planted on street walks, particularly on terraced streets where garden space is limited."*
>
> *Response from resident survey*

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

CO-BENEFITS

It can be helpful to consider the added co-benefits of given measures when planning climate action. The protection and enhancement of green infrastructure and nature-based solutions in Manchester will offer co-benefits across economic, social and environmental spheres:

Inclusive, zero carbon and climate resilient economy

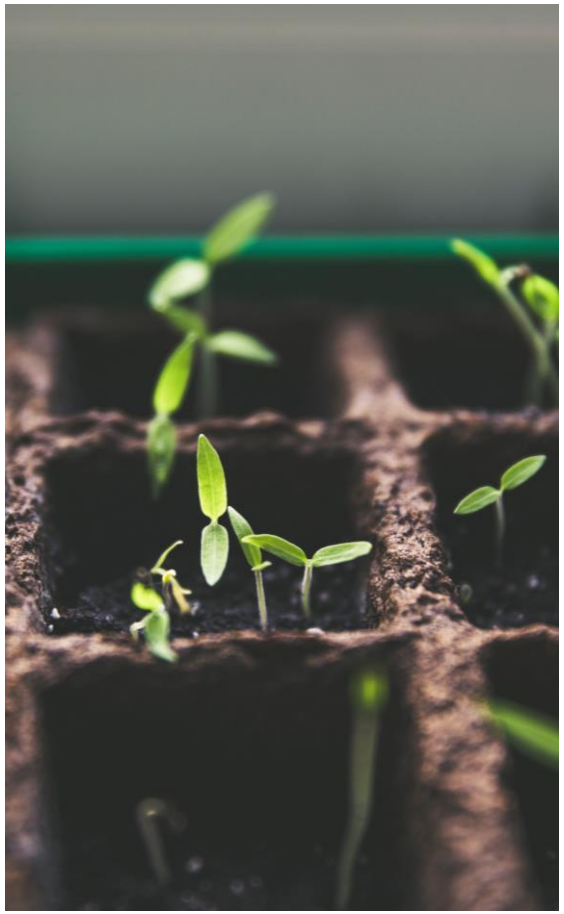
- Increasing tree coverage and tree planting results in a reduction in some building energy costs as trees lower temperatures and shade buildings in the summer.
- The benefits associated with increased physical activity and better mental health from access to green space are linked to shorter hospital stays and quicker recovery, which can save the UK health system £2.1bn per year.

Health and well-being

- Green spaces can provide a space for communities to engage, which can improve community cohesion, walkability of neighbourhoods, reduce crime and develop a connection to local place.
- Those living closer to green spaces in urban areas have been found to experience lower stress, anxiety and depression.
- Children living in areas with good access to green space have lower prevalence of obesity (11-19%) compared to children with limited access to green spaces.

Climate adaptation and resilience

- Trees and vegetation can reduce surface run-off and thus flood risk. They can also help to reduce temperature and the urban heat island effect.
- Trees and green spaces can create habitats, support species and increase biodiversity. A mature oak can host up to 5,000 different species of invertebrate that will form the basis for a healthy food chain that benefits birds and mammals.
- Trees can reduce noise pollution by up to 6-8 decibels.
- A typical fully-grown tree can absorb approx. 21 kg of CO_2 per year.



6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

ACTIONS

6.1 Increase tree coverage and tree planting

By 2025: Tree planting outside of woodlands increases by 15% from 2019

6.1.1 Priority Area: Maintaining tree coverage

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
6.1.1.1 Develop a strategy to protect and manage existing urban trees and woodland in the area	Policy & Strategy	Short	Nature Greater Manchester	• Follow up the 2016-2020 Tree Action Plan
6.1.1.2 Report on tree & hedgerow abundance, diversity and cover in the city and engage with community groups and schools to assist with monitoring and inventories	Implementation	Short	Greater Manchester Natural Capital Group, Community Groups, Friends of Parks Groups and Schools	• Community groups include Manchester City of Trees

6.1.2 Priority Area: Increasing tree coverage

Actions	Action Type	Timescale	Relevant Partners	Implementation Considerations
6.1.2.1 Plant trees, woodland or hedgerows on Manchester City Council-owned land (where appropriate)	Implementation	Short	Landowners and Transport for Greater Manchester	• Including strategic land and along grass verges or highways to reduce roadside air pollution by stimulating the mixing of polluted air at street level with relatively clean air from above and by acting as a protective barrier to pedestrians
6.1.2.2 Carry out opportunity mapping to assess areas which are available for tree planting	Research & Design	Immediate	Greater Manchester Natural Capital Group, Manchester City of Trees	
6.1.2.3 Ensure tree cover is considered for all new developments through the new Local Plan	Policy & Strategy	Short	Developers	• Mandate a minimum level of tree coverage in large new developments, and exploring incentives for developers to retain trees

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

ACTIONS

6.1 Increase tree coverage and tree planting

By 2025: Tree planting outside of woodlands increases by 15% from 2019

6.1.2 Priority Area: Increasing tree coverage (continued)				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.1.2.4 Support the development of small and large-scale tree planting projects and collaborate to engage with community groups and schools to assist with tree planting	Implementation	Short	Nature Greater Manchester, Forestry Commission, Manchester City of Trees, Community Groups and Schools	• Support the development of the City Forest Park Project • Work with Manchester City of Trees • Work with Nature Greater Manchester in line with Manchester City Council's Places for Everyone: Policy JP-G 9
6.1.2.5 Prioritise tree planting initiatives in areas which are near schools, have higher levels of deprivation or less existing green space, where the opportunities for, and benefits of, action are greatest	Implementation	Immediate	Manchester City of Trees	• Initiatives include as the Tree Action MCR programme and Manchester City of Trees • Hedge and tree planting near to schools can act as an effective barrier to pollution
6.1.2.6 Consider financial incentives and opportunities to engage with private landowners and residents to plant more trees on private property	Research & Design	Short	Residents and Businesses	• Incentives such as discounts on council tax for every tree planted

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

ACTIONS

6.1 Increase tree coverage and tree planting

By 2025: Tree planting outside of woodlands increases by 15% from 2019

6.1.3 Priority Area: Carbon offsetting				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.1.3.1 Develop an offsetting strategy to address residual emissions not tackled by direct actions in the city with a validated offsetting method	Policy & Strategy	Short	Greater Manchester Natural Capital Group	• The strategy must align with other offsetting strategies or policy of organisations within the city, such as businesses and Manchester Airport
6.1.3.2 Assess the carbon sequestration of current council land and identify opportunities to increase sequestration, looking into different natural carbon capture options	Research & Design	Short	Greater Manchester Natural Capital Group	• The strategy should consider that the sequestration potential within the City of Manchester will be limited
6.1.3.3 Encourage businesses to support city-wide offsetting initiatives where possible through Authority Based Insetting	Communication & Engagement	Short	Greater Manchester Natural Capital Group, Businesses	

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

ACTIONS

6.2 Land use management

By 2025: Maintaining existing green spaces

6.2.1 Priority Area: Maintaining and enhancing green space				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.2.1.1 Identify and signpost funding for greater enhancement of existing green spaces as housing development density increases	Communication & Engagement	Short	Greater Manchester Natural Capital Group, Developers	
6.2.1.2 Impose more ambitious green space requirements in planning policy for development and ensure that green spaces are a central pillar of planning	Policy & Strategy	Short	Developers	
6.2.1.3 Restore, retain and protect existing land uses which store CO_2 on council-owned land	Implementation	Short		
6.2.1.4 Consider imposing living wall planning requirements for all commercial developments in the city	Policy & Strategy	Short	Developers	
6.2.1.5 Carry out a mapping exercise to assess which areas of the city could be designated, protected and enhanced as green space, ensuring equitable access for communities	Research & Design	Immediate	Greater Manchester Natural Capital Group, Communities	• Access to green space was listed as a barrier by some residents during the consultation

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

ACTIONS

6.2 Land use management

By 2025: Maintaining existing green spaces

6.2.1 Priority Area: Maintaining and enhancing green space (continued)				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.2.1.6 Enhance greenery including shrubs and hedgerows within streets, where it is practical to do so	Implementation	Short	Businesses and Residents	
6.2.1.7 Develop a toolkit for green community schemes that SMEs could refer to in looking for community engagement or philanthropy opportunities	Communication & Engagement	Immediate	SMEs	

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE & NATURE-BASED SOLUTIONS

ACTIONS

6.2 Land use management

By 2025: Maintaining existing green spaces

6.2.2 Priority Area: Biodiversity in the city				
Actions	**Action Type**	**Timescale**	**Relevant Partners**	**Implementation Considerations**
6.2.2.1 Rewild verges, reduce mowing and plant and/or sensitively manage hedgerows in the city to connect and enhance wider ecological networks	Implementation	Short	Nature Greater Manchester	
6.2.2.2 Shape regional policy to include wildlife friendly planting, reduced pesticide and herbicide use and the protection and management of nature reserves	Policy & Strategy	Short	Greater Manchester Combined Authority Natural England and the Greater Manchester Ecology Unit	• Shape the Local Nature Recovery Strategy
6.2.2.3 Encourage new developments to go further than a minimum of 10% Biodiversity Net Gain	Policy & Strategy	Short	Developers	
6.2.2.4 Engage with residents on the value of land use and habitats within private gardens	Communication & Engagement	Immediate	Residents	
6.2.2.5 Run a campaign/training on Biodiversity Net Gain	Communication & Engagement	Short	Nature Greater Manchester	• In partnership with Nature Greater Manchester

6.6 IMPLEMENTATION PLAN: GREEN INFRASTRUCTURE
WORKING TOGETHER

National

National Government
- Provide funding for woodland and tree planting initiatives
- Provide funding for rewilding and biodiversity initiatives

Natural England
- Enhance biodiversity in the Local Nature Recovery Strategy by reducing pesticide and herbicide use

Forestry Commission
- Continue to support the City Forest Park Project

Greater Manchester

GMCA
- Enhance biodiversity in the Local Nature Recovery Strategy

Nature Greater Manchester
- Engage with community groups and schools to carry out tree planting, monitoring and inventories
- Run a campaign/training on Biodiversity Net Gain
- Develop a community engagement toolkit for SMEs
- Engage with residents on the value of land use and habitats

Greater Manchester Natural Capital Group
- Report on tree & hedgerow abundance, diversity and cover
- Map tree planting opportunities across the city
- Signpost funding for green space enhancement
- Develop a carbon offsetting strategy for the city's residual emissions
- Assess the carbon sequestration of council land
- Encourage businesses to support offsetting initiatives in the city

Manchester City of Trees
- Assist with mapping opportunities to plant trees across the city
- Consider levels of deprivation, existing green infrastructure and proximity to schools when selecting tree planting locations

Manchester

Manchester Residents
- Have your say in consultations
- Engage with Nature Greater Manchester projects and biodiversity campaigns
- Consider tree planting initiatives and incentives
- Engage with community groups to protect and enhance green space and trees
- Support the City Forest Park Project

Manchester Businesses
- Consider tree planting initiatives and incentives
- Increase green space and engage with Nature Greater Manchester projects and campaigns
- Engage with green community engagement schemes

Property Developers
- Maximise tree cover, biodiversity and green space in developments

07 MONITORING FRAMEWORK

7. MONITORING FRAMEWORK
INTRODUCTION

As Manchester agrees its sub-objectives and explores how to deliver action, it is important to consider how progress will be monitored and reported. Monitoring is an essential part of climate action for:

- Maintaining transparency and accountability
- Communicating to stakeholders progress on meeting the 2025 target
- Building an evidence base to improve delivery or secure further funding

This chapter provides an overview of a reporting framework that can be developed in Manchester. By developing a comprehensive monitoring framework it will improve Manchester's current reporting commitments through the CDP-ICLEI Unified Reporting System and the Manchester Climate Change Annual Report. The monitoring framework can be represented in the following pillars:

Useful Resources

This chapter has been developed based on C40 cities guidance on Monitoring, Evaluation and Reporting. Many of the principles and steps outlined have been adopted in line with Manchester's local targets and plans.

GM 5-year Environment Plan Challenge Group Plan has also been used to inform this chapter.

i) Define governance structure

Setting up governance structures to establish both who is responsible for actions across the city and who is responsible for monitoring this system. This will also need to consider avenues for sharing information and data.

ii) Identify indicators

This involves selecting indicators that will be used to assess progress and whether the desired outcomes are likely to be delivered. It should be possible to identify how each metric links to the city's targets and sub-objectives.

iii) Monitor, evaluate and report

Progress needs to be reported in a transparent way. The changes reflected in the data should be evaluated in a progress report and communicated with stakeholders.

7. MONITORING FRAMEWORK
I) DEFINE GOVERNANCE STRUCTURE

A key first step is to develop a governance structure that provides clear accountability for both who is responsible for acting and who is responsible for monitoring. It is recommended that the following three steps are considered:

- Developing partnerships and engaging key stakeholders
- Assigning responsibility for climate actions
- Setting up the governance structure for monitoring

Developing partnerships and stakeholder engagement

This refers to the coalition-building process to determine which stakeholders take "ownership" of different actions. An exercise needs to be done to assign responsibility for delivery of actions within the plan, which requires a strong partnership between public and private sector organisations, both across the city itself as well as wider networks. For this, the agency is encouraged to maximise existing partnerships such as MCCP and CBCA, as well as continuing engagement with other organisations across the city region.

Assigning responsibility

It is important to ensure that there is clear communication between stakeholders responsible for each action and delivery area e.g. developing a clear and current inventory of which actions are underway. The actions and KPIs should clearly detail the individual(s), team(s) or organisation(s) responsible for the success each action.

MCC and MCCA carry a large portion of responsibility in delivery of actions within this plan, but this responsibility is also shared between businesses, residents and other organisations in order to meet the city's climate action target. If MCCA were to only track projects which it is responsible for delivering, then this would provide a limited reflection of the city's progress.

Where possible the key partners have been identified for in the implementation steps of the plan. However, the roles and responsibilities of parties has not been defined, and other stakeholders may need to be involved.

For this reason, having well established partnerships which clearly set out an "owner" for each action is recommended as part of the monitoring framework. Action owners would lead and coordinate activity in that area, again underlining the importance in properly identifying and engaging with stakeholders.

Current Monitoring Process

MCCA currently publish an Annual Progress Report to update on how Manchester is doing against its headline objectives and the priorities set in the previous year.

- Progress against previously set priorities is addressed in qualitative terms, reporting whether the action has been completed or in progress. The priorities are focused on creating policies, plans or governance to enable further action rather than reporting against specific carbon reduction actions.
- Progress against the carbon budget is reported in partnership with the Tyndall Centre. This provides a direct comparison to the budget set in 2018 but excludes non-CO_2 GHGs. Quantitative analysis is also carried out for aviation and consumption emissions.
- Member updates from MCCP are provided in annex. As part of Framework 1, analysis was carried out to calculate the contribution of each partner to the city's footprint. Each organisation provides a description of their headline actions taken over the year, some statistics on progress are provided.

7. MONITORING FRAMEWORK
I) DEFINE GOVERNANCE STRUCTURE

Monitoring governance structure

Once responsibility for actions and clear accountability has been established, the governance of the reporting framework must be set up to allow effective monitoring and reporting. This must consider factors such as resourcing, existing systems and timeframe. Some of the key governance aspects to develop include:

- **Co-ordination** – Assigning roles and responsibilities for monitoring different sectors and actions. This will require co-ordinating with stakeholders, partners and internal staff to identify metrics, collect data and report findings. This could also consider developing channels for data sharing and collaboration.
- **Data collection process** – Setting up systems to collect and analyse data as well as identifying new potential data sources. Factors such as the type of data collected, spatial extent, the frequency of collection, expectations for data quality and data management need to be defined by MCCA. Another key part of this is scrutiny of the datasets used and analysis carried out.
- **Communication** – Determining how the findings and data collected will be communicated and who it will be shared with. There are different formats available for reporting progress which need to be evaluated by MCCA. There is also an important step in evaluating what the indicators suggest and developing the narrative around the changes that have occurred i.e., what story does the indicator tell.

Current Governance Process: Independent Advisory Groups

MCCA currently has a Zero Carbon Advisory Group and Adaptation and Resilience Advisory Group which have historically provided high level monitoring and advice. Two additional groups are being formed on Health and Wellbeing and Inclusive, Zero Carbon and Climate Resilience. While these Advisory Groups have been useful in providing analysis and oversight, their role may change as the governance structure is reviewed.

A good example of a monitoring system that tracks responsibility is the Committee on Climate Change's Annual Report to Parliament which presents whether climate actions are complete, underway or off track. The CCC report annually against progress relating to reducing emissions, progress in adapting to climate change, and further recommendations to Parliament. The aim of regularly reporting the status of different actions is to ensure continued scrutiny of responsibility as well as beginning to track impacts of actions.

Table 2
Progress against departmental recommendations in the Committee's 2020 Progress Report to Parliament

Department	Progress against last year's recommendations
Cabinet Office & No. 10	
FCDO, BEIS & the COP26 Unit	
HM Treasury	
Department for Business, Energy and Industrial Strategy	
Department for Environment, Food and Rural Affairs	
Department for Transport	
Ministry of Housing, Communities and Local Government	

= action achieved, = underway, = partly achieved, = overdue, = not achieved.

Figure 7.1: An excerpt from the CCC 2021 Progress Report to Parliament, detailing the progress of different government departments against targets set out in the CCC Pathway to Net Zero.

7. MONITORING FRAMEWORK
II) IDENTIFY INDICATORS

The next stage is measurement and incorporating some degree of “impact” analysis. This involves selecting data sources which can be used to indicate the level of progress made across 3 levels.

1. Greenhouse Gas Inventory

Broadly, progress towards the city’s emissions targets will be recorded by changes in the city’s carbon footprint. This will provide an indication of the overall direction of progress across the region and by sector. For Manchester, it will also be important to consider the impact on the cumulative carbon budget.

Recommendation: Use existing tools such as SCATTER to provide footprint data that it aligned with international reporting standards. Other datasets such BEIS Local Authority CO_2 data also provide useful context.

2. Sector Key Performance Indicators

Using only emissions data to measure progress can pose a challenge because it is only available two years in arrears, and it may not provide necessary sector detail to assess areas of success and areas whether further support is needed. This motivates the need for key performance indicators (KPIs) that publish recent-year data that can act as more useful proxies for measuring progress. MCCA (or whichever stakeholder is responsible for analysis) can then track year-on-year progress using these defined indicators. These indicators do not need to be carbon focused.

Recommendation: Select up to 5 KPIs per sector to provide an indication of progress towards the city’s sub-objectives. Potential data sources have been documented in this chapter.

3. Projects

There is a difference in tracking change across a sector or sub-objective versus looking at the impact of individual projects. Emissions data is not provided on an action-by-action level and monitoring the specific impacts of a project in this way is difficult, particularly if multiple workstreams make emissions reductions in the same area. Data may be more readily available at a sector level e.g. city-wide vehicle km, but this does require an extra step for MCCA to evaluate the cause of changes. Looking at the impact of a project requires bespoke data collection e.g. total users of a stretch of cycle lane after it has been widened. Projects may be aggregated to provide a sector KPI e.g. number of roads reprioritised. There are tools available to help with project appraisals and quantification (e.g. Anthesis' Project Carbon Impact Assessment Tool).

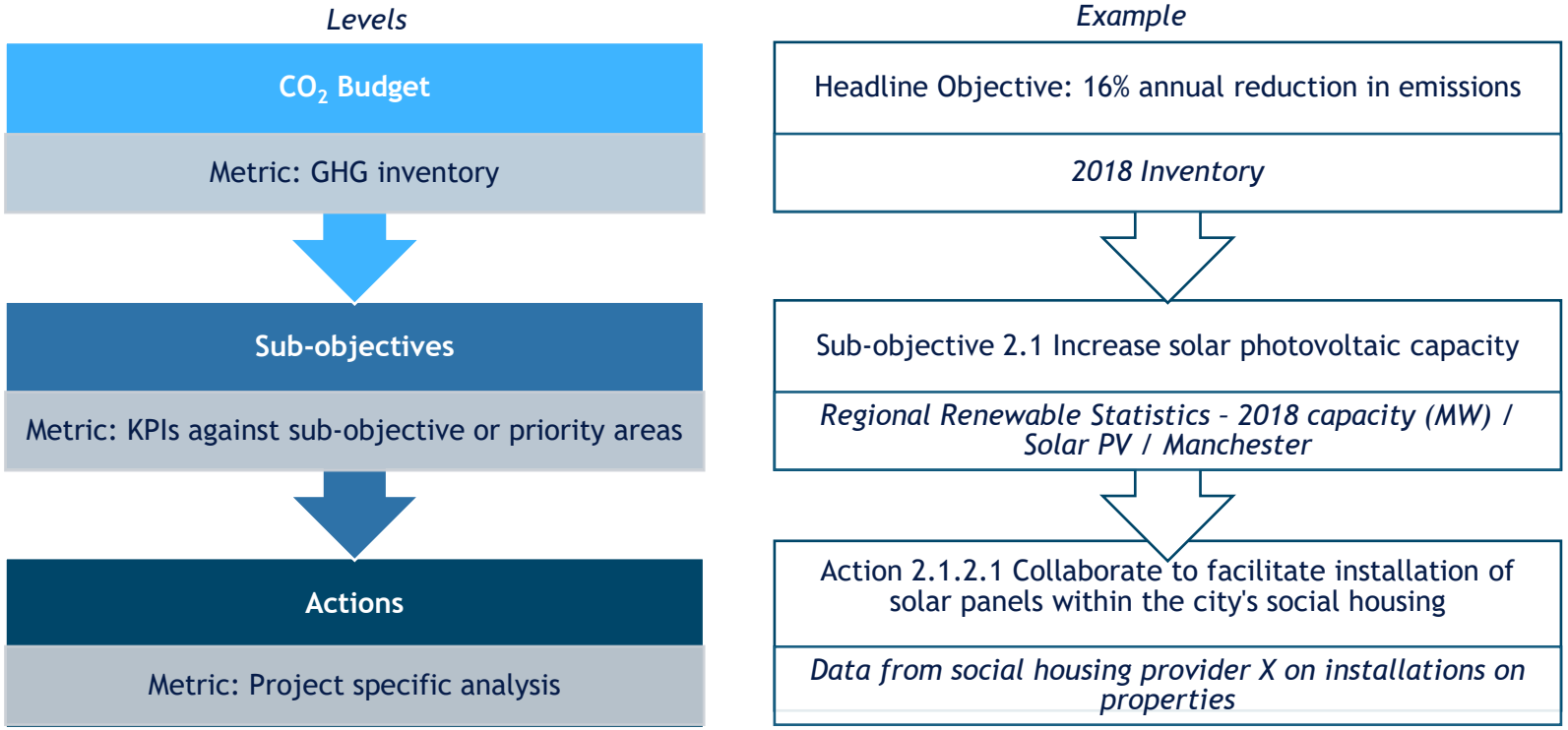
Recommendation: This will require collaboration across partners and stakeholders to collect information about projects happening in the city. Projects should be set up to factor in sufficient progress monitoring.

7. MONITORING FRAMEWORK
II) IDENTIFY INDICATORS

Linking to objectives

Each level has different methods and considerations (overleaf) for data collection but it is recommended that all three are used in parallel. This will help to create a more complete picture of the city's progress and allow detailed information to be reported alongside the overall footprint

However, it is important that each level of data can be linked to the overall target or a sub-objective (which itself can be linked back to the city target). The indicators selected by Manchester should support the SMART objectives and targets that are defined in Framework 2. This ensures clear traceability of how a selected metric is demonstrating a contribution to the city's target. It is recommended that the following structure is used for situating the data and numbering system used through-out this report can help with this:



7. MONITORING FRAMEWORK
II) IDENTIFY INDICATORS

What makes a good indicator?

When selecting the indicators that will be used to demonstrate progress it is important to evaluate what makes a good indicator. It is recommended that the following factors are considered when selecting indicators:

Data availability

The availability and quality of data for tracking is varied and should be taken into consideration. Whilst this is addressed in more detail in the next step: monitoring, it is important to have an idea of what data is available to monitor a selected indicator to ensure it can be efficiently tracked. You may have to review the selected indicators based on what data is available for monitoring.

Quantitative vs Qualitative

Both indicators can be used to reflect changes. Quantitative data can be useful as it can more objectively measure the amount of change that has occurred such as percentage shifts. However, this data is not always available and there are some instances where qualitative analysis can provide useful indicators. For example, surveys of public opinion. Binary indicators of yes/no or increased/decreased can also be useful to demonstrate an overall change. It is recommended that both types of indicator are utilised.

Co-benefits

It is also important to integrate indicators for assessing wider benefits or dis-benefits of carbon reduction activities. This will help to ensure principles of a just transition are followed. It ensures the outcomes from the actions taken benefit citizens and the planet and help identify gaps where the benefits are not being evenly distributed.

Intervention logic

Another tool that can be useful for linking actions to wider city goals is to apply an intervention logic model. As part of the C40 guidance, they recommend using this to assess the chain of results expected from an action being undertaken and to establish a cause and effect. The model includes interim outputs and outputs, moving to outcomes and impacts which can all have defined indicators. The outputs represent the areas that are within control of MCCA or the implementing actor, whereas the outcomes and impact depend on external factors too.

Interim Output → **Output** → **Outcome** → **Impacts**

C40 example: Provide a public cycle hire/sharing scheme

	Interim output	Output	Outcome	Impacts
Action	Design of scheme	Approved sharing scheme	Increased levels of cycling, job creation	Lower emissions from cars, improved health, employment
Indicator	- *# of proposed schemes*	- *# bicycles available* - *% of people <500m of scheme*	- *km cycled* - *% modal share*	- *tCO_2e*
Co-benefit indicator			- *Jobs created* - *% with access to services within 30-60 minutes*	- *PM10 concentration* - *Deaths related to air quality* - *Employment rate*

7. MONITORING FRAMEWORK
III) MONITOR, EVALUATE AND REPORT

Following the identification of indicators that will be used, it is important to consider how they will be monitored, evaluated and reported.

Monitoring

This requires developing data collection and management systems to ensure the data can provide the evidence needed for each indicator. MCCA should develop a data management strategy which covers the following factors:

- **Data needs** – C40 recommend starting with a data needs assessment. This will include both evaluating data that is already available and if it is fit for purpose as well as assessing new data sources. Gaps that are identified can then be explored if there are opportunities to collect data. Part of the data assessment should also evaluate the availability of baseline data which will be needed to measure progress against.
- **Data systems** – This links back to 1) Defining Governance Structure by developing the systems and processes in place to manage data effectively and efficiently. MCCA might wish to consider the technologies and tools available to support this and automate data sharing. C40 also have a Data Management Questionnaire to help cities assess data practices.
- **Transparency** – Maintaining transparency in the methods and data used for monitoring progress is critical to ensure stakeholders trust the process. This means clearly documenting methods and data sources. This will also ensure repeatability and consistency in monitoring.
- **Responsibility** – This links back to 1) Defining Governance Structure by assigning who is responsible for data collection and defining a data owner. This will require engagement with stakeholders to plan data collection and sharing.
- **Quality assurance** – Quality includes the completeness and reliability of data, the likelihood of error and the quality assurance process. If data is provided by other sources, then MCCA will need to scrutinize this and ensure that it meets the standards of data collection defined. MCCA should look to set up controls to ensure data quality is maintained.

Other data considerations

Emissions Footprint

Aligning with international reporting standards – There are different datasets that provide an estimate of the footprint for Manchester. This includes SCATTER inventory which is aligned with the GHG Protocol for Cities. MCCA will need to assess whether they want to align the method with best practice reporting.

Sector KPIs

Nationally collected vs local studies - There are several datasets produced nationally which could provide indicators of change across a region or local authority. However, MCCA may also wish to explore other locally-specific datasets where data is collected in Manchester or Greater Manchester only. This provides the ability to tailor collection based on the information needed. For example, travel surveys with Manchester residents.

Projects

Setting up projects to include data collection – For monitoring the impact of projects, data specific to the project needs to be collected which may vary based on the nature of the activity. Therefore, MCC and MCCA should consider integrating monitoring and data collection within projects from the beginning to ensure systems are in place to collect data before, during and after the project.

7. MONITORING FRAMEWORK
III) MONITOR: BUILDINGS

The following section highlights potential data sources that are available and others that could be explored with partners for monitoring progress across each thematic area and to support the creation of KPIs for each sub-objective.

3
SUB-OBJECTIVES

CARBON SAVINGS
674 $ktCO_2e$

Sub-Objective	Priority Areas	Nationally collected data	Local data sources to explore
1.1 Improve energy efficiency in buildings	• Privately owned non-domestic buildings • Public sector buildings • Privately owned and rented residential properties • Greater Manchester Housing Providers • New public and private sector developments	• EPC ratings – Domestic EPC and non-domestic EPC • Numbers of households in Fuel Poverty - sub-regional data • Number of ECO measures installed – Household Energy Efficiency Statistics • Utilities data - Sub national gas consumption and Sub national electricity consumption • Final energy consumption (fuel type) - Sub-national energy consumption	• Number of new builds that are zero carbon or passivhaus • Number of businesses offering retrofit services • Number of trained individual to deliver retrofit • Consumption or carbon savings from retrofit of council or public sector buildings
1.2 Shift off gas heating systems	• Private sector buildings • Public sector buildings • Greater Manchester Housing Providers	• Properties not connected to the gas network – sub-regional data • Renewable Heat Incentive installations - monthly deployment data • Utilities data - Sub national gas consumption and Sub national electricity consumption	• Survey on heat pumps • Coverage of district heat networks
1.3 Low carbon and energy efficient cooking, lighting and appliances	• Private sector buildings • New private sector buildings • Public sector buildings • Greater Manchester Housing Providers	• Utilities data - Sub national gas consumption and Sub national electricity consumption	• Local data on electrification of cooking systems requires more specific research • Rating of new appliances or lighting in social-housing stock

7. MONITORING FRAMEWORK
III) MONITOR: RENEWABLE ENERGY

3
SUB-OBJECTIVES

CARBON SAVINGS
*753 $ktCO_2e$

Sub-Objective	Priority Areas	Nationally collected data	Local data sources to explore
2.1 Increase solar photovoltaic capacity	• Private sector installations • Council-owned or affiliated property installations	• Renewable electricity (installations, capacity and generation) - Regional Statistics • Feed-in Tariff Installation - Quarterly Statistics	• Council building installations
2.2 Increase wind capacity	• Opportunities for wind power	• Renewable electricity (installations, capacity and generation) - Regional Statistics • Feed-in Tariff Installation - Quarterly Statistics	• Large scale installations may require further research
2.3 Explore other renewable technologies	• Opportunities and barriers for renewable energy • Renewables projects by businesses • Residents, schools, public sector & community groups	• Renewable electricity (installations, capacity and generation) - Regional Statistics • Feed-in Tariff Installation - Quarterly Statistics	• Survey of those on green tariffs • Number of community energy schemes

7. MONITORING FRAMEWORK
III) MONITOR: TRANSPORT

4
SUB-OBJECTIVES

CARBON SAVINGS
409 $ktCO_2e$

Sub-Objective	Priority Areas	Nationally collected data	Local data sources to explore
3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less	• Active travel • Public transport • Reduced private vehicle use	• Train station use - Estimates of station usage • Bus journeys - Local bus passenger journeys	• Modal split • Walking and cycling surveys • Travel diary • Traffic count • Air Quality data
3.2 Travel shorter distances	• Agile working • Connected neighbourhoods	• Vehicle Miles travelled - Road Traffic Statistics	• Transport Surveys • GPS data • Distances travelled • Home working statistics • 20-minute neighbourhood – checklist
3.3 Switch to electric vehicles	• Uptake of electric vehicles • Installations of electric vehicle infrastructure	• Licensed ultra low emission vehicles - VEH0132 • Ultra low emission vehicles registered for the first time (by region) - VEH0172 • Public EV charging points - Zap Maps - Charge Points • Publicly available charge points - Charging device Statistics	• % of vehicles EV on Manchester roads • Number of charge points and use • % of council and public sector fleet EV
3.4 Improve freight emissions	• Decarbonised freight transport • Reduced freight journeys and improved efficiency	• Licensed vehicles by body type - VEH0105 • Road transport energy consumption - Fuel Consumption Statistics	• HGV and LGV vehicle kms in areas of the city

7. MONITORING FRAMEWORK
III) MONITOR: FOOD

4
SUB-OBJECTIVES

CARBON SAVINGS*
~50 $ktCO_2e$

Sub-Objective	Priority Areas	Nationally collected data	Local data sources to explore
4.1 Promote sustainable diets	• Low carbon food procurement • Engagement on low carbon diets	• Crop areas and livestock numbers (2016 numbers available; does not reflect consumption) – Local Authority data	• Survey on plant-based diets • Survey of restaurants offering plant-based alternatives • Number of vegan/vegetarian restaurants • Conduct shopping basket studies
4.2 Reduce per capita food waste	• Reporting standards and targets • Resources for households and residents	• Tonnes of Household and Commercial waste collected (may not be able to isolate food waste from green recycling) – Local Authority collected waste statistics Annual	• Food waste statistics from households and businesses • Number of businesses with food waste targets • Study asking residents to weigh food and other waste.
4.3 Improve the sustainability of food supply chains	• Supply chain engagement and policy		• Relate to consumption-based metrics • Number of Manchester organisations making deforestation free pledge
4.4 Improve food security	• Social welfare • Local food production		• Number of allotments • Food redistribution statistics

Please note that only a very small proportion of these savings relate to Manchester's direct and indirect emissions.

7. MONITORING FRAMEWORK
III) MONITOR: THINGS WE BUY AND THROW AWAY

3
SUB-OBJECTIVES

CARBON SAVINGS
84 $ktCO_2e$

Sub-Objective	Priority Areas	Nationally collected data	Local data sources to explore
5.1 Reduce the quantity of waste	• Waste management strategy • Reuse initiatives and the sharing economy • The waste hierarchy	• Tonnes of Household and Commercial waste collected – Local Authority collected waste statistics Annual and Quarterly • Fly tipping statistics – Incidents by Local Authority	• Number of sharing economy initiatives
5.2 Increase recycling rates	• Businesses, sustainable products and the circular economy • A local circular economy • City recycling services • Recycling education and awareness for residents and schools • Improved best practice for businesses	• Tonnes of Household and Commercial waste collected and sent for recycling – Local Authority collected waste statistics Annual and Quarterly	• Council collected recycling statistics • Number of businesses setting targets to reduce waste
5.3 Shift away from fossil fuels and reduce industrial process emissions	• Innovation and low carbon technologies • Procurement and supply chains • Education and knowledge sharing		• Number of local industrial companies involved in partnership • Number of local industrial companies setting SBTs. • Local carbon emissions reported by industrial companies

7. MONITORING FRAMEWORK
III) MONITOR: NATURE BASED SOLUTIONS AND GREEN INFRASTRUCTURE

2
SUB-OBJECTIVES

CARBON SAVINGS
1.1 $ktCO_2e$

Sub-Objective	Priority Areas	Nationally collected data	Local data sources to explore
6.1 Increase tree coverage and tree planting	• Maintain tree coverage • Increase tree coverage • Carbon offsetting	• Woodland Indicators by Parliamentary Constituency – Woodland trust	• Tree surveys e.g. i-Tree • Number of trees planted • Installations of green infrastructure
6.2 Land management	• Maintain and enhance green space • Biodiversity in the city	• Hectares per land use type – Land use in England	• Council-owned land • Biodiversity-specific Index or indicators • Connectivity

7. MONITORING
III) MONITOR, EVALUATE AND REPORT

Evaluation

MCCA must properly evaluate actions periodically following the monitoring stage. Robust evaluation provides a critical assessment of changes in monitored parameters and data as a means of informing future activity. A good evaluation process provides an explanation for the causality between an action and its measured impact; in other words, identifying *why* measured changes have been recorded and *what* has created them, whilst holding the relevant stakeholders to account.

This is ultimately used as the basis to revise the scale or resource for each action and share learnings between stakeholders and partners. Evaluation should be carried out alongside reporting cycles after a defined period, whilst monitoring is a continuous process.

Assessing progress

The process itself is essentially an assessment of observed changes in the performance indicators of each action according to pre-defined criteria, designed to identify the extent of progress. This assessment should be carried out collaboratively with the affected owners and stakeholders for each action. MCCA should make the following considerations as part of this assessment:

- **Relevancy:** is the action and its observed impact consistent with achieving emissions reduction goals? Are its objectives still valid?
- **Compatibility:** how does the action fit with broader trends, policies and other activities within Manchester? Does the action duplicate efforts across different stakeholder groups?
- **Efficiency:** does the action use resources in the most beneficial and effective way? Are the observed impacts cost effective?
- **Impact:** does the action support wider social, economic and environmental goals of the council? Are there any previously unseen or unaccounted impacts?
- **Effectiveness:** does the action demonstrate positive progress towards its initial objectives? Are there learnings that can be applied across other actions?
- **Permanence:** does the action demonstrate lasting impacts and what resources are required to sustain its positive benefits over time?

The evaluation process serves to bridge the gap between observed progress of each action and reporting; translating progress into a narrative which can then be used to communicate successes. In the case of actions with little or no observed progress, these evaluation criteria also help to identify the required changes necessary to get back on track.

Next steps

- Establish a timeframe over which to carry out the evaluation procedure
- Define criteria for evaluation based on the above considerations, that:
    - Can be applied to all actions within the plan
    - Can be properly monitored and reported against accordingly by stakeholders
- Engage with action owners and stakeholders to ensure the full impacts of actions are well captured

7. MONITORING FRAMEWORK
III) MONITOR, EVALUATE AND REPORT

Reporting

The final piece of this framework is the reporting of progress in an accessible and transparent way. Whilst project managers may monitor progress internally, it is also crucial for the continued buy-in and public mandate that the MCCA report its progress publicly and transparently. There needs to be a clearly defined internal and external reporting process.

There are a range of solutions available in terms of reporting data, including update reports as well as digitally-enabled solutions involving online dashboards and apps. CDP Cities offers extensive guidance on disclosure of environmental information by local authorities.

Annual report

MCCA already provide an **annual progress report** on their emissions in line with the carbon budget and associated targets. This is done with support of the Net Zero Advisory Group, subgroups and MCCP. This could be developed to include reporting against metrics and indicators identified in this framework.

Manchester currently discloses annually through the CDP-ICLEI Unified Reporting System, which allows for your data to be recorded publicly alongside other leading cities environmental data. This requires certain standards of measurement in order to meet the criteria, which draw on international best practices such as GHG protocol for cities and the Global Convent of Mayors for Climate and Energy.

Open-source reporting

Driven by greater public awareness and an increased demand for information developing a dashboard could be an effective way of communicating progress. By providing more timely updates this could help with engagement and dialogue with the public. A more open-source approach could help to build more public trust. A This could serve as a valuable communication tool which could be updated on a more frequent basis and in an automated manner.

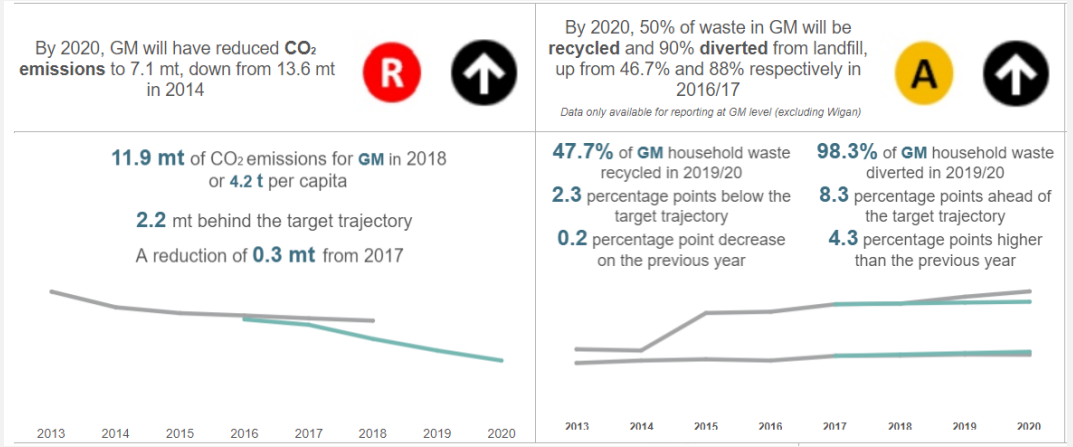


Figure 7.2: Extract from Greater Manchester dashboard showing progress against Priority 7 - A green city region and a high-quality culture and leisure offer for all.

7. MONITORING FRAMEWORK
NEXT STEPS

In summary, to create a clear monitoring framework MCC and MCCA should take the following steps:

1. **Review governance structure**
    - Review existing systems and processes and ensure they are fit for purpose. If not develop new structures to ensure optimal knowledge sharing.
    - Engage stakeholders to determine which individual(s), team(s), organisations(s) will support MCC and MCCA deliver their implementation plan.
    - Assign responsibility for the successful implementation of sub-objectives and actions.
2. **Define indicators**
    - Identify KPIs and data sources for each sub-objective that will be used to monitor progress.
    - Consider the factors that make a good indicator and how the indicators relate back to the city targets
3. **Monitor, evaluate and report progress**
    - Develop a data management strategy to ensure data will be collected and managed effectively
    - Establish a timeframe and develop a criteria for evaluating indicators
    - Define how progress will be reported based on who information needs to be shared with.

Top 3 Next Steps

The steps above are part of a longer iterative process to develop monitoring and reporting however there are some immediate steps Manchester can prioritise for Framework 2 which include:

- Map existing stakeholders and governance structures and identify any challenges
- Assign responsibility to actions with stakeholders that are currently engaged and identify actions that are not assigned
- Identify current data sources and indicators being used and identify any gaps

Figure 7.3: Process of a monitoring framework based on the C40 Monitoring, Evaluation, and Reporting system

08 NEXT STEPS

8. NEXT STEPS

The scale and speed of the interventions outlined in this report are significant.

- Exceeding the SCATTER Higher Ambition Pathway would result in over a 36% reduction by 2025, towards the target of 50%.
- Additional shifts in behaviours and technology to accelerate the speed and scale of implementation will be needed to meet the 2025 timeline.

In considering next steps to reduce emissions by 50% by 2025, Manchester should consider the following recommendations:

- **Go beyond the SCATTER Higher Ambition Pathway -** This is a necessity in order to reach the city's net zero goal. Nevertheless, the sub-objectives outlined in this report should be prioritised, as they provide a clear indication of level of scale and speed of change that the city will need to exceed.

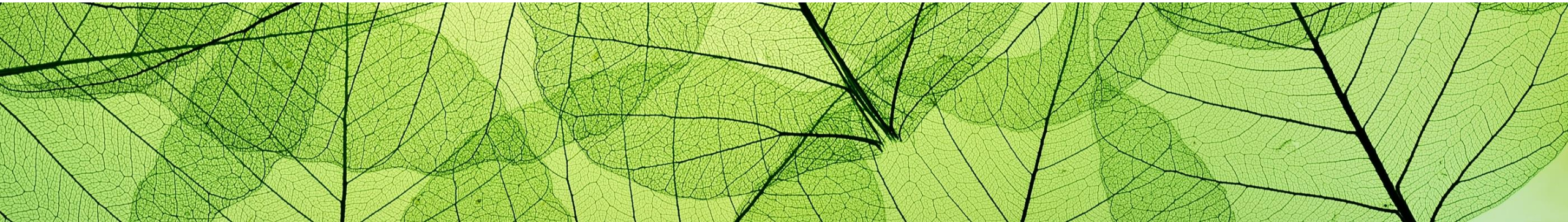
- **Consider the impacts of climate action holistically -** Climate actions offer co-benefits to the local economy, communities and environment. Many offer a return on investment or operational cost savings. There are also opportunities for a "Green Recovery" as we bounce back from the COVID-19 pandemic.

- **Work together with other stakeholders -** Encourage collaboration, build understanding, build capacity and share expertise. Key external stakeholders could include businesses, third-sector organisations, other non-profit groups, and citizens.

- **Consider a variety of funding streams -** To support financing local carbon reduction initiatives including community investment schemes and government grants. Combine efforts between the councils to maximise available government funding to decarbonise buildings and other assets that the councils own.

- **Monitor progress** - Establish appropriate indicators and governance structure to determine how on track Manchester is to reducing its emissions and implementing actions.

- **Secure resources and cross-sectoral support** - Advocate for the increased resources needed from national government and work across sectors to deliver the Framework and its actions.



09 Appendices

APPENDICES CONTENTS

APPENDIX 1: GLOSSARY OF TERMS

AFOLU: Agriculture, forestry & land use.

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

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

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

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

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

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

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

Cruise Impact Emissions: Scope 3 emissions which account for national fuel usage within the aviation sector after take-off and landing. Emissions are apportioned to each local authority based on population size and assume that flying is equal across the population.

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

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

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

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

IPCC: Intergovernmental Panel for Climate Change.

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

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

LULUCF: Land use, land use change & forestry.

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

APPENDIX 2: SCATTER FAQS

What do the different emissions categories mean within SCATTER?

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

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

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

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

- **The Direct Emissions Summary and Subsector categories** are aligned to the the World Resource Institute's Global Protocol for Community-Scale Greenhouse Gas Emission Inventories ("GPC"), as accepted by CDP and the Global Covenant of Mayors.
- **The BEIS Local Emissions Summary** represents Local Authority level data published annually by the Department for Business Energy & Industrial Strategy (BEIS).
- **Stationary energy** includes emissions associated with industrial buildings and facilities (e.g. gas & electricity).
- **Heating technologies** are based on a comparison of the scenarios defined in the DECC 2050 Calculator with the Energy Technologies Institute Clockwork Model and we acknowledge that common practice may have changed. We therefore suggest that the city can substitute in fossil fuel powered CHP with alternative low carbon sources, as is also suggested in the implementation considerations
- **IPPU** specifically relates to emissions that arise from production of products within the following industries: iron and steel, non-ferrous metals, mineral products, chemicals. These are derived from DUKES data (1.1-1.3 & 5.1).
- **Waterborne Navigation and Aviation** relate to trips that occur within the region. The figures are derived based on national data (Civil Aviation Authority & Department for Transport) and scaled to Manchester.
- The full methodology is available at http://SCATTERcities.com/pages/methodology

How does SCATTER treat future energy demand?

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

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

APPENDIX 2: SCATTER FAQS

What sets the limits of SCATTER's ambition?

In all cases, the extent of an intervention's ambition is based on a subjective judgment based on available evidence and research.

For a number of interventions this is based on the extent of ambition originally set within the DECC 2050 Pathways Calculator. This is often given in terms of a proportion e.g. an annual percentage growth factor or an overall percentage change. These proportions are then applied to each local authority's context. An example is shown opposite for housing retrofit.

Example: housing retrofit

- DECC 2050 calculator highest level of ambition indicates domestic retrofit of 24 million households (c. 90% of national stock).
- SCATTER's highest ambition retrofit targets indicate upper limits of 80% deep retrofit, 10% medium retrofit.
- Number of households in Manchester taken from local authority datasets.

- Modelled distribution of housing type taken from national averages; a more localized split is not available for every local authority.
- Changes in heating demand that occur as a result of retrofitting applied to different housing types, and overall change in demand calculated.

As part of the SCATTER tool's development, the assumptions in the DECC 2050 Calculator were reviewed and updated where necessary. The extent of ambition was also updated in coordination with relevant industry experts.

Example: housing retrofit

- "Depth" of retrofit modelled as inner and outer wall insulation.
- Association of Environmentally Conscious Buildings (AECB) standards consulted to determine the impact on demand reduction as a result of retrofit.

APPENDIX 3: SCATTER INVENTORY DATA

Note that SCATTER calculates a territorial emissions profile and therefore excludes emissions from goods and services generated outside the district (also referred to as consumption emissions).

- Within the SCATTER model, national figures for emissions within certain sectors are scaled down to a local authority level based upon a series of assumptions and factors.
- The inventory data presented here relates to the 2018 reporting year as emissions are reported two yeas in arrears.

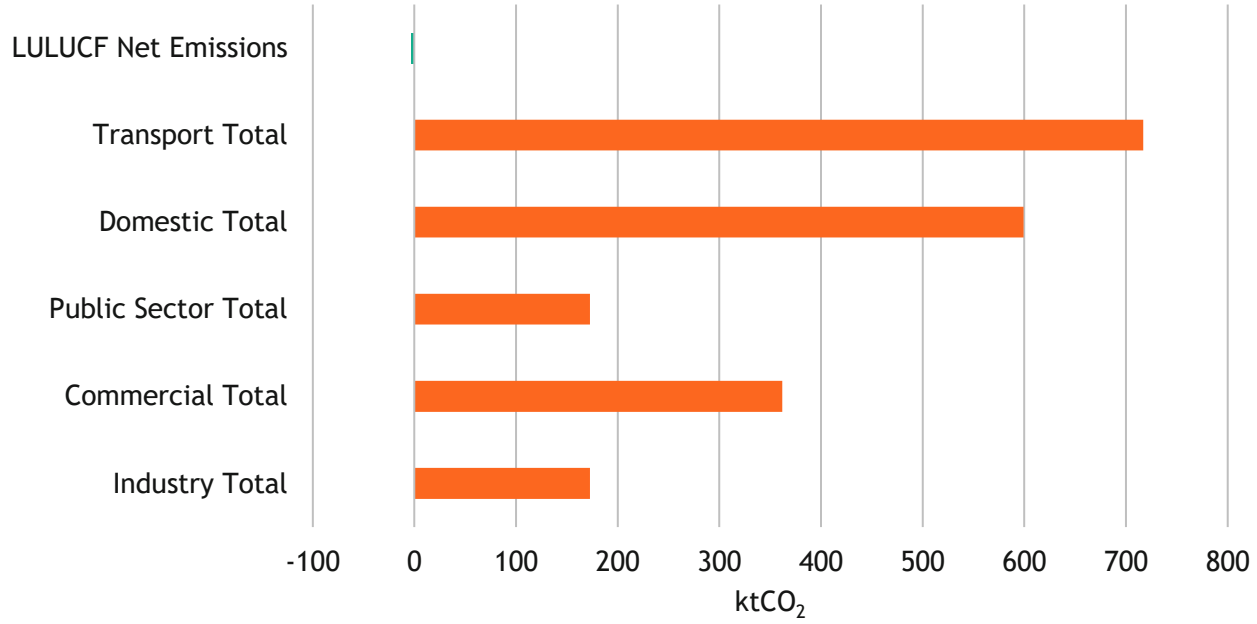
Key

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

Sector	Sub Sector	Direct (Scope 1) $ktCO_2e$	Indirect (Scope 2) $ktCO_2e$	TOTAL $ktCO_2e$
Stationary energy	Residential buildings	410.17	221.29	631.46
	Commercial buildings & facilities	78.71	212.09	290.80
	Institutional buildings & facilities	63.20	46.05	109.25
	Industrial buildings & facilities	203.55	258.89	462.44
	Agricultural fuel use	0.35	0.00	0.35
	Fugitive emissions	77.39	0.00	77.39
Transportation	On-road	539.49	IE	539.49
	Rail	6.67	IE	6.67
	Waterborne navigation	37.32	IE	37.32
	Aviation	277.21	IE	277.21
	Off-road	5.39	IE	5.39
Waste	Solid waste disposal	45.54	0.00	45.54
	Biological treatment	NO	0.00	0.00
	Incineration and open burning	NO	0.00	0.00
	Wastewater	32.24	0.00	32.24
IPPU	Industrial process	222.20	0.00	222.20
	Industrial product use	0.00	0.00	0.00
AFOLU	Livestock	3.52	0.00	3.52
	Land use	-2.59	0.00	-2.59
	Other AFOLU	NE	NE	0.00
Generation of grid-supplied energy	Electricity-only generation	NO	0.00	0.00
	CHP generation	NO	0.00	0.00
	Heat/cold generation	NO	0.00	0.00
	Local renewable generation	0.25	0.00	0.25
	Scope Total	**1,723.16**	**738.32**	
	Net Emissions Total	**2461.48**		

APPENDIX 4: BEIS EMISSIONS INVENTORY

BEIS also provide an annual estimate of emissions for each Local Authority in the UK. The difference between the emissions inventory from BEIS versus SCATTER is explored overleaf.



Sector	Scope 1 & 2 Emissions, $ktCO_2$
Industry Electricity	80.6
Industry Gas	44.7
Industry 'Other Fuels'	39.5
Large Industrial Installations	7.5
Agriculture	0.4
Commercial Electricity	226.2
Commercial Gas	132.9
Commercial 'Other Fuels'	2.9
Public Sector Electricity	61.4
Public Sector Gas	110.9
Public Sector 'Other Fuels'	0.4
Domestic Electricity	164.2
Domestic Gas	423.5
Domestic 'Other Fuels'	11.4
Road Transport (A roads)	188.4
Road Transport (Motorways)	152.2
Road Transport (Minor roads)	325.2
Diesel Railways	7.6
Transport Other	43.4
Net Emissions: Forest land	-4.4
Net Emissions: Cropland	2.4
Net Emissions: Grassland	-4.0
Net Emissions: Wetlands	0.0
Net Emissions: Settlements	2.4
Net Emissions: Harvested Wood Products	0.0
Grand Total	**2,019.8**

https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas

APPENDIX 5: SCATTER VS BEIS DATA

Differences in scope mean that direct comparisons of the Tyndall Budget which utilises BEIS $LACO_2$ data with the cumulative emissions from SCATTER Pathways trajectories should be taken as an estimate only.

The BEIS $LACO_2$ dataset indicates that Manchester emitted 2,032 $ktCO_2$ in 2018, whereas SCATTER outlines a 2018 inventory of 2,461 $ktCO_2e$.

Despite the difference in emissions profile, both data sources can still provide useful information on the emissions for different contexts:

BEIS $LACO_2$ data

The BEIS data has the benefit of providing historical context to emissions.

- **2005-2018 data** - Carbon emission estimates are available from 2005 onwards which means that this data can provide useful context on the scale of emissions reduction previously achieved. With each data release, any updates to the methodology are applied retrospectively to previous year's data to allow continued historical comparison

Sources covered:

- Industrial and Commercial (Electricity, Gas, Large installations, Agriculture)
- Domestic (Electricity, Gas, Other fuels)
- Transport (A roads, minor roads and others)

SCATTER Inventory

The SCATTER inventory has been developed to align with carbon reporting frameworks according to international guidelines.

- **GHGs included:** The BEIS $LACO_2$ dataset accounts for CO_2 emissions only whereas SCATTER utilises a CO_2 equivalent value (CO_2e) accounting for other GHGs on the basis of their global warming potentials. SCATTER includes methane (CH_4) and nitrous oxide (N_2O).
- **Scope breakdown:** The SCATTER inventory dataset details Scopes 1, 2 & and some Scope 3 emissions whereas the BEIS data only includes Scope 1 & 2.

Sources covered:

- Stationary Energy (Residential, Commercial, Institutional and Industrial buildings & facilities, Agriculture, Fugitive emissions)
- Transport (On-road, Off-road, Rail, Waterborne navigation, Aviation)
- Waste (Solid waste disposal, Biological treatment, Incineration & open burning, Wastewater)
- Industrial Processes and Product Use
- Agriculture, Forestry and Land use (Livestock, Land use)
- Generation of grid-supplied energy (Electricity-only, CHP, Heat/cold and Local renewable generation)

APPENDIX 5: SCATTER VS BEIS DATA

The Tyndall Centre Carbon Budget

The Tyndall Centre for Climate Change Research, based at the University of Manchester, have translated the Paris Agreement targets of limiting temperature change below 2°C into a fixed emissions 'carbon budget' for each local authority. There are two key ideas underpinning their research:

1. The carbon budget is a fixed amount: A global emissions limit represents the total emissions allowed before the 1.5°C threshold for greenhouse gas concentration is crossed. This global "budget" can then be scaled down to a national level, and finally, a regional level. See Appendix 3 for more detail.

2. Emissions now mean impacts later: The most crucial element of this approach is understanding the importance of cumulative carbon emissions. Once emitted, carbon dioxide remains in the atmosphere for many years, contributing to increasing the average global temperature. The carbon budget does not reset; it represents a fixed upper limit to emissions.

Emissions covered by the Tyndall carbon budget

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

- **This budget can be defined as energy-only** which means that the budget accounts for emissions from within Manchester's energy system.
- **Land use, land use change and forestry** is not incorporated into this budget analysis.
- **Only CO_2 emissions are assessed** and contributions from all other greenhouse gases, such as methane and nitrous oxide, are excluded.
- **Aviation, shipping, and other Scope 3 emissions are omitted** given the nature of these emissions. Responsibility is not attributed to individual authorities but is instead accounted for at the UK level as a "national overhead". The Tyndall Centre analysis assumes that UK emissions from aviation remain constant up until 2030, followed by a steady reduction towards net zero carbon by 2075 . Whilst emissions from aviation in 2020 have been significantly reduced, the extent of a potential "emissions rebound" post-COVID remains uncertain.

Higher Ambition: Accelerated pathway

- This pathway represents what "early" delivery of SCATTER's 2050 intervention milestones by 2038 may look like based on SCATTER data. The average reduction rate along the accelerated pathway is just under 9% annually.
- There are a number of important caveats to consider when making comparison between SCATTER's cumulative emissions and the Tyndall pathway (see above box).
- Cumulative emissions figures along the Accelerated pathway are in excess of 18.8MtCO_2e up to 2038. Using existing proportions of CO_2 versus non-CO_2 contributions from the latest SCATTER inventory, this indicates a cumulative CO_2-only figure of around 16.4Mt. This estimate should be used with caution, however, since non-CO_2 contributions are assumed to remain fixed through time despite the activities with which they are associated e.g. ICE vehicles, agriculture.

APPENDIX 6: COSTINGS

SCATTER activity	Assessed cost (£m)
Switch to electric cookers	**16** (marginal opex as a result of switching to all-electric cooking systems)
New build standards have an average annual energy consumption of 1,020kWh (equivalent to Passivhaus)	**156** (marginal capex of building to Passivhaus standard during construction) **820** (marginal capex of retrofitting new-build Part L in the future)
Reduced household energy demand	**1,794 (**capex required for retrofit on existing homes)
Switching away from gas heating	**357** (marginal capex for domestic electric heating systems) **-304** (marginal opex as a result of switching to electrified heating)

Table 6.1: Assessed costings in the domestic sector. Negative values indicate cost savings.

Notes & Caveats

Switch to electric cookers

- No additional capex assumed with the cost of installation for new electric cooking systems.
- Main cost here represents the potential added cost of fuel each year if the city switches over time to electric systems, based on a marginal cost over a gas equivalent.
- Higher Ambition assumes a linear transition to electric cookers ending in 2035 – modelled as a retirement rate of 1/15th of gas systems replaced each year from 2020.
- The cost for a household that switches from a full gas to a full electric system may incur higher energy bills as a result of the higher cost of electricity. Long-run energy prices taken from the CCC Sixth Carbon Budget.
- This analysis does not consider government subsidies for energy prices which may have a significant role to play in lowering the cost to consumers.

New build standards have an average annual energy consumption of 1,020kWh (equivalent to Passivhaus)

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

Reduced energy demand in homes

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

Switching away from gas heating

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

APPENDIX 6: COSTINGS

Building archetype	Improved building efficiency		Switching away from gas heating	
	Total capex (£m)	Annual opex (£m)	Capex (£m)	Annual opex (£m)
Arts, community and leisure	28.2	-<0.1	1.5	1
Education	26.8	-<0.1	2.6	1
Emergency services	7.6	-<0.1	0.8	<0.1
Factories	100.8	-<0.1	3.9	1
Health	21.7	-<0.1	2.4	1
Hospitality	22.7	-<0.1	1.1	<0.1
Offices	79.0	-<0.1	2.2	1
Shops	74.1	-<0.1	1.5	1
Warehouses	32.1	-<0.1	1.5	1
Total	393.1	<1	17.6	6

Table 6.2: Assessed costings in the non-domestic sector up to 2050. Negative numbers indicate cost savings.

Notes & Caveats

Improved building efficiency

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

Switching away from gas heating

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

APPENDIX 6: COSTINGS

Notes & Caveats

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

Renewable energy source	Overall investment (£m)			
	Capex	Opex	Capex	Opex
	2020-30	2020-30	2030-50	2030-50
Offshore wind	38.6	56.2	378	652
Onshore wind	63.2	41.1	147	101
Large-scale PV (>10kW)	3.0	2.4	19.8	17
Small-scale PV (<10kW)	115	23.5	901	175
Hydroelectric	0.8	0.5	16.1	9.7
Total	**221**	**124**	**1,462**	**954**

Table 6.3: Assessed costings in the energy sector.

Period	Annualised investment (£m)
2020-30	34
2030-50	121

Table 6.4: Annualised costs give an indication for the yearly scale of investment in capex and opex for renewable energy assets.

APPENDIX 6: COSTINGS

Notes & caveats

- CCC Sixth Carbon Budget costings for capital expenditure and operational savings in the surface transport sector have been recast under SCATTER interventions to 2050 to give an estimate for the implications of the SCATTER Higher Ambition Pathway.
- Costs represent a scaled down portion of national expenditure in each area as set out in the Sixth Carbon Budget, based on vehicle registrations in Manchester.
- Demand reduction and modal shift interventions have been mapped from the Higher Ambition Pathway onto the expenditure, assuming all costs rise proportionally.
- The vast majority of expenditure and savings related to transport is made in the purchase and operation of new electric vehicles.
- Additional costs have also been given as part of this analysis, shown below in Table 6.6. These are sourced from DfT and CCC Sixth Carbon Budget.
- Scaled costings have also been included for the "efficiency measures" intervention from CCC modelling. It should be noted that whilst the costings are representative of similar changes within SCATTER, the details of this measure do differ and this figure should be taken with an added caveat.

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

Table 6.5 (left): Assessed costings in the transport sector. Negative opex costs indicate a cost saving.
Table 6.6 (right): Costings for additional individual actions.

Type of cost	Overall investment (£m)	
	Capex	Opex
Infrastructure: cars/ vans/ motorcycles	134.6	-
Infrastructure: HGVs/ buses	69.1	-
Infrastructure: rail	6.6	-
Total infrastructure	**210.4**	**-**
New vehicles: cars/ vans/ motorcycles	793.9	-1,885.8
New vehicles: HGVs/ buses	538.3	-118.3
New vehicles: rail	56.3	-236.0
Total new vehicles	**1,388.5**	**-2,240.1**
Efficiency measures	**-**	-517.9

APPENDIX 6: COSTINGS

SCATTER activity	Assessed cost (£m)
Reduce overall volume of waste & increased recycling	**-242.5** (opex savings in gate fees)
Increased forest and tree coverage	**3.8** (capex range depending on availability of government grant support)
Industrial processes	**21.7** (capex)

Table 6.8: Assessed costings in the waste, industry and natural environment sectors. Negative opex costs indicate cost savings.

Notes & caveats

Waste disposal

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

Cost type	Cost of RCV (£k)	
	Diesel	Electric
Capex	164	365
Opex	459	245
Lifetime total	623	611

Table 6.7: Assessed costings of RCVs

Increased forest and tree coverage

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

Industrial processes

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

Food

- Cost is estimated from per-meal data and transition of 85% of the population to plant-based meals for two meals a day. Per-meal cost data for both meat- and plant-based food was taken from a year-long study carried out by Kantar which involved over 11,000 participants in the UK.

APPENDIX 7: EMISSIONS REDUCTION INTERVENTIONS

The following tables describe the scale of each sub-objective required to realise the emissions reductions shown in the Higher Ambition Pathway (Green line, figure 3.3) for Manchester. All reductions are against a 2018 baseline unless stated otherwise. The purpose of this analysis is to understand the scale and speed of change needed to meet the Higher Ambition Pathway.

Emissions reduction: 2025 = 36% 2030 = c.50% 2038 = 74% 2050 = 84%

Thematic Area	Sub-Objective	By 2025	By 2030	By 2038	By 2050
Buildings	1.1 Improve energy efficiency	• By 2025, 11,000 new houses are projected compared to 2020; 100% must have an average annual energy consumption of 1,020 kWh. • By 2025, 5,500 households have received medium retrofit measures 44,300 households have additionally received deep external wall insulation • Domestic energy demand for heating water demand has decreased by 15% • Commercial heating, cooling and hot water demand has decreased by 12%	• By 2030, 19,700 new houses are projected compared to 2020; 100% must have an average annual energy consumption of 1,020 kWh. • By 2030, 9,300 households have received medium retrofit measures, 74,800 households have additionally received deep external wall insulation • Domestic energy demand for heating water demand has decreased by 21% • Commercial heating, cooling and hot water demand has decreased by 17%	• By 2040, 27,380 new houses are projected compared to 2020; 100% must have an average annual energy consumption of 1,020kWh. • By 2040, 15,820 households have received medium retrofit measures, 126,920 households have additionally received deep external wall insulation • Domestic energy demand for heating water demand has decreased by 30% • Commercial heating, cooling and hot water demand has decreased by 26%	• By 2050, 38,900 new houses are projected compared to 2020; 100% must have an average annual energy consumption of 1,020 kWh. • By 2050, 25,600 households have received medium retrofit measures, 205,100 households have additionally received deep external wall insulation • Domestic energy demand for heating water demand has decreased by 43% • Commercial heating, cooling and hot water demand has decreased by 40%
Buildings	1.2 Shift off gas heating systems	• 12% of non-domestic heating systems are district heating • 20% of domestic heating systems are heat pumps	• 20% of non-domestic heating systems are district heating • 39% of domestic heating systems are heat pumps	• 32% of non-domestic heating systems are district heating • 57% of domestic heating systems are heat pumps	• 51% of non-domestic heating systems are district heating • 90% of domestic heating systems are heat pumps

APPENDIX 7 CONTINUED

Thematic Area	Sub-Objective	By 2025	By 2030	By 2038	By 2050
Buildings	1.3 Low carbon and energy efficient cooking, lighting and appliances	• Domestic lighting & appliance energy demand decreases 21% by 2025 • Commercial lighting & appliance energy demand decreases 7% by 2025 • 15% increase in domestic electric fuel use for cooking, use of fuel reduced by 15% • 5% increase in non-domestic electric fuel use for cooking, use of fuel reduced by 5%	• Domestic lighting & appliance energy demand decreases 31% by 2030 • Commercial lighting & appliance energy demand decreases 11% by 2030 • 29% increase in domestic electric fuel use for cooking, use of fuel reduced by 32% • 10% increase in non-domestic electric fuel use for cooking, use of fuel reduced by 10%	• Domestic lighting & appliance energy demand decreases 48% by 2038 • Commercial lighting & appliance energy demand decreases 17% by 2038 • 51% increase in domestic electric fuel use for cooking, use of fuel reduced by 59% • 19% increase in non-domestic electric fuel use for cooking, use of fuel reduced by 17%	• Domestic lighting & appliance energy demand decreases 73% by 2050 • Commercial lighting & appliance energy demand decreases 25% by 2050 • 84% increase in domestic electric fuel use for cooking, use of fuel reduced by 100% • 33% increase in non-domestic electric fuel use for cooking, use of fuel reduced by 28%
Renewable energy	2.1 Increase solar photovoltaic capacity	• Local PV: 344.7 MW installed capacity • Large-scale PV: 346.5 MW installed capacity	• Local PV: 596.2 MW installed capacity • Large-scale PV: 600.7 MW installed capacity	• Local PV: 1346.0 MW installed capacity • Large-scale PV: 1383.2 MW installed capacity	• Local PV: 2470.7 MW installed capacity • Large-scale PV: 2556.9 MW installed capacity
Renewable energy	2.2 Increase wind capacity	• Local wind: 12.3 MW installed capacity • Large-scale onshore wind: 7.4 MW installed capacity • Large-scale offshore wind: 231.8 MW installed capacity	• Local wind: 15.2 MW installed capacity • Large-scale onshore wind: 9.2 MW installed capacity • Large-scale offshore wind: 312.4 MW installed capacity	• Local wind: 23.2 MW installed capacity • Large-scale onshore wind: 14.3 MW installed capacity • Large-scale offshore wind: 502.6 MW installed capacity	• Local wind: 35.1 MW installed capacity • Large-scale onshore wind: 22 MW installed capacity • Large-scale offshore wind: 787.8 MW installed capacity

Renewable energy	2.3 Explore other renewable technologies	• Other renewable technologies:
		  ○ 0.2 MW local hydro
		  ○ Solid fuel biomass generation is modelled to increase fourfold
			• Other renewable technologies:
			  ○ 0.3 MW local hydro
			  ○ Declining usage of biomass having displaced fossil fuel sources in power stations
				• Other renewable technologies:
				  ○ 0.5 MW local hydro
				  ○ Declining usage of biomass having displaced fossil fuel sources in power stations
					• Other renewable technologies:
					  ○ 0.7 MW local hydro
					  ○ Declining usage of biomass having displaced fossil fuel sources in power stations

APPENDIX 7 CONTINUED

Thematic Area	Sub-Objective	By 2025	By 2030*	By 2038	By 2050
Transport	3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less	• ~5% reduction in road transport use • Minimal increase in rail transport	• 6% reduction in the use of private vehicles for road transport • 17% increase in rail transport	• 11% reduction in the use of private vehicles for road transport • 30% increase in rail transport	• 19% reduction in the use of private vehicles for road transport • 50% increase in rail transport
Transport	3.2 Travel shorter distances	• 17% reduction in total distance travelled per person	• 25% reduction in total distance travelled per person	• 25% reduction in total distance travelled per person	• 25% reduction in total distance travelled per person
Transport	3.3 Switch to electric vehicles	• 63% of vehicles are EV or HEV • 87% of buses and trains are electric	• 89% of cars are EV or HEV • 100% of buses and trains are electric	• 100% of cars are EV or HEV • 100% of buses and trains are electric	• 100% of cars are EV or HEV • 100% of buses and trains are electric
Transport	3.4 Improve freight emissions	• 6% reduction in road freight mileage • 47% reduction in energy used per mile travelled	• 9% reduction in road freight mileage • 71% reduction in energy used per mile travelled	• 14% reduction in road freight mileage • 73% reduction in energy used per mile travelled	• 22% reduction in road freight mileage • 75% reduction in energy used per mile travelled
Food	4.1 Promote sustainable diets	• Reduce the amount of meat and dairy in council-supplied food by 20%	• Reduce the amount of meat and dairy in council-supplied food by 20%	• Reduce the amount of meat and dairy in council-supplied food by 26%	• Reduce the amount of meat and dairy in council-supplied food by 35%
Food	4.2 Reduce per capita food waste	• Food waste per capita does not exceed 125kg per person	• 50% reduction in food waste	• 54% reduction in food waste	• 60% reduction in food waste
Food	4.3 Improve the sustainability of food supply chains	• Engage with a minimum of 75% of council food suppliers (by spend)	• Engage with a minimum of 80% of council food suppliers (by spend)	• Engage with a minimum of 88% of council food suppliers (by spend)	• Engage with 100% of council food suppliers (by spend)
Food	4.4 Improve food security	• Increase allotment coverage by 20%	-	-	-

*Please see page 216

APPENDIX 7 CONTINUED

Thematic Area	Sub-Objective	By 2025	By 2030	By 2038	By 2050
Things we buy and throw away	5.1 Reduce the quantity of waste	• 17% reduction in the volume of waste	• 24% reduction in the volume of waste	• 37% reduction in the volume of waste	• 57% reduction in the volume of waste
Things we buy and throw away	5.2 Increase recycling rates	• 9% increase in recycling rate	• 15% increase in recycling rate	• 24% increase in recycling rates	• 38% increase in recycling rates

Things we buy and throw away	5.3 Shift away from fossil fuels and reduce industrial process emissions	• Electricity consumption is 40% of total industrial energy consumption by 2025
		• Process emissions reduced:
		  • 10% for chemicals
		  • 6% for metals
		  • 8% for minerals
		  • 37% other industries
			• Electricity consumption is 41% of total industrial energy consumption by 2030
			• Process emissions reduced:
			  • 14% for chemicals
			  • 10% for metals
			  • 11% for minerals
			  • 50% other industries
				• Electricity consumption is 53% of total industrial energy consumption by 2038
				• Process emissions reduced:
				  • 20% for chemicals
				  • 14% for metals
				  • 17% for minerals
				  • 62% other industries
					• Electricity consumption is 65% of total industrial energy consumption by 2050
					• Process emissions reduced:
					  • 30% for chemicals
					  • 21% for metals
					  • 25% for minerals
					  • 80% other industries

Green Infrastructure & Nature-based Solutions	6.1 Increase tree coverage and tree planting	• Tree planting outside of woodlands increases by 15% from 2019, equivalent to 920 hectares	• 24% increase in forest coverage • Tree planting outside of woodlands increases by 30% from 2019, equivalent to 1040 hectares	• 24% increase in forest coverage • Tree planting outside of woodlands increases by 40% from 2019, equivalent to 1123 hectares	• Tree planting outside of woodlands increases by a further 20% from 2030, equivalent to 1248 hectares
Green Infrastructure & Nature-based Solutions	6.2 Land use management	• Maintaining existing green spaces	• Maintaining existing green spaces	• 2% decrease in grassland and 4% decrease in cropland to increase forestland and carbon sequestration potential • Maintaining existing green spaces	• 2% decrease in grassland and 5% decrease in cropland to increase forestland and carbon sequestration potential • Maintaining existing green spaces

APPENDIX 7 CONTINUED

Notes on amendments to the transport pathway interventions

Additional analysis, with an amended set of transport pathway interventions, was carried out alongside this analysis.

These pathways have the following milestones at 2030:

Activity	SCATTER intervention at 2030
Distance reduction	• 30% reduction in passenger km`
Modal share	• Walking: 10% • Cycling: 10% • Cars, vans and motorcycles: 60% • Buses: 11% • Rail: 9%
Technology share	• ICE car: 20% • PHEV car: 15% • EV car: 65% • Electrified rail: 100% • EV buses: 75% • HEV buses: 25%

The implication of this scenario is a heavier weighting towards active travel and lesser weighting given to the electrification of vehicles. This scenario achieves a similar estimated overall saving to the interventions described on page 214.

APPENDIX 8: CARBON SAVINGS METHODOLOGY

Why are carbon savings important to estimate?

Understanding the activities which offer the highest potential carbon savings is another way to prioritise action towards net zero. Understanding which activities contribute most to reducing emissions also links into the hierarchy of actions for project development and sets out the "heavy hitting" interventions defined by SCATTER.

Estimating emissions savings

Using the SCATTER "Higher Ambition" and "Business as Usual" scenarios we can estimate emissions savings, broken down into different categories. This is done by comparing the projected emissions along each pathway from different subsectors (e.g. domestic lighting or commercial heating) for each year, and defining the difference between them.
A visual representation of this method is given opposite in figure 8.1.

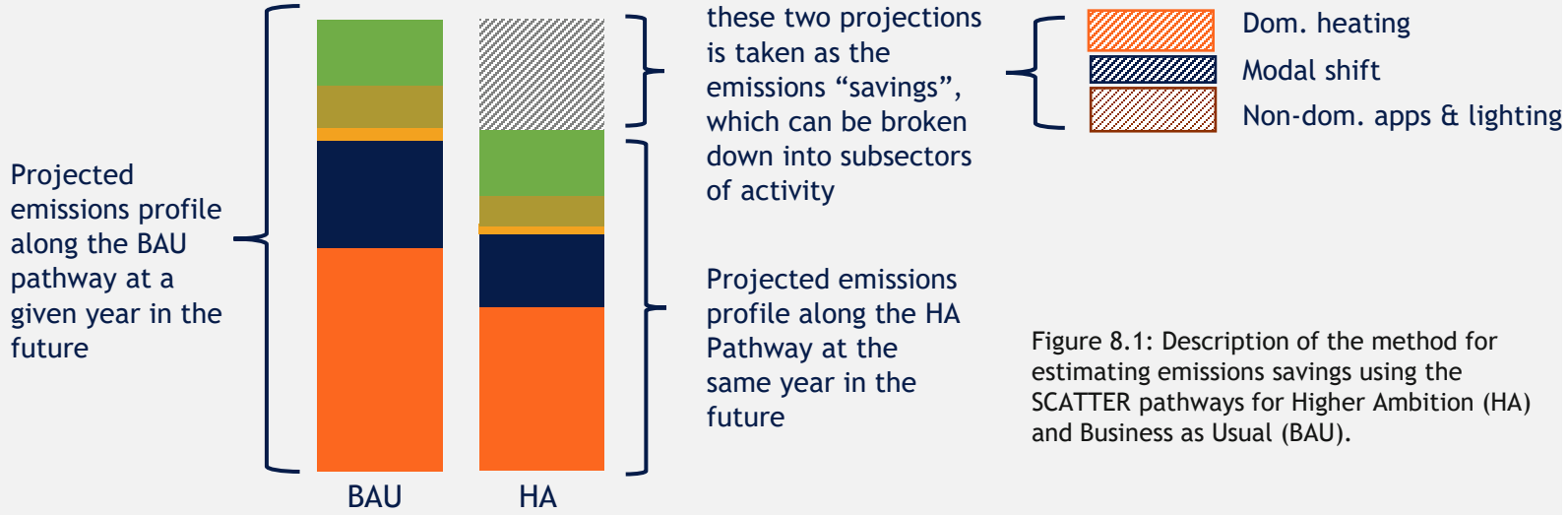


Figure 8.1: Description of the method for estimating emissions savings using the SCATTER pathways for Higher Ambition (HA) and Business as Usual (BAU).

Which areas of activity have been estimated?

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

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

Energy supply

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

APPENDIX 9: CARBON SAVINGS SUMMARY

The estimated cumulative carbon savings related to the sub-objectives within this chapter are listed below for the periods 2020-2025 and 2020-2038. Emissions savings are calculated relative to the BAU scenario within SCATTER. The calculation methodology is outlined in Appendix 8.

Theme	Sub-Objective	Sub-sector matching SCATTER	Cumulative Carbon Savings 2020 - 2025	Cumulative Carbon Savings 2020 - 2038
Buildings	1.1 Improve energy efficiency	Domestic buildings	**382 $ktCO_2e$**	**4,004 $ktCO_2e$**
		Industrial buildings and facilities	**145 $ktCO_2e$**	**2,699 $ktCO_2e$**
	1.2 Shift off gas heating systems	Space heating, cooling, and hot water	**82 $ktCO_2e$**	**1,164 $ktCO_2e$**
	1.3 Low carbon and energy efficient cooking, lighting and appliances	Domestic lighting, appliances, and cooking	**25 $ktCO_2e$**	**831 $ktCO_2e$**
		Commercial lighting, appliances, equipment, and catering	**40 $ktCO_2e$**	**1,080 $ktCO_2e$**
Renewable energy	2.1 Increase solar photovoltaic capacity 2.2 Increase wind capacity 2.3 Explore other renewable technologies	Renewable energy generation	**753 $ktCO_2e$**	**10,380 $ktCO_2e$**

APPENDIX 9: CARBON SAVINGS SUMMARY

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

Please note carbon savings for energy supply and demand interventions should not be aggregated

Theme	Sub-Objective	Sub-sector matching SCATTER	Cumulative Carbon Savings 2020 - 2025	Cumulative Carbon Savings 2020 - 2038
Transport	3.1 Make walking, cycling and public transport use more attractive and encourage people to use their cars less 3.2 Travel shorter distances 3.3 Switch to electric vehicles 3.4 Improve freight emissions	On-road	**409 $ktCO_2e$**	**3,010 $ktCO_2e$**
Food	4.1 Promote sustainable diets 4.2 Reduce per capita food waste 4.3 Improve the sustainability of food supply chains 4.4 Improve food security	*based on a direct population scaling of CCC estimates. Please note that only a very small proportion of these savings relate to Manchester's direct and indirect emissions.	**47 $ktCO_2e$***	-
Things we buy and throw away	5.1 Reducing the quantity of waste 5.2 Increased recycling rates	Solid waste disposal	**5 $ktCO_2e$**	**110 $ktCO_2e$**
	5.3 Shift away from fossil fuels and reduce industrial emissions	Industrial processes	**79 $ktCO_2e$**	**603 $ktCO_2e$**
Green Infrastructure & Nature-based solutions	6.1 Increase tree coverage and tree planting 6.2 Land use management	Land use	**0.7 $ktCO_2e$**	**9 $ktCO_2e$**

APPENDIX 10: 50% REDUCTION SUMMARY

These tables specify the interventions, carbon savings and costs required to deliver a 50% reduction in emissions, according to the modified SCATTER pathway.

Intervention	Change required to achieve indicative 50% target	Carbon savings	Capital cost
1.1 Improve energy efficiency	• 19,700 new houses are projected compared to 2020; 100% must have an average annual energy consumption of 1,020 kWh. • 9,300 households have received medium retrofit measures, 74,800 households have additionally received deep external wall insulation • Domestic energy demand for heating water demand has decreased by 21% • Commercial heating, cooling and hot water demand has decreased by 17%	• Domestic space heating and hot water: **222ktCO$_2$e** • Non-domestic space heating and hot water: **68ktCO$_2$e** • Industrial buildings & facilities: **193ktCO$_2$e**	• Domestic new build: £78.2m • Domestic retrofit: £760.5m • Domestic heating: £146.6m • Non-domestic retrofit: £167.1m • Non-domestic heating: £12.7m
1.2 Shift off gas heating systems	• 20% of non-domestic heating systems are district heating • 39% of domestic heating systems are heat pumps		
1.3 Low carbon and energy efficient cooking, lighting and appliances	• Domestic lighting & appliance energy demand decreases 31% • Commercial lighting & appliance energy demand decreases 11% • 29% increase in domestic electric fuel use for cooking, use of fuel reduced by 32% • 10% increase in non-domestic electric fuel use for cooking, use of fuel reduced by 10%	• Domestic lighting, appliances and cooking: **86ktCO$_2$e** • Non-domestic lighting, appliances, equipment and catering: **94ktCO$_2$e**	• No marginal cost assumed for appliance replacement • Small increases in fuel costs for electric cooking systems
2.1 Increase solar photovoltaic capacity	• Local PV: 596.2 MW installed capacity • Large-scale PV: 600.7 MW installed capacity	• Installing local renewables:* **902ktCO$_2$e**	• Small-scale PV: £114.9m • Large-scale PV: £3.0m • Offshore wind: £38.6m • Onshore wind: £63.3m • Hydro: £0.8m
2.2 Increase wind capacity	• Local wind: 15.2 MW installed capacity • Large-scale onshore wind: 9.2 MW installed capacity • Large-scale offshore wind: 312.4 MW installed capacity		

2.3 Explore other renewable technologies	• Other renewable technologies:
	  ○ 0.3 MW local hydro
	  ○ Declining usage of biomass having displaced fossil fuel sources in power stations		

APPENDIX 10: 50% REDUCTION SUMMARY

These tables specify the interventions, carbon savings and costs required to deliver a 50% reduction in emissions, according to the modified SCATTER pathway. Please note that food interventions have not been included here on account of them not being assessed by the SCATTER tool.

Intervention	Change required to achieve indicative 50% target	Carbon savings	Capital cost
3.1 Make walking, cycling and public transport use	• 6% reduction in the use of private vehicles for road transport • 17% increase in rail transport	• On-road transport: **397ktCO$_2$e**	New vehicles • Cars, vans, motorcycles: £325.9m • Buses, HGVs: £0.7m • Rail: £1.4m Infrastructure • Cars, vans, motorcycles: £16.3m • Buses, HGVs: £37.2m £16.3m/£37.2m • Rail: £15.9m
3.2 Travel shorter distances	• 25% reduction in total distance travelled per person		
3.3 Switch to electric vehicles	• 89% of cars are EV or HEV • 100% of buses and trains are electric		
3.4 Improve freight emissions	• 9% reduction in road freight mileage • 71% reduction in energy used per mile travelled		
5.1 Reduce the quantity of waste	• 24% reduction in the volume of waste	• Solid waste disposal: **19ktCO$_2$e**	• Gate fees assumed broadly consistent
5.2 Increase recycling rates	• 15% increase in recycling rate		
5.3 Shift away from fossil fuels and reduce industrial process emissions	• Electricity consumption is 41% of total industrial energy consumption • Process emissions reduced: • 14% for chemicals; 10% for metals; 11% for minerals; 50% other industries	• Industrial processes: **142ktCO$_2$e**	• Industrial processes: £7.7m
6.1 Increase tree coverage and tree planting	• 24% increase in forest coverage • Tree planting outside of woodlands increases by 30% from 2019, equivalent to 1,040 hectares	• Agriculture, livestock and land use: **<1ktCO$_2$e**	• Tree planting: £2.0m
6.2 Land use management	• Maintaining existing green spaces		

APPENDIX 11: EXPLANATORY NOTES

Example of a costing calculation

SCATTER intervention

- *New build houses are built to PassivHaus standard*

Identified cost variables

- Number of new builds
- Capital cost required for PassivHaus

Costing calculation

- Currie Brown & Aecom report, sourced via CCC Sixth Carbon Budget
- Estimate found for cost of building to PassivHaus standard **relative to** the cost of building to Part L standard (i.e. the "business as usual" case)
- Estimated number of new builds in Manchester taken from SCATTER projections
- Total = cost per household × total number of new builds
- Figure represents estimated additional capital required to deliver new builds to PassivHaus

What do the costs represent in the Evidence Base?

The costs estimated in the Evidence Base report indicate the scale of capital required to implement low-carbon solutions. They have been based on available research and high-level estimates as opposed to robust investment-grade costings.

How are the costs calculated?

The costs provided in this analysis are mostly based on figures published by the Committee on Climate Change in the Sixth Carbon Budget, or from other research and analysis which fed that report. SCATTER's interventions have been defined in terms of "cost variables" and then scaled accordingly to the High Ambition Pathway (see example opposite). Costs are **representative** of delivery of the whole intervention unless stated otherwise. Specific details for each measure have been added where appropriate.

What is meant by the different categories of cost?

In our analysis, *capital* costs refer to investment required to set up or install a low-carbon solution or technology. *Operational* (or *revenue*) costs represent money invested or saved following the installation of low-carbon solutions. Cost figures are given in terms of the *additional* cost of purchasing/installing the low-carbon solution when compared to a business-as-usual/standard case – we term these estimates *marginal* costs. To illustrate these definitions with an example, we can consider the purchase of a new electric vehicle (EV). The *marginal capital* cost of purchasing an EV is the **difference** in price between an EV and a petrol/diesel equivalent. The *marginal operational* cost of purchasing the vehicle is calculated from the **differences** in price between fuels required to run the vehicle, fit new parts and carry out maintenance etc.. Over the lifetime of the vehicle, the operational costs typically represent a cost saving (many low-carbon solutions represent long-term savings). We represent these savings as negative £ values in our analysis.

Why are the categories different for costs vs carbon savings?

Costings are derived from different datasets and research than the carbon savings. The costings methodology does not derive data from categories in energy consumption statistics, whereas carbon savings do. There are strong overlaps between the two and the same activities are captured by both metrics, but as a result of the difference in the methods for the analysis the categories are labelled differently.

APPENDIX 11: EXPLANATORY NOTES

Results

The table opposite shows the results of the costings assessment.

Costs are given as a cumulative total between the baseline year and the level of spending required to reduce emissions 50% within the SCATTER pathways i.e. costs have been aligned to the level of activity required to deliver the 50% reduction in emissions.

The most significant capital projects relate to retrofitting building fabric and heating systems. There are also significant capital costs in producing renewable energy and replacing vehicles with electric equivalents – though in all cases significant revenue savings are also estimated. Where figures are given as negative values, this indicates a cost saving relative to a business as usual case.

"NE" denotes costs that are not estimated, due to uncertainty around the extent of available energy savings and the overlap between different measures. However, it is likely that energy efficiency measures in the built environment offer a payback period in the region of 5-15 years.

Who is responsible for these costs?

These estimates consider the scale of cost for a low carbon measure. It does not identify an "owner" responsible for this cost, which will vary in each case significantly.

In the case of vehicle replacement for cars and other small vehicles, costs are likely to be borne by consumers and residents. For non-domestic retrofits, costs are likely to be incurred by businesses and other organisations. Costs identified in this analysis are not solely borne by the council.

Sector	Activity	Cumulative cost to 2030	
		Capital (£m)	Revenue (£m)
Domestic buildings	Cooking	-	3.8
	New build	78.2	NE
	Retrofit	760.5	NE
	Heating	146.6	- 32.9
Non-domestic buildings	Retrofit	167.1	- 1.5
	Heating	12.7	NE
	Cooking	-	NE
Industry	Industrial processes	7.7	NE
Transport	Cars/vans/motorcycles (new vehicles)	325.9	- 243.9
	Cars/vans/motorcycles (infrastructure)	16.3	NE
	HGVs/buses (new vehicles)	0.7	- 22.4
	HGVs/buses (infrastructure)	37.2	NE
	Rail (new vehicles)	1.4	- 21.3
	Rail (infrastructure)	15.9	NE
	Efficiencies	-	- 94.5
Energy	Hydro	0.8	0.5
	Offshore	38.6	56.2
	Onshore	63.3	41.1
	Large PV	3.0	2.4
	Small PV	114.9	23.5
Waste	Gate fees	NE	- 18.2
Nature	Tree planting	2.0	0.3

NE - not estimated

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